Appendix

E

E.3 | Biodiversity Development Assessment Report Part 2

EMM creating opportunities | SPARK RENEWABLES

5. Identifying prescribed impacts

5.1. Assessment of the occurrence of prescribed impacts

Prescribed impacts have been identified in accordance with Section 6 of the BAM and clause 6.1 of the BC Regulation. Identification of prescribed impacts are outlined below in Table 46 and Sections 5 and 6, and discussed in detail in Section 8.3.

Table 46 Prescribed impacts associated with the project

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	No	No karst, caves, crevices, cliffs, rocks or other geological features of significance occur within the subject land or assessment area.	N/A
Human-made structures and non-native vegetation	Yes	Human made structures are present within the subject land. Within the development corridor the following human made structure are present: • Dams. • Irrigation channels • Farm tracks. • Public roads. • Existing transmission lines • Rural infrastructure (fences, shearing sheds, storage sheds) Non-native vegetation occurs, predominately in the form of irrigated and dryland cropping areas, and exotic components of retained native vegetation.	Avian fauna species are known to utilise artificial and human made structures for nesting due to historic clearing of native vegetation. Dams and irrigation channels are utilised by fauna species as permanent water resources throughout the year, some dams are created in areas that likely originally supported natural ephemeral billabongs. Microbats may use shearing sheds and storage sheds for roosting. Exotic vegetation, including irrigated cropping and dryland cropping areas are known to be utilised by raptor species and waterbirds for foraging. *Litoria raniformis* records were also observed within irrigation channels adjacent to cropping areas Refer to Section 8.3.1.
Habitat connectivity	Yes	Natural corridors in the form of native vegetation and riparian watercourses in both a project level scale and broader landscape scale occur. Landscape scale habitat connectivity also exists for aerial species over the wind farm between water bodies present in the surrounding landscape. This includes both vegetation and non-vegetation (or farmed/cropped) areas.	All threatened fauna, flora and TECs within the landscape. Aerial species are particularly at risk from habitat connectivity issues arising from potential barrier effect of operations wind turbines. Refer to Section 8.3.2.
Waterbodies, water quality and hydrological processes	Yes	The subject land is characterised by low-lying flood prone terrain, with multiple unnamed ephemeral waterways that dissect the subject land and development corridor, with Delta Creek, Blind Creek and Bublebundie Creeks the most significant natural waterways. The subject land is largely flat with some minor drainage depressions that temporarily hold water during and	When containing water, migratory species, and fauna species have the potential to use creeks and floodplain depressions / watercourses outside the subject land. Ephemeral wetland areas that occur may become inundated during periods of high rainfall and wet seasons. Riparian areas are utilised by fauna species as connectivity corridors. Refer to Section 8.3.3

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Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
		following rainfall. Several minor topographic depressions on the floodplain hold water for longer, creating scattered swamp environments.	
Wind turbine strikes	Yes	See Section 5.2 and 6 below.	See Section 5.2, Sections 6 and 8.3.4 below.
Vehicle strikes	Yes	Vehicle movement will increase during construction, and to a lesser extent during operation, of the project. this increase in vehicle movements has the potential to impact upon threatened fauna species.	During increased vehicle movements, particularly in the early stages of construction and potentially during vegetation clearing, low flying birds and ground dwelling mammals have the potential to collide with vehicles travelling to and from the project. Refer to Section 8.3.5.

5.2. Identification of potential impacts associated with wind farm developments

5.2.1. Background review and bird and bat utilisation surveys

Globally, the onshore wind farm industry continues to experience significant developments and expansion. Turbine infrastructure is larger in both scale and energy output and site footprints have increased in area and capacity. As such, there is an increasing threat to native taxa. The associated environmental impact must be granted appropriate consideration, with bat and bird fatalities representing the principal risk, with recorded instances occurring at international and domestic sites (de Lucas 2012, Smales 2013). Despite this, the impacts of wind farms are considered to be relatively low in comparison to other industries, and anthropogenic influences on native taxa (Smales 2013). It is currently estimated that wind farms account for approximately 0.1% of global anthropogenic causes of avian fatalities (Bennett 2019). With the wind industry also being one of the only energy-generating enterprises that must continue systematic monitoring of birds (Smales 2014). While collisions are thought to be the primary cause of mortality, the construction and operation of wind farms can also lead to secondary impacts on bat and bird species including habitat loss or modification, and avoidance response of species. (Fox et al. 2006, Masden & Cook 2016, Smales 2012).

Bird and bat collision risk on wind farms is due to a complex number of factors including species-specific elements, such as flight patterns, size and foraging behaviour, environmental factors, and site -specific factors pertaining to the layout of and configuration of turbine infrastructure (Jenkins et al. 2010, de Lucas et al. 2012, Smallwood et al. 2020). Considering this, not all wind farm sites would contain the same level of collision risk. Quantifying individual collision for bat and bird species presents many challenges. Wind speeds, landscape features and weather events can also contribute to this (Gorman et al. 2021). Understanding collision risk is important to identifying species which may be susceptible and to determining population level impacts, specifically to threatened taxa, with a view to implementing strategies to reduce impacts (Smales 2013).

Birds

Australia is home to considerable avian diversity, with many species inhabiting, utilising, or passing through wind farm sites throughout each year. Studies of bird and bat fatalities across south-eastern Australia have identified 24 species of bird and four species of bat that are most often impacted by direct collision, with larger birds being deemed more likely to collide than smaller birds (Everart 2014, Smales 2013). Commonly struck species include the Australian Magpie *Cracticus tibicen*, the Nankeen Kestrel *Falco cenchroides*, and the Brown Falcon *Falco berigora* which constitute 24%, 15% and 12% respectively, of all species impacted (Smales 2013). Publicly accessible data from currently operating wind farms in New South Wales have reflected these findings with the Australian Magpie being the most commonly found species in post-construction monitoring searches constituting 18% of all bird carcasses found on these sites. This is followed by Nankeen Kestrels (17%), Wedge-tailed eagle (10%), Crimson rosella (6.6%), and the Sulphur-crested Cockatoo (4.8%).

A major focus of bird collision research has prioritised large raptors (May et al. 2011, de Lucas et al. 2012, Hull & Muir 2013, Smales 2013). This may be because there is a large number of threatened species within the order, they have a relatively low reproductive output and are thought to be prone to collision risk and are often of great community interest (Garvin et al. 2010). However other larger bird species including waterbirds, such as Ibis and Pelicans, parrots, and migratory species are also at risk.

Nesting densities of species may be useful in identifying some likelihood of collision risk (Marques et al. 2014). While important in assessing population and utilisation of a site by different species, abundance alone has been shown to be a poor predictor of collision mortality (Madders & Whitfield, 2006, de Lucas et al. 2008). Additionally, there are foraging and feeding behaviours that may make some species more susceptible to

collision, such as aerial or shrub searching (Hull et al., 2013). This accounts for observations seen in collision fatality comparisons between raptor species occupying the same site. Species including the Wedge-tailed Eagle *Aquila audax*, Brown Falcon and White-bellied Sea Eagle account for a higher proportion of deaths than species such as the Brown Goshawk *Accipiter fasciatus*, Collared Sparrowhawk *Accipiter cirrocephalus* and Grey Goshawk *Accipiter novaehollandia* (Hull et al. 2013). Seasonal changes to behaviour have also been seen to affect collision risk for a species (Smith & McWilliams 2016).

Flight height, particularly species flying at rotor height, may expose some species to higher collision risk, but are not the sole factor (Smales, 2014). There are some differences in rates of avoidance in eagle species (Hull et al. 2013). Species-dependent avoidance rates are prescribed by regulatory bodies, but more work is needed to understand the ecological differences between species such as the Wedge-tailed Eagle, and White-bellied Sea Eagle, which have been shown to exhibit differing avoidance rates (Hull et al. 2013). As such, collision risk models assume a great deal about bird behaviour, including uniform avoidance rates for all individuals within a species, which is considered to be unlikely (Masden et al. 2016).

Given the distribution of potential and known habitat south (Victoria) and north (Coleambally/Leeton) of the subject land, and the likely local and seasonal movements from these areas, a portion of Australasian Bitterns using the local wetlands are expected to fly across the subject land on occasion. Satellite tracking and changes in local densities indicate Australasian Bitterns undertake seasonal and dispersive movements between breeding and non-breeding habitats, and as local habitat suitability conditions change (Bitterns in Rice Project 2017, Department of the Environment and Energy 2019). Local and daily movement patterns of Australasian Bitterns are not well documented. Given the similarities with the Eurasian Bittern, movements of the latter species may be helpful in understanding those of the Australasian Bittern, though local habitat suitability and conditions are likely to be strong drivers of movement behaviour. During the non-breeding season, individuals fly out to feed at dawn and return to the roost at dusk (White & Royal Society for the Protection of Birds 2006). Similar to the Eurasian Bitterns, Australasian Bitterns have been observed engaging in aerial displays and chasing of each other, flying out of wetlands before dawn and flying from a nest to forage (Biosis 2021a). These observations have included flights of up to 400 metres within and between wetlands at heights of approximately 2–30 metres, including above tree canopy height (I. Veltheim pers. obs.). However, they are known to ascend to higher altitudes on occasion, and although based on a small sample size of three individuals, recent GPS movement tracking of Australasian Bitterns in New Zealand has shown the species can fly within RSA height, with one individual spending 61% of its time at heights of 20–200 metres. Satellite tracking of the species in Australia has also shown the species flying at heights of 3–100 metres above ground (AOC 2023). At other times, such as during longer-range nomadic flights between coastal and wetland habitats it is likely that the species flies well above RSA height.

Bats (Microchiroptera and Megachiroptera)

The primary reasons why bats collide with wind turbines is still debated (Hein & Schirmacher 2016, Smallwood 2009). A current hypothesis includes turbines acting as a resource attractant, with food sources, including insects, often present. Other sources have attributed their attraction to the consequence of vegetation clearing and landscape modification that sees spaces between turbines mimic flyways (Kunz et al. 2007). There is also insufficient research to determine at what speed blade tips become invisible to echolocation, if any (Lawson et al. 2020, Wellig et al. 2018).

Regardless of the cause, bat fatalities have been recorded globally, with a number of high-flying species suspected to be more susceptible, including the White-striped freetail bat *Austronomus australis*, Gould's wattled bat *Chalinolobus gouldii* and the Chocolate wattled bat *Chalinolobus morio* in south-eastern Australia (Smales 2014, Bennet 2019). The White-striped freetail bat is a common species of bat occurring throughout southern Australia, foraging in open cleared areas often at heights of 50 metres. This species was also the

first wind farm-related fatality reported globally and is now known to be the most frequently struck species on sites in Victoria and south-east Australia (Smales 2012, Stark & Muir 2020). Accessible collision data in New South Wales mirror these findings, with the White-striped freetail bats shown to be the most commonly found microbat species during post-construction carcass monitoring searches. This species was found at seven out of the eight wind farms with accessible monitoring data and represented 40.6% of microbat mortalities found. Gould's wattled bat was the second most commonly found and represented 20.2% of mortalities, followed by Large Forest Bat *Vespadelus darlingtoni* (7.1%), Chocolate Wattled Bat (6.9%), Little Forest Bat *Vespadelus vulturnus* (6.05%), and the Southern free-tailed Bat *Ozimops planiceps* (5.5%).

There is limited data available in Australia for bat fatalities at large wind farms, with more information and monitoring required to further understand collision risk for the taxa. This is due to a number of factors including challenges involved with detection and movement, due to their cryptic nature; difficulties in carcass monitoring; the cost and time prohibitive nature of searches and methods, including detection dogs (Bennet 2022, Wellig et al. 2018). Identifying risk for collisions is more attainable for avian species, as their flights can be recorded during BUS. The same cannot be replicated with bat species, and ultrasonic recording or trapping must instead be used to identify species present on site. A key limitation to the current use of these detectors, is the inability to consistently install them within the rotor swept zone. Sampling on sites currently includes the deployment of detectors on meteorological towers, however, as there is usually only one of these present per site, the sampling area is quite small at these heights (Gration, 2011).

The nocturnal forging behaviour of bats makes it difficult to observe the differing heights at which certain species fly at and their landscape utilisation across a site. Megachiropteran species have also been known to travel significant distances in a night to forage. Collisions with aircraft are also common, and as these incidences are often recorded, height collisions ranging from zero to 1524m, with the largest proportion of strikes occurring at 152.4m (Parsons et al. 2008). The Grey-headed Flying-fox *Pteropus poliocephalus* is a vulnerable species in NSW and has been recorded as a collision fatality on Australian wind farms, mostly recently in Victoria, with Little-red Flying-fox also having unexpected collisions at the Crudine Ridge Wind Farm in central NSW.

Seasonal patterns in fatalities have been observed with Australian bats, with monitoring finding the majority of bat strikes to occur during January to April in temperate zones (Bennet et al. 2022). Bat activity in RSA has also been seen to decrease with higher wind speeds, which is an important environmental factor in assessing collision risk (Smith & McWilliams 2016; Wellig et al. 2018, Gorman et al. 2021).

It was previously accepted that barotrauma was the primary cause of mortality for bats. While conclusive evidence is difficult to attain, it is now accepted that it is unlikely that barotrauma is the predominant cause (WREN 2018, Lawson et al. 2020). Pressure changes necessary to cause barotrauma would be located at such close proximity to the blade itself, it is deemed unlikely that a bat could experience barotrauma without simultaneously being struck by the blade itself, likely resulting in fatal injury. Furthermore, evidence to suggest that visual inspection of bat carcasses may be less effective at identifying injuries related to collision-related mortalities, in contrast to other techniques such as radiography. Additionally, there are similar characteristics that may present as signs of barotrauma, including internal bleeding and fluid buildup in the lung, that may also have been resultant of collision (WREN 2018). Regardless of the cause, bat interaction with wind turbines causes bat mortality, and a greater understanding is needed of bat activity near wind farm sites. Table 47 demonstrates the currently capacity of operational wind farms in NSW and links to annual reporting data where available.

Table 47 NSW operational wind farms reviewed for bird and bat collisions data

Wind farm name	Capacity (MW)	No. of turbines	Turbine Model	Year of completion	Collision data availability and notes
Bango Wind farm	244	46	GE 5.3MW	2023	No data available (new project)
Biala Wind Farm	145	31	Goldwind 3.5MW	2021	Some data available https://bialawind farm.com/the-project/project-approvals-and-documents/
Blayney Wind Farm	10	15	Vestas V47-660kW	2000	No data available
Boco Rock Wind Farm	113	67	GE 100-1.7	2015	Data available. 8 years of monitoring https://www.bocorockwind farm.com.au/_files/ugd/bc9b99_c4b9d1d1dd324bedbaef1852f593f076.pdf
Bodangora Wind Farm	113.2	33	GE 3.43-130	2019	Data available (at least 2 years monitoring) https://www.infigenenergy.com/our-assets/owned-renewable-energy-assets/bodangora https://www.infigenenergy.com/assets/BOD-BBAMP-Annual-Report-2021.pdf
Capital Wind farm	140.7	67	Suzlon S88	2009	No data available
Collector Wind Farm	228	55	Vestas V117-4.2 MW turbines	2021	No data available – website currently inaccessible
Crookwell Wind Farm	4.8	8	Vestas V44-600kW	1998	First operational wind farm in NSW. Small scale project to prove the technology was scalable in Australia. No collision data available
Crookwell 2 Wind Farm	92	46	GE 130-3.4 MW	2018	No data available
Crudine Ridge Wind Farm	135	37	GE 3.8MW	2021	Data available for 2 years of carcass monitoring https://www.squadronenergy.com/our-projects/crudine-ridge-wind-farm
Cullerin Range Wind Farm	30	15	Senvion 2MW	2009	First fully operational wind farm in NSW to be significant in the National Electricity Market. No collision data available
Gullen Range Wind farm	165.5	73	GRW100-2.5MW (56 turbines) and the GW82-1.5MW (17 turbines)	2013	Data available (at least 2 years monitoring) https://gullenrangewind farm.com/wp-content/uploads/2017/05/2015-Annual-BBAMP-Report_GRWF_BLA_Final.pdf
Gunning Wind Farm	46.5	31	1.5MW	2011	No collision data available

Wind farm name	Capacity (MW)	No. of turbines	Turbine Model	Year of completion	Collision data availability and notes
Hampton Wind Park	13.2	2	660 kW Vestas V-47	2001	No collision data. Small project
Sapphire Wind Farm	270	75	Vestas V126 3.6 (200m)	2018	Data available (4 years monitoring) https://www.squadronenergy.com/our-projects/sapphire-wind-farm
Silverton Wind Farm	200	58	GE 3.8MW	2019	Data available (2 years monitoring) https://www.agl.com.au/content/dam/digital/agl/documents/about-agl/how-we-source-energy/silverton-wind-farm/220616-02022-238-silverton-wind-farm-bird-and-bat-mortality-survey-year-2-v3-with-appendices.pdf https://www.agl.com.au/about-agl/how-we-source-energy/silverton-wind-farm/documents
Taralga Wind Farm	107	51	Vestas V90-2.0MW, V100-1.8MW, V90-3.0MW	2015	Repot accessible, however no specific data about species included https://www.taralga-windfarm.com.au/_files/ugd/d232bb_5ef21aa789da421691d339d66379acf3.pdf Data not publicly accessible, but there are reports that indicated it was undertaken. (Section 6.0) https://www.taralga-windfarm.com.au/_files/ugd/d232bb_b76545fd807c41698e8922897d52c688.pdf
White Rock Wind Farm	175	70	Goldwind 121 2.5MW	2018	Data available (at least 2 years monitoring) https://whiterockwind farm.com/project/managing-impacts/
Woodlawn Wind Farm	48.3	23	Suzlon S88 2.1 MW	2011	No data available

5.2.2. Bird and bat utilisation survey results

A review of key guidelines with regard to impacts associated with bird and bat utilisation of the subject land, and associated impacts such as wind turbine strikes and barrier effect has been undertaken. The following sources of information were reviewed, and have been relied on in the completion of this portion of the BDAR:

- Wind Farms and Birds – Interim Standards for Risk Assessment' issued by the Australian Wind Energy Association (AusWEA 2005).
- Onshore Wind Farms – Interim guidance on bird and bat management (DAWE 2022).
- Onshore Wind Farm Guidance (Cth DCCEEW 2023a).
- Best Practice Guidelines for Wind Energy Developments in Australia (Clean Energy Council 2018).
- Draft Wind Energy Guideline: Guidance for state significant wind energy development (DPE 2023a).
- Unpublished South West Biodiversity and Conservation Division Draft Turbine Risk Assessment Guidance (BCS 2023a).

- Unpublished South West Biodiversity and Conservation Division Suggested BBUS Method (BCS 2023b).

Bird utilisation survey

Biosis undertook BUS in accordance with the requirements of the Best Practice Guidelines for Wind Energy Developments in Australia issued by the Clean Energy Council (2018) to provide baseline data on the pre-construction utilisation by avian species. Additional to this, surveys were completed in accordance with the *Onshore Wind Farms – Interim guidance on bird and bat management* (DAWE 2022).

Seasonal BUS were undertaken to inform collision risk modelling and therefore potential prescribed impacts, including the risk of collision with turbine blades. It was also used to inform the targeted species surveys for candidate species credit species. A full list per species at each BUS point is demonstrated in Appendix 4.

Background research and data sources were reviewed to identify all protected bird species records within 50 kilometres of the subject land. Information from relevant literature and incidental species sightings during other surveys were used to inform surveys and cover the following species groupings.

- All threatened species.
- Species which are rarely recorded.
- Species which exist naturally at relatively low densities.
- Waders.
- Larger birds such as raptors (eagles, hawks, kites) and waterbirds (herons, pelicans).
- Migratory birds.

A total of 26 fixed survey sites were established, including 16 impact sites and 10 control sites, across two years and eight seasons, and a total of 729 replicates. Methods of survey are described in Section 4.3.1. The survey locations were selected to represent likely turbine positions identified early in the project design and to obtain data at potential impact locations. They were distributed in different vegetation classes as a surrogate for habitat types. As the design developed, some turbine locations moved to avoid other environmental constraints, which resulted in modifications to the bird utilisation survey design, resulting in decommissioning of some sites early on and some control sites becoming impact sites (evident by number ID changes). Some BUS points were placed on the fringes of woodlands, where there is a continuum of habitats (woodland to grassland etc), therefore, some sites sampled multiple habitat types. There are also sites adjacent to or within cropped areas to capture the spatial extent of the subject land.

The locations for impact and control sites are shown in Figure 11b and Table 49.

Table 48 BUS survey seasons

Year	Summer	Autumn	Winter	Spring
2022	-	-	1- 5 August	21- 25 November
2023	6 - 10 February	8 - 12 May	23 -27 July	16 - 20 October
2024	22 - 26 January	13 - 17 March	-	-

Table 49 Bird utilisation survey points

Site	Point type	Purpose	Stage	PCT	Habitat type	Formation
CTL1	Control	CRM/BBAMP	2	160 mod_good	Inland Floodplain Shrublands	Freshwater Wetlands

Site	Point type	Purpose	Stage	PCT	Habitat type	Formation
CTL2	Control	BBAMP only	2	13 moderate	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL3	Control	CRM/BBAMP	1	26 intact	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL6	Control	BBAMP only	2	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL7	Control	CRM/BBAMP	1	26 intact	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL8	Control	BBAMP only	2	13 moderate	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL9	Control	BBAMP only	2	Cat 1 exempt	Exotic/Cropping	-
CTL10	Control	BBAMP only	2	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
CTL11	Control	CRM/BBAMP	2	28 moderate	Riverine Sandhill Woodlands	Semi-arid Woodlands (Shrubby sub-formation).
CTL12	Control	BBAMP only	1	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP1	Impact	CRM	2	160 mod_good	Inland Floodplain Shrublands	Freshwater Wetlands
IMP2	Impact	CRM	1	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP3/18	Impact	CRM	1	13 thinned	Inland Floodplain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP4	Impact	CRM	2	13 moderate/46 Moderate	Inland Floodplain Woodlands and Riverine Plain Grasslands	Semi-arid Woodlands (Grassy sub-formation) and Grasslands
IMP5/19	Impact	CRM	2	26 intact	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP6	Impact	CRM	1	Cat 1 exempt	Exotic/Cropping	-
IMP7	Impact	CRM	2	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP9	Impact	CRM	1	26 DNG	Riverine Plain Woodlands (DNG)	Semi-arid Woodlands (Grassy sub-formation) and Grasslands
IMP10	Impact	CRM	1	26 DNG	Riverine Plain Woodlands (DNG)	Semi-arid Woodlands (Grassy sub-formation) and Grasslands
IMP11	Impact	CRM	1	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP13	Impact	CRM	2	26 DNG/15 moderate	Riverine Plain Woodlands (DNG) and Inland Floodplain Woodlands	Semi-arid Woodlands (Shrubby sub-formation) and Semi-arid Woodlands (Grassy sub-formation)
IMP16	Impact	CRM	1	13 moderate	Inland Floodplain	Semi-arid Woodlands

Site	Point type	Purpose	Stage	PCT	Habitat type	Formation
					Woodlands	(Grassy sub-formation)
IMP15	Impact	CRM	2	28 moderate/ 26	Riverine Sandhill Woodlands and Riverine Plain Woodlands	Semi-arid Woodlands (Shrubby sub-formation) and Semi-arid Woodlands (Grassy sub-formation)
IMP20	Impact	CRM	1	28 low	Riverine Sandhill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)
IMP21	Impact	CRM	2	26 sparse	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)
IMP22	Impact	CRM	2	26 intact	Riverine Plain Woodlands	Semi-arid Woodlands (Grassy sub-formation)

The Biosis survey effort across the eight seasons and two years equates to the equivalent of 28 replicates (729 replicates across 26 sites) at 20 minutes per point. This is adequate and within a reasonable survey tolerance for BBUS and the requirements of the CRM.

A total of 131 bird species were recorded within the subject land during BUS and within the eight seasons and two years of survey. The total list of species is provided in Appendix 4. The total number of flights recorded was 23,311 and the total number of flights within the Rotor Swept Area (RSA) height was 255 undertaken by 18 different species. The percentage of flights within RSA compared to that of all flights recorded is 1.09%.

The following height matrix was defined to classify bird height:

- Below RSA: <80 metres.
- Within RSA: 80 – 280 metres.
- Above RSA: >280metres.

The following guilds were used to categorise species:

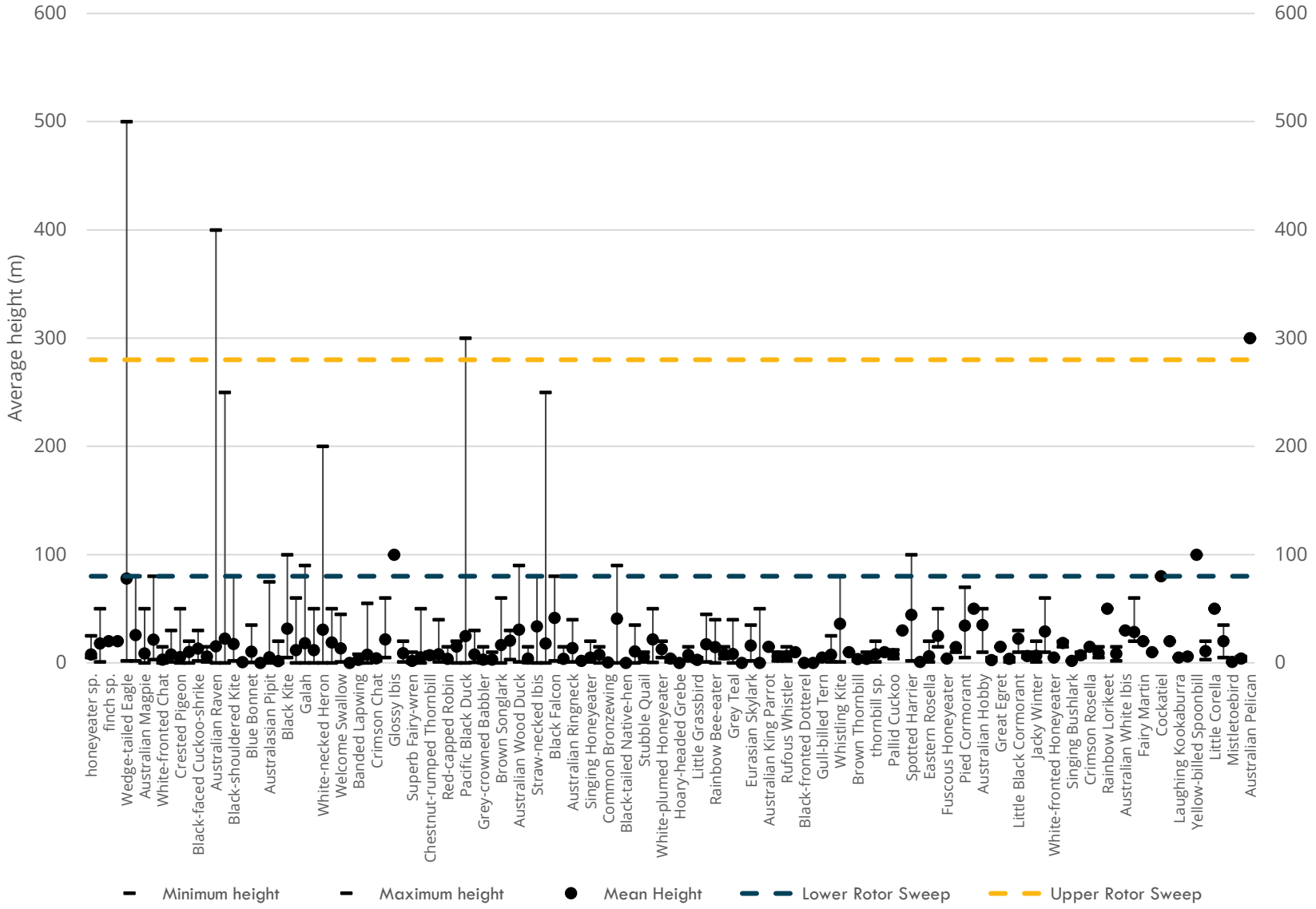
- Raptors.
- Grassland, shrubland and ground-dwelling birds.
- Waterbirds, seabirds and other aquatic foragers.
- Woodland birds (including parrots and songbirds).
- Exotic birds.

The following threatened species were recorded during the BUS:

- Southern Whiteface *Aphelocephala leucopsis* (Vulnerable, EPBC Act).
- Spotted Harrier *Circus assimilis* (Vulnerable, BC Act).
- White-fronted Chat *Epthianura albifrons* (Vulnerable, BC Act).
- Pied Honeyeater *Certhionyx variegatus* (Vulnerable, BC Act).
- Black Falcon *Falco subniger* (Vulnerable, BC Act).
- Superb Parrot *Polytelis swainsonii* (Vulnerable, EPBC Act and BC Act).
- Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis* (Vulnerable, BC Act).
- Redthroat *Pyrrholaemus brunneus* (Vulnerable, BC Act).

The most diverse guild of birds were the woodland birds which made up about 66% of all species observed. Up to 23 waterbird species were recorded, representing approximately 18% as the second-most recorded group. Raptors made up 11% of all species observed.

Graph 1 below shows the average heights of birds recorded. Section 6 discusses further the results of the CRM and risk assessments for at risk species.



Graph 1 **Average flight heights for bird species recorded during BUS**

Bat utilisation survey

Biosis completed seven seasons of surveys from 2022 to 2024 to provide baseline data on the pre-construction utilisation of the subject land by microbat species. The survey effort was a broad analysis undertaken to determine the presence or absence of all possible species predicted to occur in the area, with a particular focus on potential threatened species, as well as analysis of bat activity in conjunction with wind data from the on-site Met Mats.

Table 50 BUS survey seasons

Year	Summer	Autumn	Winter	Spring
2022	-	-	-	21- 25 November
2023	6 - 15 February	8 - 12 May	23 -27 July	15 - 20 October
2024	15 - 23 January	11 - 16 March	-	-

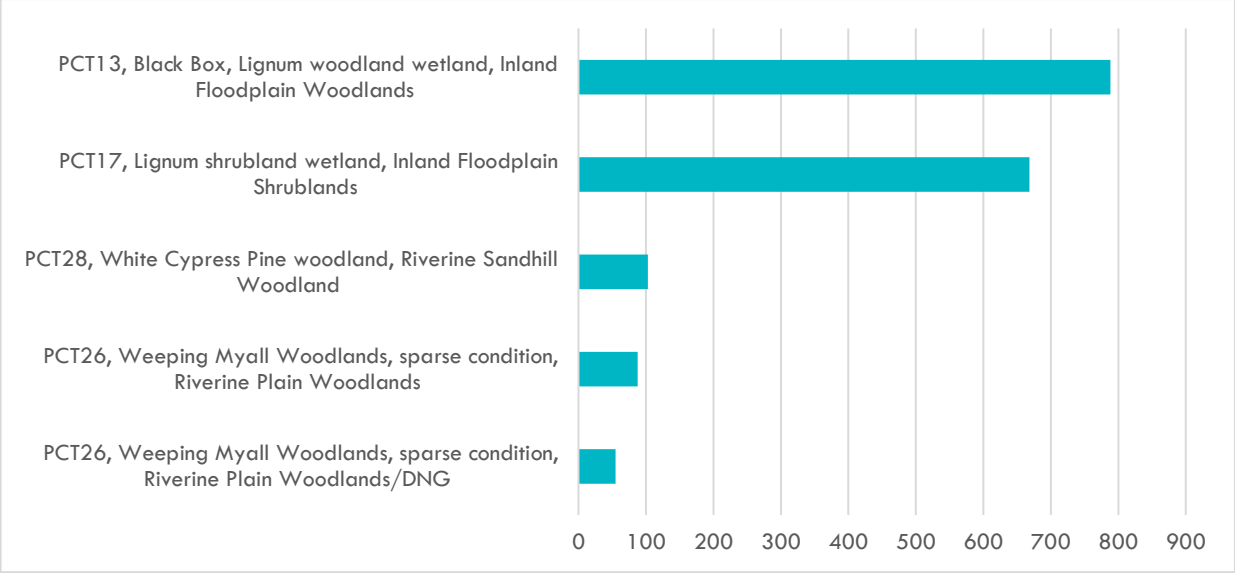
Bat activity was sampled across a range of habitat types within the subject land. The survey effort per habitat type is shown in Table 51.

Table 51 Microbat survey seasons

PCT	Zone	Vegetation class	Total bat calls recorded	Number of detector nights	Avg activity per detector per night
PCT13, Black Box, Lignum woodland wetland	Moderate	Inland Floodplain Woodlands	30,746	39	788
PCT17, Lignum shrubland wetland	Moderate	Inland Floodplain Shrublands	10,694	16	668
PCT28, White Cypress Pine woodland	Moderate	Riverine Sandhill Woodland	3400	33	103
PCT26, Weeping Myall Woodlands	Sparse	Riverine Plain Woodlands	9399	107	88
PCT26 Weeping Myall Woodlands	Sparse/DNG	Riverine Plain Woodlands/DNG	757	33	55
Totals			**54,996**	**228**	**241**

It can be seen from Table 51, and Graph 2 below, that bat activity was found to be higher within wetter areas within the subject land such as floodplain woodland and shrublands. This is consistent with what would be expected in dry, open landscapes. Foraging resources are likely to be concentrated in wetter areas, where insect abundance and diversity is also likely to be higher. Structural vegetation diversity is also likely to be associated with increased foraging opportunities for a greater diversity of bats. Eucalypt woodland containing Black Box had the highest activity, which may also reflect increased roosting opportunities available in these habitats compared to other treed habitat types.

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Graph 2 Average bat activity per night per habitat type

Total bat activity each season and number of detector nights is shown in Table 52.

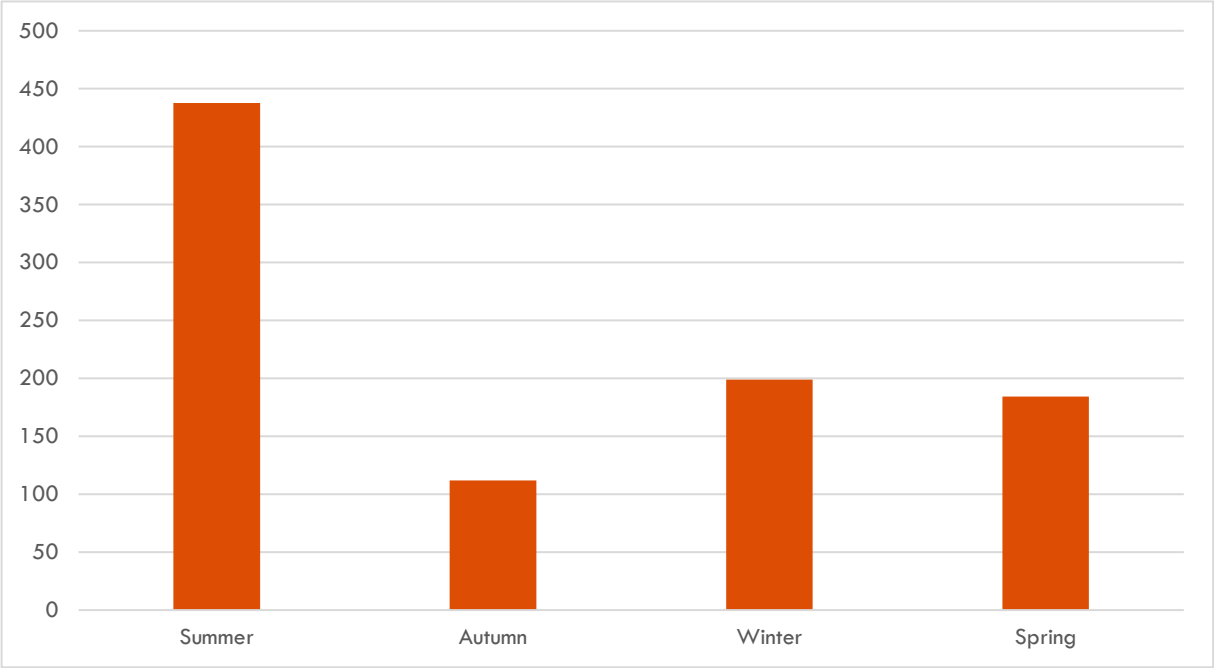
Table 52 Seasonal bat activity and effort (ground level detectors only).

	Summer	Autumn	Winter	Spring
Total activity	25,815	5,934	8,549	14,552
Detector nights	59	53	43	79

The average activity per detector per night is shown for each season in Graph 3. Average activity per detector per night was found to be highest in summer. The peak in summer activity early February coincides with when juvenile bats would be beginning to leave the roost and fly on their own, and may reflect increased numbers of bats and bat activity at this time. The low average activity between 10 - 15 February is likely to be due to only one detector being out at this time, which was located in PCT 26, which did not record high activity overall. This pattern is unlikely to be representative of bat activity across the site during this time, which would presumably be highest in floodplain shrubland and woodlands. Similarly in summer 2024, sampling was only undertaken at paired detectors located on the two met masts, which were both in PCT 26. This may be why the average activity per detector was lower than that observed in summer 2023. Again, this activity level is unlikely to be representative of activity across the site. It does further demonstrate however, that bat activity in this PCT, which is where the majority of turbines are proposed to be located, is consistently low, compared to other PCTs and vegetation classes.

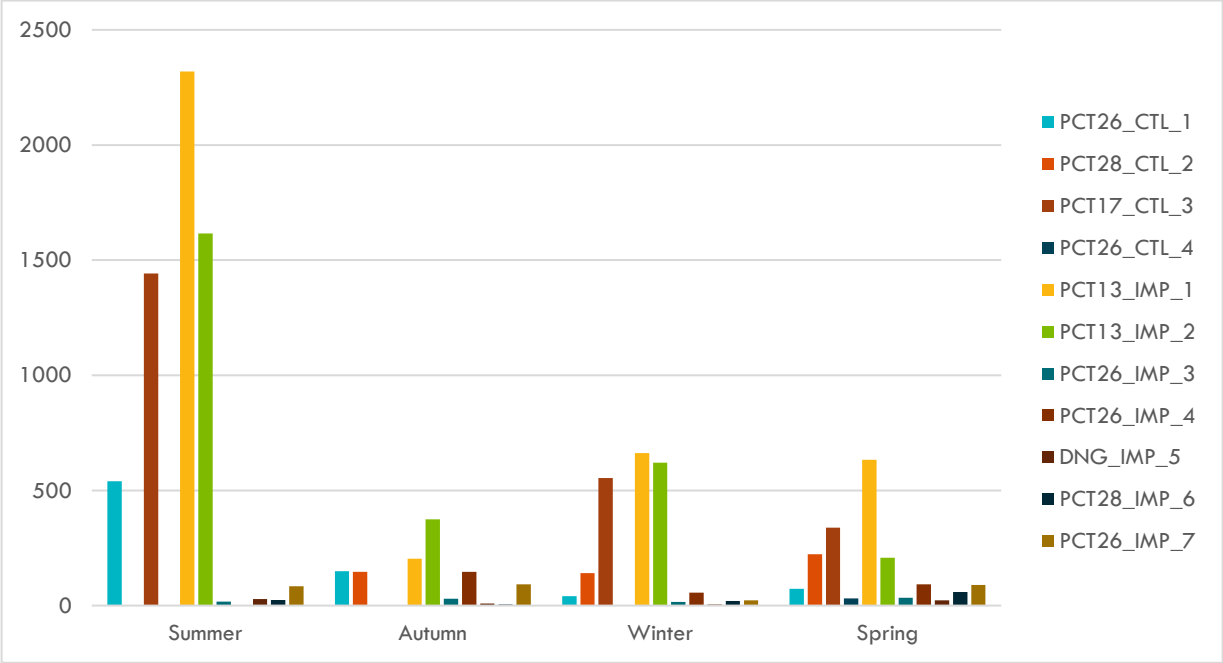
Average bat activity was found to be lowest in autumn. It is unclear why this is the case, and increased replication may be required to further determine why bat activity, particularly in autumn 2024 which occurred in early March, was so much lower than that observed in early February. Similarly, activity in spring was not as high as may be expected, and increased replication may be required to ascertain true activity patterns. Spring 2022 was particularly wet and the site experienced heavy flooding, which may have altered activity patterns.

Activity in winter was unexpectedly higher than in both autumn and spring. Sampling in winter was conducted across four nights only, which may not have been enough to capture nightly variability. When average bat activity is compared per night of sampling, it can be seen that there was a spike in activity during winter on one sampling night (27 July), while the other sampling nights were comparatively much lower.



Graph 3 Average activity (number of calls) per detector per night for each season

The increased activity was associated with three sites in particular, all of which were in floodplain woodland and shrubland habitats where bat activity was found to be highest across all sampling periods. This is consistent with the hypothesis that bat activity is highest in these vegetation communities, such as PCT 13, PCT 15, and most likely PCT 10. It is possible that bat activity temporarily increased at these locations to exploit favourable weather conditions during what is normally a time of reduced activity for microbats due to colder nightly temperatures (Graph 4).



Graph 4 Average bat activity per night per site each season

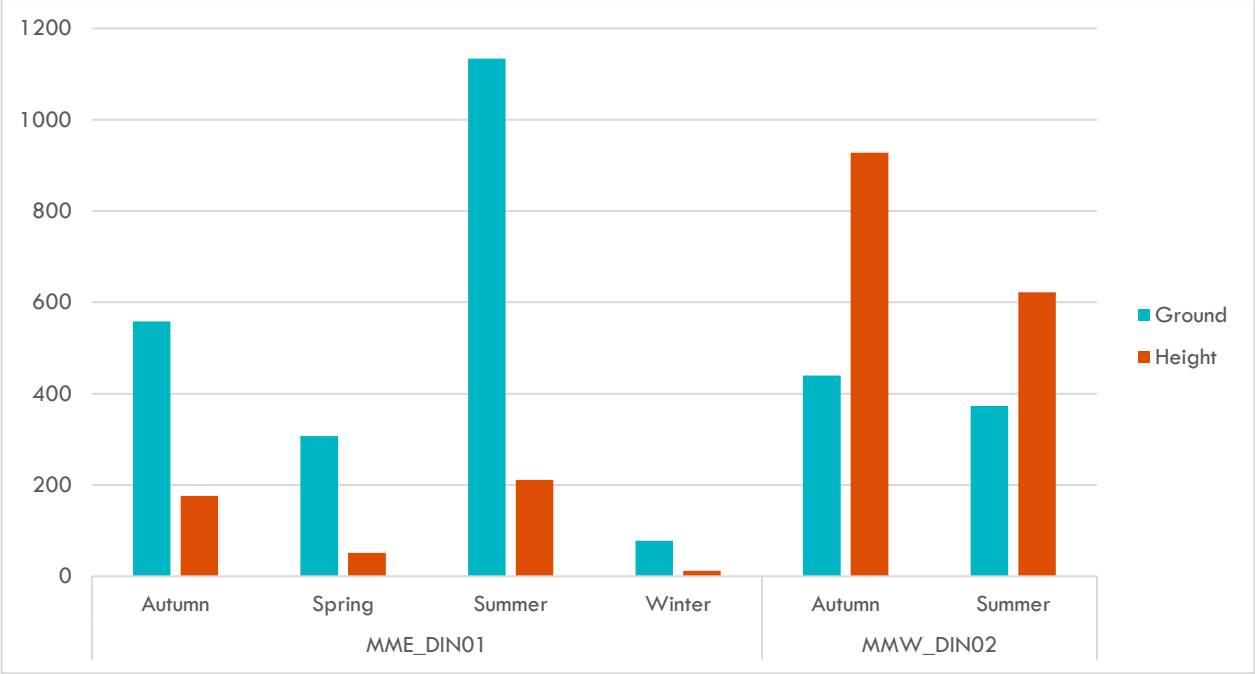
Additionally, bat activity was compared between paired detectors located at MME_DIN_01(eastern Met Mast) in summer, autumn, winter and spring 2023, and paired detectors at both MME_DIN_01 and MMW_DIN_02 (western Met Mast) in summer 2024. Species diversity at height was lower than that recorded at ground level. The majority of activity at height could be attributed to known high-flying and aerial foraging bat species such as White-striped Free-tailed Bat, Yellow-bellied Sheathtail-bat, Free-tailed Bats (*Ozimops* spp.) and Gould's Wattled Bat.

When all data is pooled, activity at height was seen to be lower than the activity recorded at ground level in all seasons except autumn. It appears that this pattern was mostly a result of activity at MMW_DIN_02, where activity of bats was higher overall than at MME_DIN_01. Comparing the pattern at each met mast, it can be seen that the activity at height was consistently lower than at ground level at MME_DIN_01 but this was not the same at MMW_DIN_02 (Table 53, Graph 5). Although both Met Masts are located in PCT 26, the habitat surrounding MMW_DIN_02 is higher quality bat habitat compared to that at MME_DIN_01. The eastern met mast (MME_DIN_01) is surrounded by PCT 26 sparse woodland and cropping areas, subject to more frequent agricultural use in the form of cropping and grazing. The western met mast (MMW_DIN_02) is located amongst larger, more intact patches of native vegetation including PCT 26 Intact and PCT 13 moderate, the latter is more likely to represent a focal point in the landscape for bat activity (Graph 5). Data from MMW-DIN_02 also has a smaller sample size compared to MMW_DIN_001.

Table 53 Activity at ground level vs height data

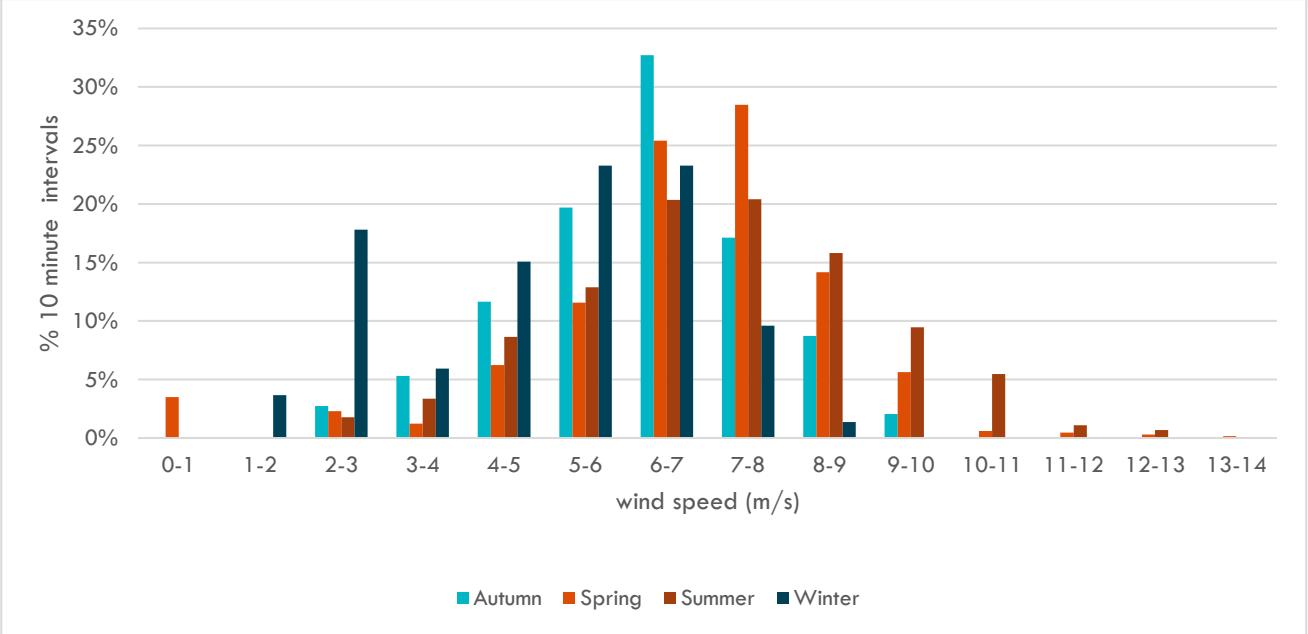
	Detector nights	Total activity (ground)	Total activity (height)
Summer*	26	1507	833
Autumn*	10	998	1104
Winter	4	78	12
Spring	4	307	51
TOTAL	44	2890	2000

*** includes data from paired detectors at DIN_01 in summer 2023, and paired detectors at both DIN_01 and DIN_02 in summer 2024.**



Graph 5 Comparison of activity at height versus ground level at each met mast

Wind speed data was recorded at 10 minute intervals from an anemometer mounted at approximately 50 metres on MME_DIN_01 for the duration of each detector deployment. Data was compared for each season during the times when the detectors were deployed between 6pm and 6am when bats are likely to be active. The percentage of 10 minute intervals for each wind speed each season is shown in Graph 6.

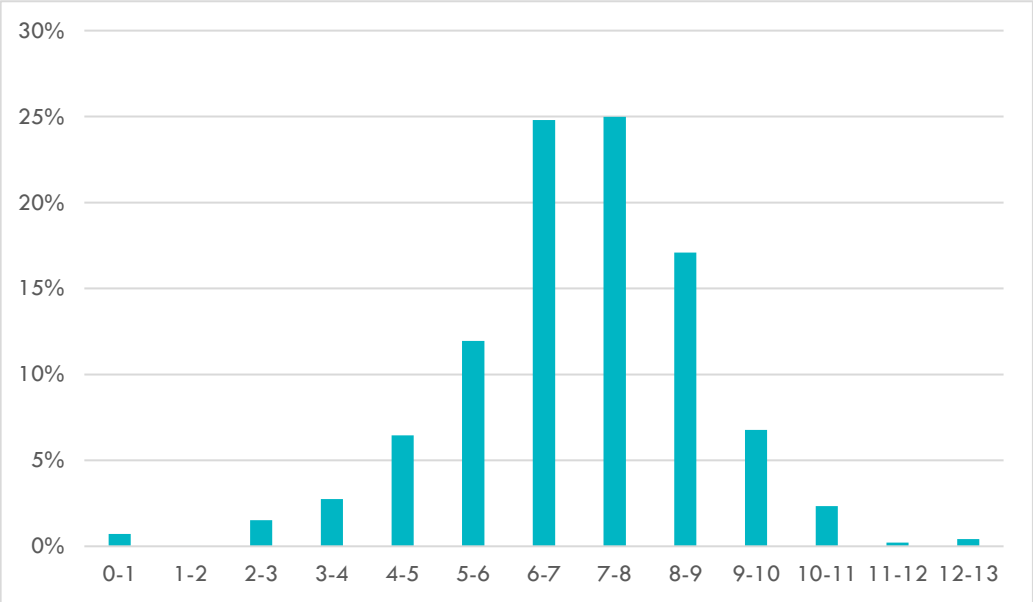


Graph 6 Percentage of 10-minute intervals per windspeed during each night (6pm-6am) of each deployment period

Average bat activity per detector per night was plotted against average nightly temperature and wind speed collected from MME_DIN_01 during each deployment. This data does not show a clear correlation between temperature, wind speed and bat activity. It is likely that more detailed analysis is needed to interpret the

influence of these variables on bat activity within the subject land. Each bat call was assigned a wind speed value based on the nearest 10 minute interval. The percentage of calls for each wind speed is shown in Graph 7. This shows that 73% of bat activity occurred when wind speeds were 8m/s or less. Conversely, only 27% of bat activity occurred at wind speeds greater than 8 m/s. However it must be noted that the low percentage of bat activity at low wind speeds is likely due to the absence or lack of 10-minute intervals during the night that recorded low wind speeds, as shown on Graph 6. That being, the wind data suggests there are very limited times where the wind speed it is actually around the ≤3m/s mark. In summary, the data suggests that bat activity is generally highest up until around 8 m/s before activity begins to taper off.

Overall, data regarding the relationship between bat activity and wind speed or temperature was not conclusive for the project. The strongest predictor of bat activity appears to be habitat type, with inland floodplain woodland (PCT 13 and PCT 15) and shrubland (PCT 17 and PCT 160) consistently recording higher bat activity than other habitat types. These areas are largely being avoided by the project.



Graph 7 Percentage of bat activity per wind speed

5.2.3. Identification of resident, nomadic and migratory species and flight paths

Section 6.1.5 of the BAM dictates that wind farm developments must identify resident threatened aerial species, resident raptor species and nomadic/migratory species likely to fly over the proposed development site as a flyway or migration route. These species are summarised below in their respective categories.

Resident raptor species

The following resident raptor species were identified as being present within the subject land during BUS;

- Brown Goshawk *Accipiter fasciatus*.
- Wedge-tailed Eagle *Aquila audax*.
- Spotted Harrier *Circus assimilis* (Vulnerable, BC Act).
- Swamp Harrier *Circus approximans.*
- Black-shouldered Kite *Elanus axillaris*.
- Brown Falcon *Falco berigora*.

- Nankeen Kestrel *Falco cenchroides cenchroides*.
- Australian Hobby *Falco longipennis.*
- Black Falcon *Falco subniger* (Vulnerable, BC Act).
- Whistling Kite *Haliastur sphenurus.*
- Black Kite *Milvus migrans*.

Many of these species are considered common/widespread and likely to occur as resident raptor species, with dispersing juveniles, with Spotted Harrier and Black Falcon both listed as Vulnerable under the BC Act.

Threatened woodland aerial species

Threatened woodland aerial species recorded during BBUS include the following species:

- Southern Whiteface *Aphelocephala leucopsis* (Vulnerable EPBC Act and BC Act), credit type not yet assigned.
- Painted Honeyeater *Grantiella picta* (Vulnerable EPBC Act and BC Act).
- Spotted Harrier *Circus assimilis (Vulnerable, BC Act).*
- White-fronted Chat *Epthianura albifrons (Vulnerable, BC Act).*
- Black Falcon *Falco subniger* (Vulnerable, BC Act).
- Superb Parrot *Polytelis swainsonii* (Vulnerable EPBC Act and BC Act).
- Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris* (Vulnerable, BC Act).

Of these species, all but Painted Honeyeater, Southern Whiteface and White-fronted Chat are considered at risk of collision based on known behaviours and flight heights recorded from BBUS.

Nomadic/Migratory species

The following species considered as nomadic/migratory that were recorded during BUS, or are known to move through the subject land during nomadic movements, such as the Australasian Bittern, within the locality include:

- Australasian Bittern *Botaurus poiciloptilus* (Endangered, BC Act and EPBC Act).
- Australian Pelican *Pelecanus conspicillatus.*
- Australian White Ibis *Threskiornis Molucca.*
- Black Falcon *Falco berigora* (Vulnerable, BC Act).
- Cockatiel *Nymphicus hollandicus.*
- Fairy Martin *Petrochelidon ariel.*
- Fork-tailed Swift *Apus pacificus*
- Great Egret *Ardea alba*
- Grey Teal *Anas gracilis*
- Gull-billed Tern *Gelochelidon nilotica*
- Little Black Cormorant *Phalacrocorax sulcirostris*
- Little Egret *Egretta garzetta.*
- Little Pied Cormorant *Microcarbo melanoleucos.*

- Masked Woodswallow *Artamus personatus.*
- Mulga Parrot *Psephotus varius.*
- Pacific Black Duck *Anas superciliosa.*
- Plumed Whistling Duck *Dendrocygna eytoni.*
- Pink-eared Duck *Malacorhynchus membranaceus*
- Rainbow-Bee-eater *Merops ornatus.*
- Straw-Necked Ibis *Threskiornis spinicollis.*
- Superb Parrot *Polytelis swainsonii* (Vulnerable EPBC Act and BC Act).
- White-necked Heron *Ardea pacifica.*
- Yellow Spoonbill *Platalea flavipes.*

An assessment of habitat, movements and flight paths of nomadic and migratory species identified was completed. The nomadic/migratory movements within Australia of the non-threatened and threatened species are summarised below in Table 54. The migratory movement of species outside Australia are summarised below in Table 55 that may occur on a rare occurrence or low likelihood.

Table 54 Nomadic/migratory avian species movements within Australia

Species	Nomadic/Migratory movement description	Movement trigger	Habitat in subject land
Threatened species			
Australasian Bittern	Partially nocturnal, cryptic. Not considered highly nomadic, meaning they inhabit a particular area for an extended period but may move within that range in response to changing conditions. Recent satellite tracking work indicates that a large portion of the Riverina rice crop breeding population disperses to coastal wetlands after harvest, whilst other stay local (Bitterns in Rice, 2024).	In response to changes in environmental conditions, such as food availability or weather patterns, searching for suitable breeding habitat or better foraging opportunities.	Sub optimal habitat occurs within the subject land, but may occur transiently in PCT 24 or PCT 160 during optimal flooding years., such as the spring /summer 2022/2023 flooding events. Primarily though, the subject land occurs within the flight path between Victoria and Coleambally, with tracking data indicating the movement of Bitterns on occasion through the subject land.
Australian Painted Snipe	Poorly known, but dynamic and highly mobile. Potential for north south migration in eastern Australia, and not often seen in winter in southern eastern Australia.	Responds to flooding of ephemeral inland wetlands, but vanishes for years from key sites even when suitable habitat is available.	Sub optimal habitat occurs within the subject land, but may occur transiently in ephemeral waterways and swamps such as PCT 24, PCT 13, PCT 17 or PCT 160 during optimal flooding years.
Black Falcon	Partially nomadic following rain and the consequent increase in prey numbers.	Inland movements are influenced by rainfall and seasonal factors, as well as prey abundance.	Observed within PCT 28, PCT 10 and fringing PCT 26 sparse woodlands.

Species	Nomadic/Migratory movement description	Movement trigger	Habitat in subject land
Superb Parrot	In the Riverina, mostly sedentary, but can become nomadic or dispersive in winter or based on environmental conditions.	Overwintering or based on foraging resources available.	Observed within PCT 26 intact Myall and PCT 13 riparian areas.
Non-threatened species			
Australian Pelican	Pelicans sometimes flock in large number to breed in inland areas. As waters recede, they head for more permanent wetlands or the coast.	Inland movements are influenced by rainfall and seasonal factors.	Observed in flooded riparian areas such as PCT 13. May also use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Australian White Ibis	Highly nomadic, moving in search of suitable habitat, often with Straw-necked Ibis.	Inland movements are influenced by rainfall and seasonal factors.	Open PCT 26 DNG areas and may use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Cockatiel	Highly dispersive and nomadic species.	Based on food and water sources become more or less prevalent.	Observed in PCT 13 and PCT 26 woodland.
Fairy Martin	Seasonally migratory, moving north for winter.	Breeding and over wintering. Seasonally common and locally abundant across most of its range.	Observed in PCT 13 and PCT 26 woodland.
Fork-tailed Swift	Breeding occurs April – July in Siberia. Migration starts around August-September with birds moving south, arriving in Australia September/October. Once in Australia this species disperses across most of Australia, often following low pressure systems (Cth DCCEEW 2024e).	Species departs from Australia April/May returning to breeding grounds in Siberia. Return migration triggered by temperatures in Australia (Cth DCCEEW 2024e).	Species is almost exclusively aerial, foraging from 1 to 300m above ground. Foraging usually occurs along the edge of low pressure systems occurring over inland plains, above foothills and coastal areas. Roosting can occur in woodland areas but also aerially. Woodland areas may be used for roosting within the subject land.
Grey Teal	Highly dispersive and nomadic species.	Rainfall and/or flooding events that occurred up to 10 km from resident location.	Observed in flooded riparian areas such as PCT 13. May also use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.

Species	Nomadic/Migratory movement description	Movement trigger	Habitat in subject land
Little Black Cormorant	Partially nomadic. Mostly sedentary, but can become nomadic during above average rainfall and flooding events.	Inland movements are influenced by rainfall and seasonal factors.	Observed in flooded riparian areas such as PCT 13. May also use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Little Egret	Dispersive and, in parts of its range, with multi-directional post-breeding movements of up to 280 km recorded. Undertakes regular seasonal movements, mostly to and from breeding colonies, and towards the coast in the dry season.	There is circumstantial evidence of long-distance migration, with regional differences in reporting rates suggesting that individuals migrate north to winter in tropical northern Australia, consistent with changes in the availability of suitable wetland habitat.	Observed in flooded riparian areas such as PCT 13. May also use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Little Pied Cormorant	Partially nomadic. Mostly sedentary, but can become nomadic during above average rainfall and flooding events.	Inland movements are influenced by rainfall and seasonal factors.	Observed in flooded riparian areas such as PCT 13. May also use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Masked Woodswallow	Post-breeding movement to northern Australia over winter months, and returning to southern areas to breed in spring and early summer.	Breeding and over wintering. Seasonally common and locally abundant across most of its range.	Observed commonly in PCT 28 White Cypress Pine communities.
Mulga Parrot	Seasonal movements of the Mulga Parrot are not well known, but it is usually considered to be either nomadic or to stay in much the same area all year.	Based on foraging resource and response to drought .	PCT 26 Weeping Myall Woodlands
Pacific Black Duck	Mostly sedentary, but can become nomadic during above average rainfall and flooding events.	Inland movements are influenced by rainfall and seasonal factors.	May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Plumed Whistling Duck	Highly dispersive and nomadic species. Prefers margins of shallow, temporary waters and swamps. Feeds in adjacent grassland areas.	Inland movements are influenced by rainfall and seasonal factors.	May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Pink-eared Duck	Highly dispersive and nomadic species. Prefers shallow, temporary waters,	Inland movements are influenced by rainfall and seasonal factors.	Observed in flooded riparian areas such as PCT 13. May also use dams and

Species	Nomadic/Migratory movement description	Movement trigger	Habitat in subject land
	however, open wetlands support large flocks.		irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Rainbow-Bee-eater	Majority of global population breeds in Australia. Breeding has also been recorded in Papua New Guinea and may occur in the Lesser Sundas Island, Indonesia. (Cth DCCEEW 2023c).	Seasonally common and locally abundant across most of its range. In Australia, breeding season occurs August – January. Moves north across Australian winter.	Observed commonly in PCT 28 White Cypress Pine communities.
Straw-necked Ibis	Highly nomadic, moving in search of suitable habitat, often with Australian White Ibis.	Inland movements are influenced by rainfall and seasonal factors.	Open PCT 26 DNG areas and may use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
White-necked Heron	Highly mobile, moving around in response to seasonally and annually varying rainfall patterns.	Inland movements are influenced by rainfall and seasonal factors.	May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Yellow Spoonbill	Nomadic across the north and well-watered inland areas in response to water and habitat.	Inland movements are influenced by rainfall and seasonal factors.	May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.

Table 55 Migratory avian species movements within and outside of Australia relevant to subject land

Species	Migratory movement description	Movement trigger	Habitat in subject land
Curlew Sandpiper	Nesting occurs in Siberia in June/July. Migration between nesting grounds and Australia occurs from July/August, with birds arriving in northern Australia from August – September. Once in Australia, birds move across Australia from August – December (Cth DCCEEW 2024a) .	Return migration triggered by temperatures in Australia. Foraging in Australia occurs until January – April, where birds begin migration back to breeding grounds in Siberia. Some non-breeding individuals (mostly juveniles) stay in Australia until the following season, when they return to Siberia to breed (Cth DCCEEW 2024a).	Sub-optimal. May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.

Species	Migratory movement description	Movement trigger	Habitat in subject land
White-throated Needletail	Breeding and nesting occurs in Asia around May – June, with most birds migrating August – October arriving to Australia September/October (Cth DCCEEW 2024b).	Return migration triggered by temperatures in Australia. Foraging in Australia occurs until January – April, where birds begin migration back to breeding grounds in Siberia. Some non-breeding individuals (mostly juveniles) stay in Australia until the following season, when they return to Siberia to breed (Cth DCCEEW 2024a).	Subject land is at this species' most westerly distribution. This species is almost entirely aerial, foraging from 1m to 1000m above the ground, they occur over most habitat types, with a preference towards wooded areas. Roosting occurs in in forest/woodland in dense canopy or hollow, with indications of aerial roosting also occurring (Cth DCCEEW 2024b).
Common Greenshank	Nesting occurs in Palaearctic in the northern hemisphere April – June, with migration to the southern hemisphere occurring from July – September. Birds arrive in Australia from August, and disperse throughout Australia to late December (Cwth DCCEEW 2024b).	Return migration triggered by temperatures in Australia. Foraging occurs in Australia until around February, with birds departing March – April to return to breeding grounds (Cwth DCCEEW 2024b).	Sub-optimal. May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Latham's Snipe	Breeding/Nesting occurs in Japan and far eastern Russia departing breeding grounds July – November in migration to eastern Australia, arriving in Australia July-November. Once in Australia individuals slowly move south along the coast and inland. Within Australia the species is dispersive, with foraging movements triggered by rainfall and availability of food (Cth DCCEEW 2024d).	Foraging occurs in eastern Australia until around February – March, where individuals, likely triggered by temperature, return to breeding grounds in the northern hemisphere (Cth DCCEEW 2024d).	Sub-optimal. May use dams and irrigated crop areas in the subject land and areas of PCT 160 or PCT 17 during optimal years.
Caspian Tern	Within Australia, this species is resident with breeding occurring year-round subject to seasonal conditions. Migration between foraging and breeding areas occurs between coastal and inland sites (Cwth DCCEEW 2024c).	Migration between foraging and breeding areas occurs between coastal and inland sites based on seasonal conditions (Cwth DCCEEW 2024c).	Sub-optimal. May also use dams and irrigated crop areas in the subject land.
Pectoral Sandpiper	Nesting occurs in northern Russia and North America arriving in Australia August –	Species departs Australia generally March-April, with temperature as the likely	Sub-optimal. May use dams and irrigated crop areas in the subject land and areas of PCT

Species	Migratory movement description	Movement trigger	Habitat in subject land
	September. Noted as an uncommon migrant to Australia, mostly sighted in south-eastern Australia, the Murray Darling Basin and western Victoria. Individuals generally arrive in coastal areas before dispersing inland (Birds in Backyards 2024).	trigger (Birds in Backyards 2024).	160 or PCT 17 during optimal years.

Flyways and nomadic movements

Flyways and movements of aerial taxa likely to occur, or recorded within the subject land are described below in the following guilds: Microbats, raptors, waterbirds, woodland and shrubland birds and ground dwelling birds. Within the subject land, and broader landscape, the vast majority of flights observed were between more intact patches of woody vegetation, roadside corridors and along riparian waterways dominated by PCT 13 and PCT 15, patches of fragmented sandhill vegetation dominated by PCT 28, and more intact areas of PCT 26 Weeping Myall. Raptor species and more common disturbance tolerant woodland species, such as Ravens and Galahs, as well as common parrots such as Blue Bonnets, were also observed transiting or foraging across more open grassland and sparse woodland landscapes.

Raptors

A total of 11 raptor species, including the Black Falcon and Spotted Harrier, were identified during the BUS survey effort by Biosis within the subject land. Raptor presence varied between seasons, however presence of identified raptor species are considered resident, with dispersing juveniles, within the subject land. Predominately raptor movement is influenced by a complex interplay of ecological factors, and specific patterns that can vary greatly between species. Within the subject land, raptors utilise woodland and scattered trees within PCT 13, PCT 15 and PCT 28 for roosting and nesting whilst foraging was observed within the more open grasslands and sparse woodlands. Raptor species move throughout the day and covering larger distances between nesting, roosting and foraging locations, particularly Wedge-tailed Eagles. Table 62 demonstrates a review of the risks associated with collisions for raptors known to occur within the subject land, or predicted to occur on occasion.

Waterbirds

A total of 23 waterbirds were observed during BUS surveys. Movements of waterbird species are likely to occur as a mixture of resident day or nightly movement, nomadic movements subject to climatic conditions and for some species, seasonal migration movements during warm and cold months. Flight paths are likely to occur through the subject land and across into the broader landscape. During wetter seasons and flooding events, such as in spring 2022, larger numbers of waterbirds were observed then on average due to optimal foraging conditions and more permanent water.

Satellite tracking of Australasian Bitterns has record flights through the subject land between Coleambally and Victora (Bitterns in Rice, 2024). The potential flight heights for Australasian Bitterns can vary depending on several factors, including habitat type, weather conditions, and behavioural patterns. Generally, Australasian Bitterns are known to fly at relatively low altitudes, often skimming over wetland vegetation such

as reeds and grasses. This low-level flight behaviour is believed to be an adaptation to their hunting strategy, as they primarily prey on small fish, frogs, and invertebrates found in shallow water within wetland habitats. During normal flight activity, Australasian Bitterns typically fly just above the surface of the water or wetland vegetation, often staying within a few meters above ground level. However, they may occasionally ascend to slightly higher elevations, particularly during certain behaviours such as territorial displays or courtship flights, which may involve flights up to several meters above the ground. Overall, while the precise flight heights of Australasian Bitterns may vary depending on specific circumstances, they generally exhibit a low-level flight behaviour, closely associated with the wetland habitats they inhabit and the hunting strategies they employ. However, recent research shows they can ascend to higher altitudes, and although based on a small sample size of three individuals, recent GPS movement tracking of Australasian Bitterns in New Zealand has shown the species flies at RSA height, with one individual spending 61% of its time at heights of 20–200 metres. Satellite tracking of the species in Australia has also shown the species flying at heights of 3–100 metres above ground (AOC, 2023).

Woodland, grassland and shrubland birds

A total of 87 woodland, grassland and shrubland bird species, including parrots, robins and honeyeaters, were recorded within the subject land during the BUS survey effort by Biosis. The collective sum of these species utilises almost all the habitat within the subject land for foraging, roosting or nesting, however, generally stick to flights within or just above canopy heights. Resident species complete daily movements, moving from roosting habitat across foraging areas. Movements of many species are centred on abundance and availability of food, or occur seasonally with temperature changes and seasonal conditions. Breeding is likely to occur year-round across the species identified. Resident species are likely to hunt and or forage and roost in patches of preferred habitat, with minimal dispersal outside of breeding seasons. Species subject to nomadic movements are likely to use both riparian and terrestrial woodland corridors, and for smaller species, such as the threatened White-fronted Chat and Southern Whiteface, areas of shrubland habitat throughout the landscape. Terrestrial movement corridors have been identified within Figure 13 and Figure 14. Threatened woodland and shrubland bird species identified within the subject land include White-fronted Chat, Grey-crowned Babbler (eastern subspecies), Southern Whiteface and Superb Parrot. Areas of identified habitat that may support the threatened Plains-wanderer were also identified within the subject land, however this species is considered predominately as sedentary, with occasional dispersal movements due to the dynamic nature of grassland habitats.

Microbats

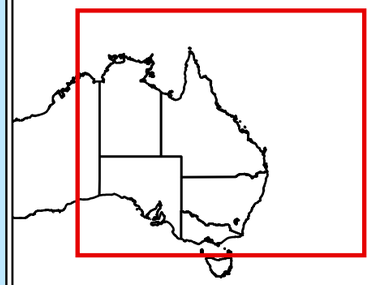
As previously mentioned, 14 species were positively identified of the 20 species that are known or predicted to occur within the subject land (Australasian Bat Society 2022). Up to four additional species may also have been recorded however reliable identification to species level was not possible due to similarity of call characteristics between species. Bat activity was found to be higher in wetter areas within the study area such as floodplain woodland and shrublands. This is consistent with what would be expected in dry, open landscapes. Foraging resources are likely to be concentrated in wetter areas, where insect abundance and diversity is also likely to be higher. Structural vegetation diversity is also likely to be associated with increased foraging opportunities for a greater diversity of bats. Table 56 and Table 63 provides a review of behaviour and flight characteristics of microbat species recorded within the subject land and collision risk.

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Table 56 Microbat behaviour overview

Species	Foraging space	Flight characteristics	Canopy	Overview
White-striped free-tailed bat *Austronomus australis*	Open	Fast, not designed for manoeuvrability	Above canopy	Fast-flying species intercepting their prey 50 m or more above the ground. (Churchill 2008).
Gould's Wattled Bat *Chalinolobus gouldi*	Edge	Fast, agile	Generally, within the lower level of the tree canopy and along forest edges, creek lines and isolated paddock trees. Can fly at height and open areas on occasion	Feeds on a wide variety of prey, regularly foraging 5 - 10 km from their roost site. They fly just below or within the lower level of the tree canopy and along the forest edges, creek lines and around isolated paddock tree with fast, agile flight (Churchill 2008).
Chocolate Wattled Bat *Chalinolobus morio*	Edge	Fast, agile, direct	Below canopy	In inland areas their distribution is associated with water courses that provide large trees for roosts. They prefer forests to small forest patches (Churchill 2008). They forage up to 5 km from their roost site, their flight is usually fast and direct with considerable agility (Churchill 2008). They mostly forage in the zone between the top of the understorey and the canopy, although sometimes fly low along forest trails.
Long-eared Bat *Nyctophilus sp*	Closed	Slower, more manoeuvrable.	Below canopy, in and around vegetation.	Highly manoeuvrable and able to change direction often and quickly (Churchill 2008). Fly very close to vegetation, usually at canopy height, where they weave between gaps in the canopy (Churchill 2008).
Inland Free-tailed Bat *Ozimops petersi*	Open/ Edge	Fast, direct	Above canopy	Forage in open unobstructed areas. They fly fast above the canopy. They are not very manoeuvrable in flight.
South-eastern Free-Tailed Bat *Ozimops planiceps*	Open/Edge	Fast, agile	Below canopy on ground, edge of canopy and above canopy.	Forage up to 12 km from their roost site. Roost in tree hollows with narrow entrances and cavities. Forage in spaces between trees, at edge of canopy of remnant vegetation and above canopy. Can also forage on the ground due to their agility (Australian Museum 2020).
Ride's Free-tailed Bat *Ozimops ridei*	Open/ Edge	Fast, direct	Above canopy	Fly predominantly in the spaces between trees.

Species	Foraging space	Flight characteristics	Canopy	Overview
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	Open	Fast, direct, not manoeuvrable	Above canopy	Almost all habitats, migratory, probably fly high. Long, narrow wings.
Inland Broad nosed Bat *Scotorepens balstoni*	Edge	Moderately fast, agile	Below canopy	Flight is continuous with sudden rapid diversions. Forage mostly between trees but also at the edges of forests, and out in open areas. (Churchill 2008). They stay within 15 m of the ground and do not forage above the canopy.
Little Broad-nosed Bat *Scotorepens greyii*	Edge	Moderately fast, agile	Below canopy	Flight is continuous, moderately fast, agile. Search for insects close to the tree tops but not above them, flying in the open spaces along the contour of the vegetation within 2 m of the foliage. Forage over water, grasslands and other open habitat. (Churchill 2008).
Large Forest Bat *Vespadelus darlingtoni*	Edge	Fast, less manoeuvrable.	Below canopy	Fast-flying bat that is less manoeuvrable than most *Vespadelus*. Avoid cluttered regrowth and rainforest by foraging mainly within the spaces among trees and between the canopy and the understorey.
Southern Forest Bat *Vespadelus regulus*	Edge	Fast, agile, manoeuvrable	Below canopy	Highly manoeuvrable, moderately fast insectivores. Fly with great agility very close to vegetation and readily enter gaps in the understorey, usually foraging at less than half the canopy height. Small foraging range of less than 10 ha.
Little Forest Bat *Vespadelus vulturnus*	Edge			
Inland Forest Bat ***Vespadelus baverstocki***	Edge	Fast, agile, manoeuvrable	Below canopy	Highly manoeuvrable, moderately fast insectivores. Fly with great agility very close to vegetation and readily enter gaps in the understorey, usually foraging at less than half the canopy height. Small foraging range of less than 10 ha.
In general:				
Open space / aerial = typically free-tail and sheath-tail bats. Fly fast. Long, narrow wings, not manoeuvrable.				
Edge space = most bats (Vespertilionids and Myotis). Fly fast to moderately slow. Moderately long and broad wings.				
Closed = gleaning bats (*Phoniscus, Nyctophilus, Rhinolophus*) = slow, but able to manoeuvre and hover in cluttered places. Broad, shorter wings, rounded tip, large tail membrane.				



Legend

Location of proposed Dinawan wind farm

Migratory bird flight paths

Indicative international migratory flight path

Indicative mainland migratory movements

Indicative nomadic movements

Figure 13 Indicative nomadic and migratory flight paths

0 100 200 300 400 500 600

Kilometers

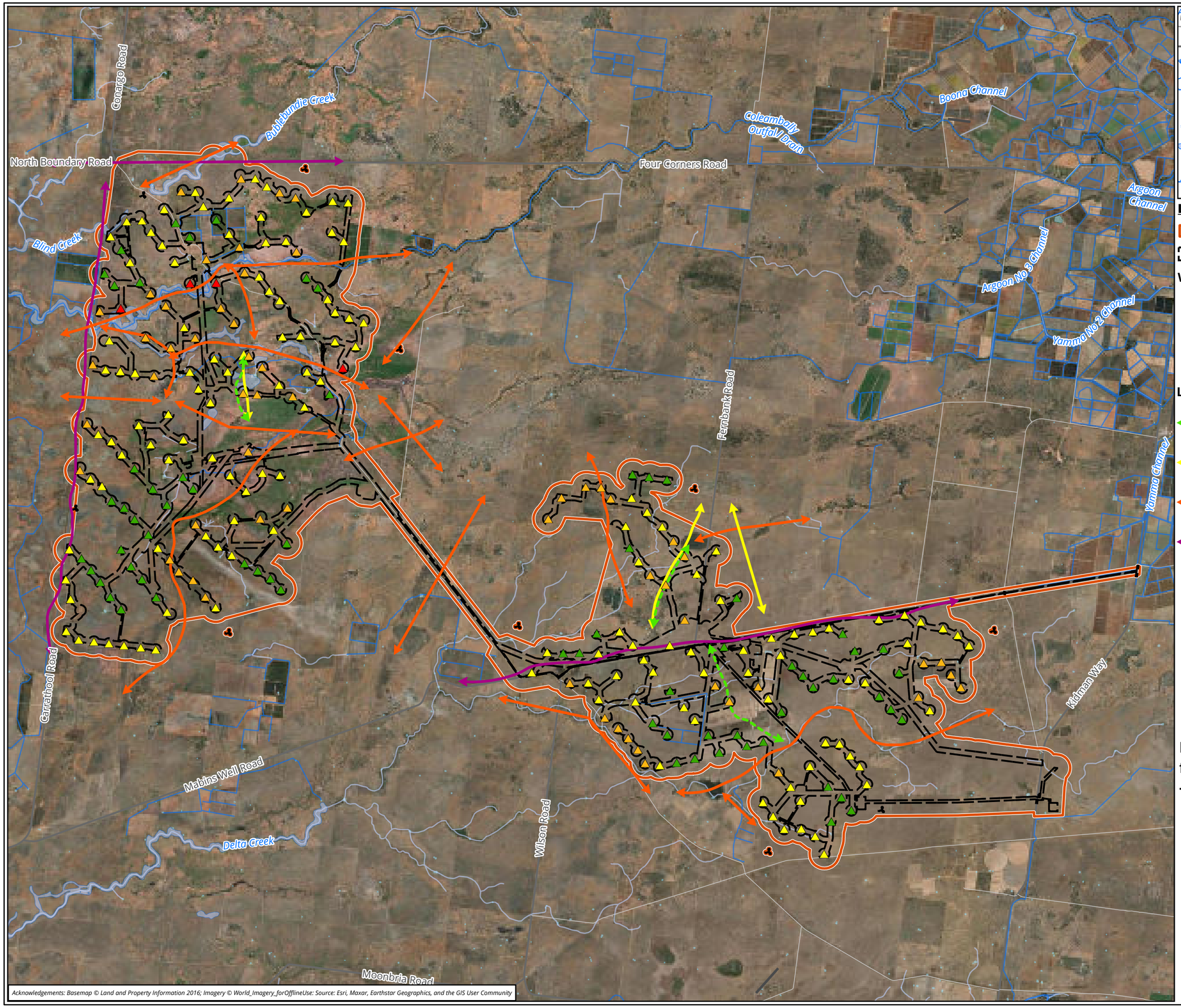
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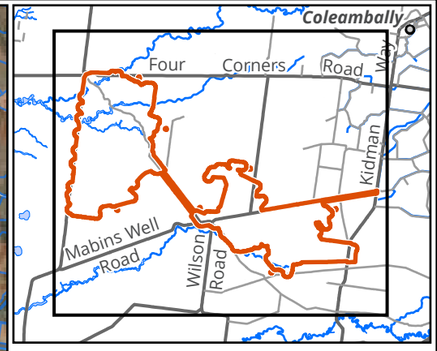
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37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F13_MigrFlightPath

Acknowledgements: Basemap © Land and Property Information 2016





Legend

- Subject land
- Development corridor

Wind turbine constraint

- Very High
- High
- Moderate
- Low

Local flight paths

- Minor pathway - Observed local at risk species
- Minor pathway - Woodland and waterbirds fliers
- Major pathway - Woodland and waterbirds fliers
- Roadside pathway - Woodland and waterbirds fliers

Figure 14 Indicative local flight movements - Overview

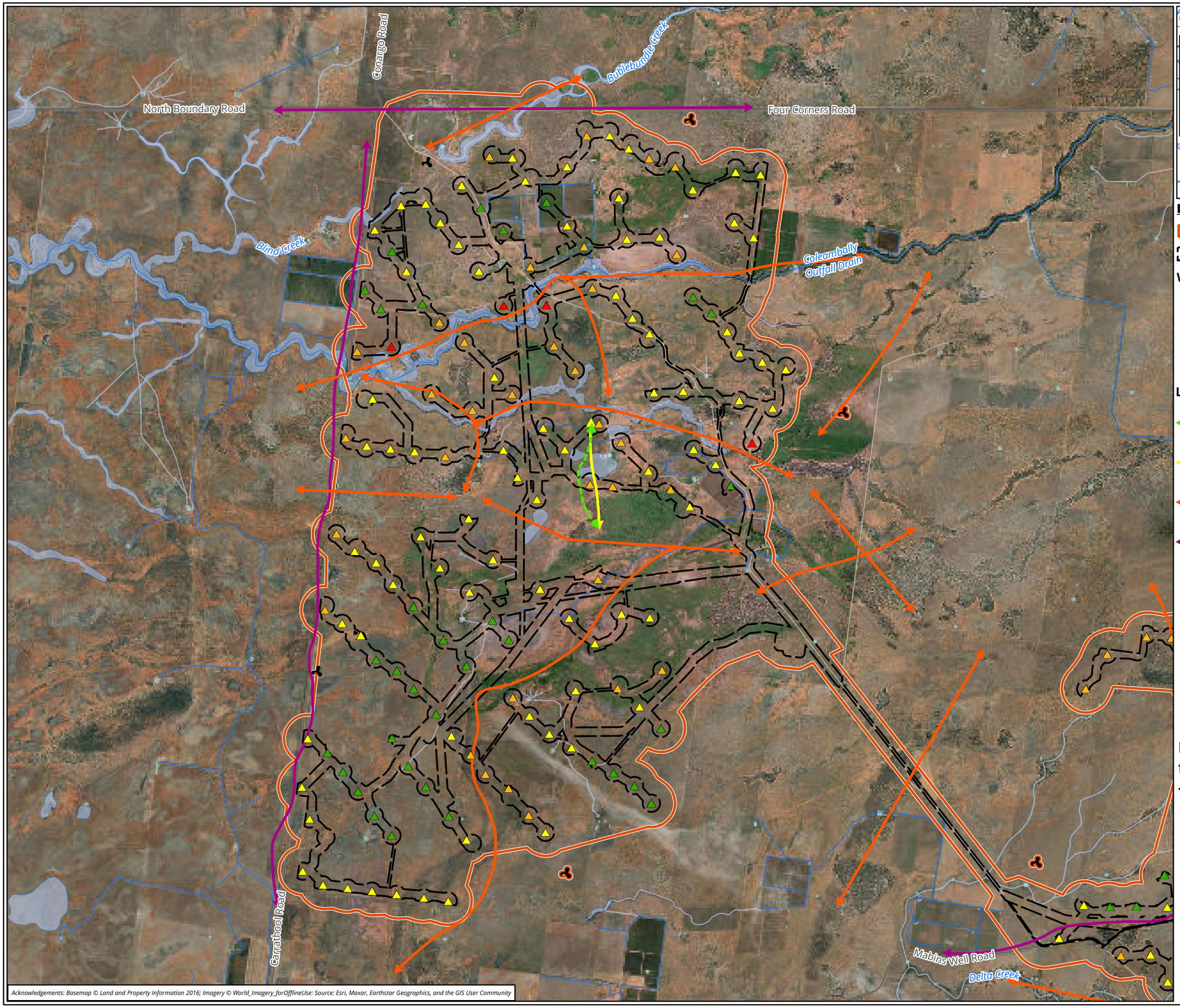
0 1 2 3 4 5

Kilometers
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Layout: 37263_Wind_F14_LocalFlightPath



Legend

- Subject land
- Development corridor

Wind turbine constraint

- Very High
- High
- Moderate
- Low

Local flight paths

- Minor pathway - Observed local at risk species
- Minor pathway - Woodland and waterbirds fliers
- Major pathway - Woodland and waterbirds fliers
- Roadside pathway - Woodland and waterbirds fliers

Figure 14 Indicative local flight movements - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System: GDA2020 MGA Zone 55

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37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F14_LocalFlightPath

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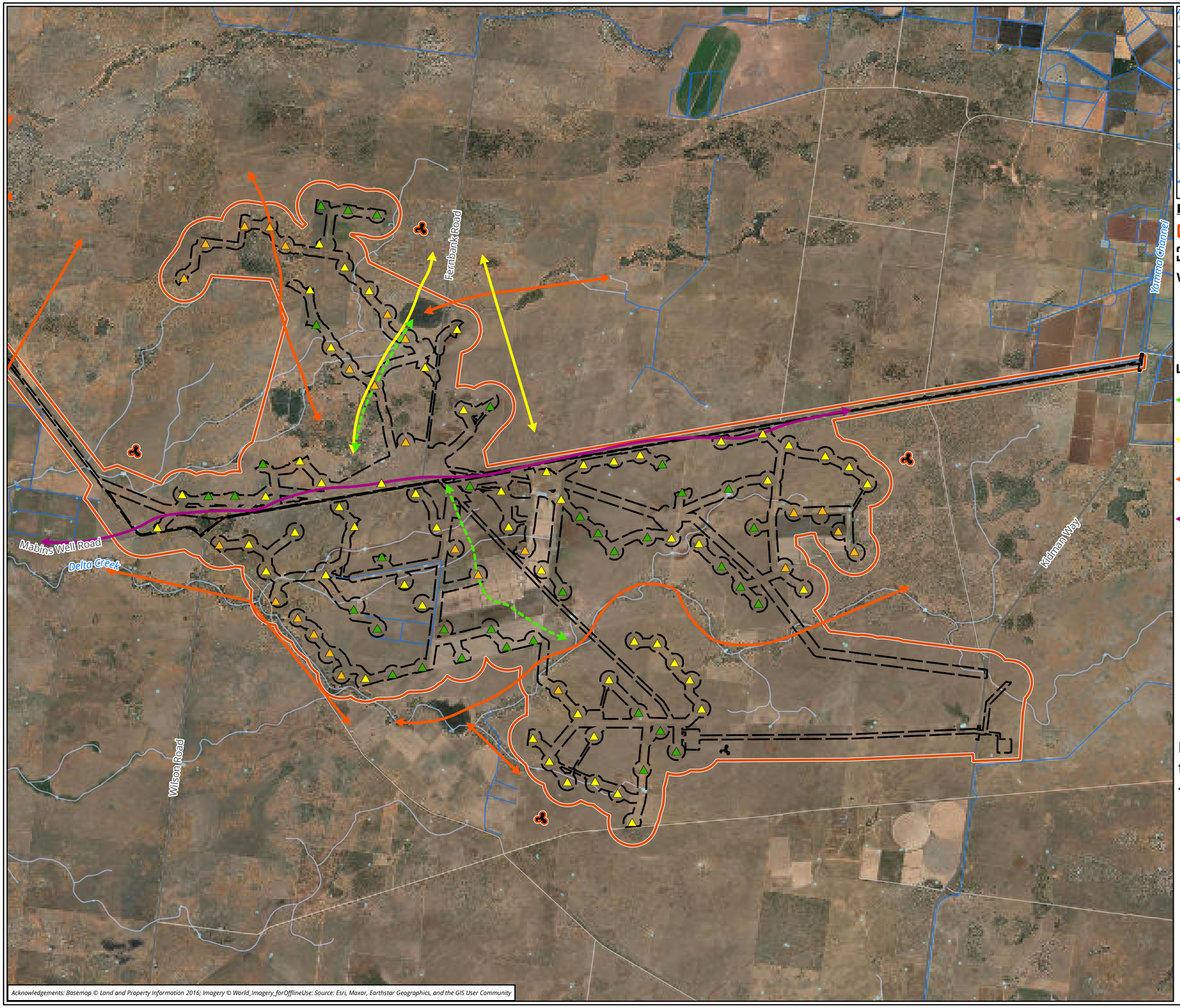


Figure 14 Indicative local flight movements - Stage 1

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Layout: 37263_Wind_F14_LocalFlightPath

6. Collision and barrier effect risk assessments

Biosis undertook collision risk modelling and bird and bat risk assessment to inform the overall biodiversity impact assessment for the project. This assessment identified species or groups of birds and bats considered at potential risk of collision with turbines, and the potential impact on bird and bats subject to disturbance and/or barrier effects posed by constructed wind turbines. The outcome of these assessments enables the targeted assessment of key species to be considered in the preparation of the impact assessment for the wind farm. In addition to direct loss of habitat from the construction of a wind farm, indirect impacts on birds and bats can arise from three potential pathways, including:

- Turbine strike (and possibly barotrauma) with towers and/or operating wind turbine blades at RSA heights.
- Loss of habitat connectivity (barrier effects) between essential resources, such as foraging and roosting areas.
- Avoidance of areas of habitat due to air disturbance surrounding operational turbines (habitat sterilisation).

6.1. Collison Risk Model (CRM)

6.1.1. Background

Collisions of birds and bats with wind turbines have been documented to occur at various frequencies around the world. Quantitative modelling to estimate the number of collision mortalities of threatened and non-threatened taxa is widely used as part of environmental impact assessments for proposed wind energy facilities (Masden & Cook 2016). The impact of any collisions on the viability of threatened and non-threatened fauna populations is more important than determination of simple numbers of mortalities, and population models can be used in combination with results of collision risk models to evaluate such impacts, but population modelling would be a separate exercise to the collision risk modelling presented here.

Modelling of collision risk is reliant on empirical data for flights by species at the wind farm site. There is no practicable method to obtain species-specific flight data for bats that are likely to utilise the site and bat-call data does not provide information about the number of flights by bats. The modelling presented here is therefore confined to diurnal birds. Mathematical modelling of risk is intended to provide an articulated, transparent and replicable evaluation of what may occur in the real world. The rationale behind projections is explicitly stated in the mathematics of a model, which means that the logical consistency of the predictions can be easily evaluated. The explicit nature of inputs and rigour entailed in modelling means that the process is replicable and consistent and it is open to analysis, criticism or modification when new information becomes available. Modelling is designed as a mechanism to evaluate uncertainties – if there was no uncertainty there would be no need to use a model. As a consequence of uncertainty in various parameters, some assumptions are required and while it is necessary to include some assumptions and arbitrary choices when deciding on the structure and parameters of a model, these choices are explicit. To the extent feasible, assumptions are informed by the best available information.

Models are also valuable for their heuristic capacities as they focus attention on important processes and parameters entailed in risk (Brook et al. 2002). Their very nature facilitates incorporation of information as it is learnt (Burgman 2005) and refinements should thus be expected of any model.

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Most factors related to the layout, dimensions and geometry of turbines are known. The risk modelling detailed here entails the use of informed assumptions related particularly to the flights of birds. The bird utilisation data collected from the site provides an empirical basis for extrapolations required for use in the model. We consider the assumptions and values used are reasonable and they are informed by available information about the ecology of relevant species. As a consequence, we consider the results of modelling detailed here provide a basis for evaluation of probable effects of the proposed Dinawan Wind Farm on relevant species of birds. The only alternative to a quantitative modelling approach is one of qualitative subjective judgement. All the benefits of using mathematical modelling outlined above are difficult, if not impossible to achieve with a purely qualitative assessment. A description of the Biosis collision risk model can be found in Smales et al. (2013), provided in Appendix 8.

6.1.2. Overview

The collision risk model takes account of bird flights that occur within the height zone that will be occupied by turbines. Data for the number of flights and their heights was documented by a regime of fixed-time point counts at locations representative of future turbine locations across the subject land. The model uses the empirical sample of flight data for each species and extrapolates that to determine a potential number of such flights that might occur over an entire 12 month period. This factor takes into account what is known about seasonal presence of particular species that may be migratory or may be present only for part of the year for other reasons.

In the model, the turbine is decomposed into its static and dynamic components. The entire turbine (including the tower, nacelle and the rotor when stationary) represents the static component. The dynamic component is the volume swept by the leading edge of the rotor blades in the time it takes the species of interest to pass across the depth of the rotor-swept disk.

Since the turbine tower below rotor swept height is always a static component and poses minimal collision risk, the model takes this into account by dividing flights into those below turbine rotor height, and those within the height zone swept by turbine rotors and allocating different risk rates to these height classes.

The risk assessment accounts for a combination of variables that are specific to the project and to data for birds from within the vicinity of the project. They include the following:

- The numbers of flights of each species below rotor height, and for which just the lower portion of turbine towers present a collision risk.
- The numbers of flights at heights within the zone swept by turbine rotors, and for which the upper portion of towers, nacelles and rotors present a collision risk.
- The numbers of bird movements-at-risk, as recorded during timed point counts, extrapolated to determine an estimated number of movements-at-risk the species makes in an entire year. Account is taken of the portion of the year that birds are within proximity of the subject land and that they may thus be at risk.
- The mean area (m2 per turbine), of tower, nacelle and stationary rotor blades of a wind generator that present a risk to birds. Thus, the mean area presented by a turbine is between the maximum (where the direction of the bird is perpendicular to the plane of the rotor sweep) and the minimum (where the direction of the bird is parallel to the plane of the rotor sweep). The mean presented area is determined from turbine specifications supplied to Biosis for specific make and model of a turbine. It represents the average area presented to an incoming flight from any direction.

- The additional area (m2 per turbine) presented by the movement of rotors during the potential flight of a bird through a turbine. This information is determined via a calculation involving species-specific, independent parameters of the flight speed and body length of the bird and supplied specifications for speed and dimensions of the turbine rotor.
- The model assumes that all turbines represent equal risk.
- A calculation of the average number of turbines a bird is likely to encounter in a given flight through the subject land. This is based on the scattered configuration of turbines in the landscape and the total number of turbines proposed for the project.

6.1.3. Avoidance rates

Results are provided for various avoidance rates. Avoidance rate is the capacity for a bird to avoid a collision, whether that occurs due to a cognitive response on the part of a bird or not. Thus at the extremes of the rates applied, a 0.90 avoidance rate equates to one flight in 10 in which a bird does not avoid a turbine and a 0.99 avoidance rate equates to one flight in 100 in which it does not avoid a turbine. Based on experience with a wide range of bird species, it is certain that virtually all species have high capacity to avoid collision with the static components of turbines. Avoidance rate for these components is thus consistently considered to be 0.99 in the modelling (i.e. one flight in 1,000 in which it does not avoid a static turbine component). Various avoidance rates are modelled for the dynamic turbine components because it is not certain how adept various species may be at evading collision with the moving rotor. For this reason, results are provided for 0.90, 0.95, 0.98 and 0.99 avoidance rates for the dynamic components (moving rotor) of turbines.

It should be noted that internationally there is very little empirical evidence for the actual avoidance rate for any bird species and for this reason it is prudent to provide a range of estimates that are considered to be reasonable. The evidence that is available suggests that avoidance capacity is species-specific and that the great majority of birds have a very high avoidance capability that is higher than 0.98. Nonetheless, the avoidance rate for Wedge-tailed Eagles appears to differ somewhat between wind farms. For three operational wind farms it has been between 0.95 and 0.97, while for a fourth it has been slightly lower than 0.90 (Smales 2023).

6.1.4. Results metrics

Generally, the model's results are expressed as the number of flights at risk of collision per annum for each species. This is a relative measure that permits comparison of risk rates associated with various turbines or turbine configurations. It does not necessarily equate to the number of collisions that might occur because we do not know how many individual birds of each species use the site and may thus be at risk. The difference between flights at risk of collision and number of actual collisions can be simply explained by way of an example. If there are just two individuals of a given species occupying the wind farm, they may make multiple flights that could result in collisions, however the maximum number of fatalities that could occur is two. As can be seen from this example, the number of actual fatalities due to collisions can be no greater than the number of individual birds, but it can also be no more than the number of flights at risk, and if the site-population is small but the birds fly actively within the site, the number of collisions will always be considerably lower than the number of flights at risk.

In cases where a good estimate or estimate of higher confidence for a site-population for particular species can be made, this can be incorporated into the model to provide results and expressed as an annual estimate of collisions.

Existing knowledge of the population dynamics for most of the species within the subject land is not sufficient to allow an estimate to be made for their site-populations. However, for three resident raptors (Nankeen Kestrel, Wedge-tailed Eagle and Black-shouldered Kite), an estimate of their possible site-

populations has been made and the model has been run to provide a projection of results for them as an annual estimate of collisions.

The model cannot forecast the frequency of collisions around the predicted annual average and it is important to recognise that the number of any actual collisions that might occur can be expected to vary from year to year in a distribution around the average.

All results are provided to two significant figures, however they represent annual 'average' results and, of course actual bird fatalities will always be measured in numbers of individuals and the average results of modelling must represent a distribution that can be expected to vary from year-to-year around the mean.

6.1.5. Wind farm turbine parameters

The Biosis CRM requires a range of numeric inputs, to quantify the number of turbines, key dimensions of turbines, and to estimate bird utilisation characteristics, including the number of flights within and outside of rotor swept height for species to be included in the model. Following the results of the preliminary evaluation, the CRM used the following Key parameters:

- Number of turbines: *267*
- Turbine type: *Generic TH 280 – HH 180*
- Turbine tower hub height: *180 m*
- Rotor diameter: *200 m*
- Rotational speed: *12 rpm*
- The 200 metre diameter blades have a length of 100 metres, resulting in rotor swept height between 80 and 280 metres above the ground.

In the scattered or 'clustered' array of turbines such as those within the development corridor, a bird has a high probability of encountering multiple turbines in a given flight. The CRM has a built-in function to account for any difference whereby the turbine array can have any setting from 100% of turbines fully clustered to 0% in which turbines are entirely linearly configured.

6.1.6. Bird species data

Following the results of the BUS, undertaken across eight seasons and two years, the CRM was run for all species for which there were any flights recorded at RSA height. That included all flights documented from between 80 and 280 metres above the ground.

A total of 121 species of birds were recorded during BUS. While many of them may have capacity to fly at rotor swept height, 18 species were recorded doing so, and thus have data available for use in the model. For those species not recorded within RSA, but have potential to fly within RSA on occasion, or not recorded during BUS due to their cryptic nature, are covered further in risk assessments presented in Section 6.2.2. All modelled species are predicted to be present all year round, despite some aspects of nomadic and seasonal migration behaviours for some.

With the exception of three species of raptors, it is not feasible to estimate the site-population sizes of the species modelled. As a consequence, model results for the remaining 15 species are expressed as the number of flights at risk of collision per annum. The resident raptors, Nankeen Kestrel, Wedge-tailed Eagle and Black-shouldered Kite, tend to occupy territories that remain stable over periods of several years and, because they are apex predators they occur at relatively low densities. In light of published studies for those species, Biosis undertook a process to estimate the sizes of their potential populations for the subject land.

For those three species, it was thus possible to run the model to provide results expressed as annual estimates of collision fatalities.

Table 57 Bird utilisation surveys included in the CRM

Site	Summer	Winter	Spring	Autumn	Total
Control sites (included in CRM for assessment)					
CTL1	7	5	7	7	**26**
CTL3	9	7	7	7	**30**
CTL7	6	7	7	7	**27**
CTL11	6	5	7	7	**25**
Impact sites					
IMP1	9	5	4	7	**25**
IMP2	9	6	8	7	**30**
IMP3/18	9	6	10	7	**32**
IMP4	9	5	8	7	**29**
IMP5/19	10	5	4	7	**26**
IMP6	10	7	8	7	**32**
IMP7	10	5	8	7	**30**
IMP9	12	7	8	7	**34**
IMP10	9	5	8	7	**29**
IMP11	10	6	9	7	**32**
IMP13	10	5	8	7	**30**
IMP16	10	7	8	7	**32**
IMP15	10	6	8	7	**31**
IMP22	10	5	7	7	**29**
IMP20	9	3	4	7	**23**
IMP21	10	2	4	7	**23**

6.1.7. Population estimates

Wedge-tailed Eagle

Cherriman (2007) provided an overview of studies, including his own, that have investigated the size of Wedge-tailed Eagle territories in temperate regions. Territory sizes in studies near Perth (Cherriman 2007); at two other sites in the south-east of Western Australia (Ridpath and Brooker 1987); near Canberra in south-eastern Australia (Leopold and Wolfe 1970); and, in South Australia (Rowe et al. 2017) were all between 31 km² and 42 km². Foster and Wallis (2010) studied the species west of Melbourne and recorded nearest-neighbour distances averaged 4.7 kilometres. In a study in western NSW, Sharp et al. (2001) found the mean distance to nearest neighbour between Wedge-tailed Eagle nests was in the order of 1 pair per 3–9 km2. They noted this was considerably higher than that noted in other semi-arid zone studies (1 pair per 40–48 km2).

Using a conservative mean Wedge-tailed Eagle territory size of 30 km², the average diameter of a territory would be slightly greater than 12 kilometres. As a consequence, we have based the modelling exercise for Wedge-tailed Eagles on the assumption that the 313 kilometre square array within the subject land may intersect with several territories, occupied by 21 adult birds.

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Cherriman (2013) reported that breeding productivity (number of chicks fledged) was 0.73 young per pair, across 15 occupied territory-years. Debus et al. (2007) recorded very similar results with 10 young produced in 12 pair-years, equating to 0.8 young fledged per pair per year. On the basis of those studies, we have conservatively assumed that, on average, three pairs will be accompanied by a total of three flying juveniles, bringing the average site-population of Wedge-tailed Eagles to a total of 31. Hence we have modelled for this number of birds as being at potential risk of collision.

During BUS, Biosis staff documented a number of instances in which three, four and five, and up to eight Wedge-tailed Eagles were observed simultaneously.

Nankeen Kestrel and Black-shoulder Kite

Using a conservative mean Nankeen Kestrel territory size of 5.3 km², the average diameter of a territory would be approximately 2.6 kilometres. As a consequence, we have based the modelling exercise for Nankeen Kestrel and Black-shouldered Kites on the assumption that the 313 kilometre square array within the subject land may intersect with several territories, occupied by 118 adult birds.

Baker-Gabb (1984) reported a mean number of 1.3 fledglings per territorial pair. On the basis of that study, we have assumed that, on average, 10 pairs will be accompanied by a total of 13 flying juveniles, bringing the average site-population of Nankeen Kestrels and Black-shouldered Kites to a total of 194 and we have modelled for this number of birds as being at potential risk of collision.

6.1.8. Model results

CRM results for Nankeen Kestrel, Black-shouldered Kite and Wedge-tailed Eagle are shown in Table 58. As detailed above, informed assumptions have been made for the possible site-population sizes of these three species, and results for them are provided here expressed as projected numbers of annual average collisions. Results are provided for four potential avoidance rates.

Experience with these species at wind energy facilities in south-eastern Australia demonstrates that both Nankeen Kestrels and Wedge-tailed Eagles collide with wind turbines (Moloney et al. 2019), and potentially Black-shouldered Kites. For Wedge-tailed Eagles, there is some published empirical data (Smales 2023) where evidence suggests that the model's projections accurately equate to avoidance capacity of between 0.90 and 0.97. As with any forward-projection modelling, the accuracy of the results presented here for the project, will depend upon the precision of all assumptions used for the modelling process. The modelling indicates that between a 95% and 98% avoidance rate, it is estimated that

- Between six to three Wedge-tailed Eagles respectively may collide with a turbine annually.
- Between five and three Nankeen Kestrels respectively may collide with a turbine annually.
- Approximately one Black-shouldered Kite may collied with a turbine annually.

Table 58 CRM mortality results for raptors with known site populations

Common name	Scientific name	Mortality (Collisions/Year)			
		Dynamic rotor avoidance rate			
		0%	95%	98%	99%
Black-shouldered Kite	*Elanus axillaris*	69.03	1.27	0.95	0.84
Nankeen Kestrel	*Falco cenchroides*	134.04	5.16	2.97	2.23
Wedge-tailed Eagle	*Aquila audax*	30.99	6.13	3.30	2.29

CRM results for all 18 species of birds recorded in RSA based on movements at risk is shown below in Table 59. As discussed, information about the possible site-population sizes of 15 of these species is not available, and results for them are provided here expressed as projected numbers of annual flights that may be at risk of turbine collisions. Results are provided for four potential dynamic avoidance rates.

Table 59 Total CRM results based on two years of data for movements at risk for species within RSA

Scientific name	Common name	Movements at risk			
Dynamic avoidance		0%	95%	98%	99%
Aquila audax	Wedge-tailed Eagle	238.24	6.83	3.49	2.38
Ardea pacifica	White-necked Heron	36.80	0.88	0.50	0.37
Chenonetta jubata	Australian Wood Duck	52.77	1.38	0.74	0.53
Circus assimilis	Spotted Harrier	13.15	0.56	0.24	0.13
Corvus coronoides	Australian Raven	384.61	6.84	4.59	3.85
Dendrocygna eytoni	Plumed Whistling-Duck	117.27	5.02	2.13	1.17
Elanus axillaris	Black-shouldered Kite	84.44	1.27	0.95	0.84
Eolophus roseicapilla	Galah	835.31	8.51	8.39	8.35
Falco berigora	Brown Falcon	47.47	1.33	0.69	0.47
Falco cenchroides	Nankeen Kestrel	224.03	5.23	2.99	2.24
Falco subniger	Black Falcon	14.91	0.58	0.26	0.15
Haliastur sphenurus	Whistling Kite	21.62	0.64	0.32	0.22
Milvus migrans	Black Kite	88.33	3.02	1.42	0.88
Nymphicus hollandicus	Cockatiel	82.16	3.81	1.57	0.82
Platalea flavipes	Yellow-billed Spoonbill	58.68	2.72	1.12	0.59
Polytelis swainsonii	Superb Parrot	86.21	3.00	1.40	0.86
Sturnus vulgaris*	Common Starling*	1816.80	33.12	21.90	18.17
Threskiornis spinicollis	Straw-necked Ibis	91.23	1.77	1.13	0.91

On the assumption that the collision avoidance capacity of the species in Table 59 is at least 95%, the results can be summarised as follows.

- Four species with less than one flight per annum that would be at some risk of collision.
- Eight species with one to five flights per annum that would be at some risk of collision.
- Six species with greater than five flights per annum that would be at some risk of collision.

In terms of threatened species;

- The Superb Parrot has three flights per annum that would be at some risk of collision.
- The Black Falcon has less than one flight per annum that would be at some risk of collision.
- The Spotted Harrier has less than one flight per annum that would be at some risk of collision.

6.2. Qualitative risk assessment

6.2.1. Risk matrix methodology

Assessment of potential impacts to avian fauna including microbats as a result of turbine strike has been undertaken by way of a qualitative risk assessment used to determine the likelihood of impact and the potential consequences of any impact that may occur. A risk matrix was applied for individual species of birds

and bats that incorporates probability that the wind farm might impact birds or bats from habitats at the wind farm. The risk assessment has also been applied to non-threatened species of birds and bats recorded in the locality, where it is considered that their flight behaviours may put them at a risk of collision, outside of those species used within the CRM.

The species that have been the subject of this risk assessment include bird and bat species recorded or predicted to occur within 50 kilometres of the subject land, based on database searches, including:

- Species listed as threatened under both EPBC Act and/or BC Act.
- Birdlife Australia, the New Atlas of Australian Birds 1998-2015.
- Australasian Bat Society Bat map https://www.ausbats.org.au/batmap.html, accessed 15 March 2024.
- Species known to have documented collisions with turbines based on collision data from other operating wind farms in New South Wales.
- Species that may exhibit risk behaviour and potentially interact with the operation of wind turbines.

The criteria used to establish the likelihood of impact and potential consequences of turbine strike are provided in Table 60. The matrix used to qualify the risk associated with the significance of a collision impact as outlined in Table 60 and Table 61, with results per species provided in Table 62.

Table 60 Qualitative risk assessment criteria for likelihood and consequences of the impacts of turbine strike and barrier effect for birds and microbats

Likelihood	Criteria	Consequence	Criteria
Rare	An event may occur only in unusual circumstances (less than 5 %). The risk event is only theoretically possible, or would require exceptional circumstances to occur.	**Negligible**	Occasional individuals lost but no reduction in population viability.
Unlikely	It is less probable than not that the risk event could occur in any year (< 50%).	**Minimal**	Repeated loss of small number of individuals but no reduction in population viability.
Likely	It is equally probable that the risk event could or could not occur in any year (50%).	**Moderate**	Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.
Possible	It is more probable than not that the risk event could occur in any year (>50%)	**Significant**	Major loss in number of individuals, leading to reduction in population viability for between five to 10 years.
Probable	It is very probable that the risk event could occur in any year (>95%).	**Severe**	Extreme loss in number of individuals, leading to reduction in population viability for a period of at least 10 years.

Table 61 Qualitative risk assessment matrix for significance of impacts of potential turbine collisions for birds and microbats

Likelihood	Consequence				
	Negligible	Minimal	Moderate	Significant	Severe
Rare	Negligible	Negligible	Negligible	Low	Low
Unlikely	Negligible	Negligible	Low	Moderate	High
Likely	Negligible	Low	Moderate	High	High
Possible	Negligible	Low	Moderate	High	Severe
Probable	Negligible	Low	High	Severe	Severe

6.2.2. Risk matrices

In addition to the CRM, the results of the qualitative risk assessment have identified the likely species at risk of collision with operational wind turbines. This then accounts for species that may fly within RSA, but were not recorded during BBUS and accounted for in the CRM, or species that are vagrant, cryptic or migrate infrequently. The qualitative risk assessment found 31 species (birds and bats) to be at more than a 'Negligible' risk of collision with an operating turbine as shown in Table 62 and Table 63.

The qualitative risk assessment identified 23 bird species with a likelihood of collision greater than 'Low - Repeated loss of small number of individuals but no reduction in population viability', which includes Spotted Harrier, Australian Magpie, Galah and waterbirds such as Straw-necked Ibis, White-necked Heron and Yellow Spoonbill. The qualitative risk assessment also identified seven bat species with a likelihood of collision listed as 'low'.

The risk assessment identified a total of four species with a 'moderate' collision risk such as Black Falcon, Black-Shouldered Kite, Nankeen Kestrel and Superb Parrot, and also one species with 'high' collision risk, being the Wedge-tailed Eagle.

Up to nine species including Australasian Bittern and Wedge-tailed Eagle, are considered to have a low risk of impact as a result of barrier effects for the proposed wind farm layout. This includes nomadic species that may employ macro or meso avoidance (see Section 6.3. All other species have no more than a negligible risk of impact as a result of barrier effect for the proposed wind farm layout.

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Table 62 Bird collision risk and likelihood consequence

Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Botaurus poiciloptilus	Australasian Bittern	EN- BC Act EN - EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Moderate	Low	Low
Tachybaptus novaehollandiae	Australasian Grebe	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Ardeotis australis	Australian Bustard	V - BC Act	Grassland/Shrubland birds and Ground-dwellers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Falco longipennis	Australian Hobby	-	Raptors	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Gymnorhina tibicen	Australian Magpie	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Likely	Minimal	Low	Negligible
Aegotheles cristatus	Australian Owlet-nightjar	-	Nocturnal foragers (Owls and Nightjars)	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Rostratula australis	Australian Painted Snipe	EN - BC Act EN - EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Moderate	Negligible	Low
Pelecanus conspicillatus	Australian Pelican	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Stiltia isabella	Australian Pratincole	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Corvus coronoides	Australian Raven	-	Woodland birds (including Parrots and Songbirds)	Recorded in RSA	Likely	Minimal	Low	Negligible
Barnardius zonarius	Australian Ringneck	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Porzana fluminea	Australian Spotted Crake	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Threskiornis molucca	Australian White Ibis	-	Grassland/Shrubland birds and Ground-dwellers	Recorded onsite, however not within RSA	Likely	Minimal	Low	Negligible
Chenonetta jubata	Australian Wood Duck	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Likely	Minimal	Low	Negligible
Vanellus tricolor	Banded Lapwing	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Ninox connivens	Barking Owl	-	Nocturnal foragers (Owls and Nightjars)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Falco subniger	Black Falcon	V - BC Act	Raptors	Recorded in RSA	Likely	Moderate	Moderate	Low
Milvus migrans	Black Kite	-	Raptors	Recorded in RSA	Likely	Minimal	Low	Negligible
Cygnus atratus	Black Swan	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Artamus cinereus	Black-faced Woodswallow	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Elanus axillaris	Black-shouldered Kite	-	Raptors	Recorded in RSA	Probable	Moderate	Moderate	Low
Limosa limosa	Black-tailed Godwit	V - BC Act EN - EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Minimal	Negligible	Negligible
Tribonyx ventralis	Black-tailed Native-hen	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Himantopus himantopus	Black-winged Stilt	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Northiella haematogaster	Blue Bonnet	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Neophema chrysostoma	Blue-winged Parrot	-	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Grus rubicunda	Brolga	V - BC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Falco berigora	Brown Falcon	-	Raptors	Recorded in RSA	Probable	Minimal	Low	Negligible
Accipiter fasciatus	Brown Goshawk	-	Raptors	Not recorded, BioNet Records	Likely	Negligible	Negligible	Negligible
Melopsittacus undulatus	Budgerigar	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Burhinus grallarius	Bush Stone-curlew	V - BC Act	Grassland/Shrubland birds and Ground-dwellers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Hydroprogne caspia	Caspian Tern	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Nymphicus hollandicus	Cockatiel	-	Woodland birds (including Parrots and Songbirds)	Recorded in RSA	Unlikely	Minimal	Negligible	Negligible
Accipiter cirrocephalus	Collared Sparrowhawk	-	Raptors	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Tringa nebularia	Common Greenshank	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Actitis hypoleucos	Common Sandpiper	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Platycercus elegans	Crimson Rosella	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Likely	Minimal	Negligible	Negligible
Calidris ferruginea	Curlew Sandpiper	EN - BC Act CE - EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Eurystomus orientalis	Dollarbird	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Gallinula tenebrosa	Dusky Moorhen	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V - BC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Tyto javanica	Eastern Barn Owl	-	Nocturnal foragers (Owls and Nightjars)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Bubulcus coromandus	Eastern Cattle Egret	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Likely	Negligible	Negligible	Negligible
Numenius madagascariensis	Eastern Curlew	CE - EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Ardea alba modesta	Eastern Great Egret	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Platycercus eximius	Eastern Rosella	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Petrochelidon ariel	Fairy Martin	-	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Apus pacificus	Fork-tailed Swift	Migratory	Woodland birds (including Parrots and Songbirds)	Recorded above RSA	Possible	Minimal	Low	Low
Eolophus roseicapilla	Galah	-	Woodland birds (including Parrots and Songbirds)	Recorded in RSA	Likely	Minimal	Low	Negligible
Calyptorhynchus lathami	Glossy Black-Cockatoo	V - BC Act V - EPBC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Rare	Minimal	Negligible	Negligible
Plegadis falcinellus	Glossy Ibis	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Unlikely	Minimal	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Phalacrocorax carbo	Great Cormorant	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Podiceps cristatus	Great Crested Grebe	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Falco hypoleucos	Grey Falcon	V - BC Act V - EPBC Act	Raptors	Not recorded, BioNet Records	Rare	Moderate	Negligible	Negligible
Anas gracilis	Grey Teal	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Gelochelidon nilotica	Gull-billed Tern	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Aythya australis	Hardhead	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Poliocephalus poliocephalus	Hoary-headed Grebe	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Ardea intermedia	Intermediate Egret	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Gallinago hardwickii	Latham's Snipe	Migratory	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Dacelo novaeguineae	Laughing Kookaburra	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Elanus scriptus	Letter-winged Kite	-	Raptors	Not recorded, BioNet Records	Rare	Moderate	Negligible	Negligible
Phalacrocorax sulcirostris	Little Black Cormorant	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Cacatua sanguinea	Little Corella	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Hieraaetus morphnoides	Little Eagle	V - BC Act	Raptors	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Egretta garzetta	Little Egret	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Likely	Minimal	Low	Negligible
Glossopsitta pusilla	Little Lorikeet	V - BC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Microcarbo melanoleucos	Little Pied Cormorant	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Likely	Minimal	Low	Negligible
Corvus mellori	Little Raven	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Cacatua tenuirostris	Long-billed Corella	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Anseranas semipalmata	Magpie Goose	V - BC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Minimal	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V - BC Act EN - EPBC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Tringa stagnatilis	Marsh Sandpiper	Migratory	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Tyto novaehollandiae	Masked Owl	V - BC Act	Nocturnal foragers (Owls and Nightjars)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Artamus personatus	Masked Woodswallow	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Likely	Negligible	Negligible	Negligible
Psephotus varius	Mulga Parrot	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Biziura lobata	Musk Duck	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Falco cenchroides	Nankeen Kestrel	-	Raptors	Recorded in RSA	Probable	Moderate	Moderate	Low
Nycticorax caledonicus	Nankeen Night Heron	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Anas superciliosa	Pacific Black Duck	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Calidris melanotos	Pectoral Sandpiper	Migratory	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Falco peregrinus	Peregrine Falcon	-	Raptors	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Phalacrocorax varius	Pied Cormorant	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Malacorhynchus membranaceus	Pink-eared Duck	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Pedionomus torquatus	Plains-wanderer	CE- BC Act CE – EPBC Act	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Dendrocygna eytoni	Plumed Whistling-Duck	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Likely	Minimal	Low	Negligible
Merops ornatus	Rainbow Bee-eater	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Rare	Negligible	Negligible	Negligible
Charadrius ruficapillus	Red-capped Plover	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Recurvirostra novaehollandiae	Red-necked Avocet	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Psephotus haematonotus	Red-rumped Parrot	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Rare	Minimal	Negligible	Negligible
Platalea regia	Royal Spoonbill	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Calidris acuminata	Sharp-tailed Sandpiper	Migratory	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible

Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Ninox novaeseelandiae	Southern Boobook	-	Nocturnal foragers (Owls and Nightjars)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Porzana tabuensis	Spotless Crake	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Circus assimilis	Spotted Harrier	V - BC Act	Raptors	Recorded in RSA	Possible	Minimal	Low	Low
Lophoictinia isura	Square-tailed Kite	V - BC Act	Raptors	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Threskiornis spinicollis	Straw-necked Ibis	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Likely	Minimal	Low	Negligible
Cacatua galerita	Sulphur-crested Cockatoo	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Minimal	Negligible	Negligible
Polytelis swainsonii	Superb Parrot	V - BC Act V - EPBC Act	Woodland birds (including Parrots and Songbirds)	Recorded in RSA	Likely	Moderate	Moderate	Low
Circus approximans	Swamp Harrier	-	Raptors	Recorded onsite, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Lathamus discolor	Swift Parrot	CE - BC Act CE - EPBC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Podargus strigoides	Tawny Frogmouth	-	Nocturnal foragers (Owls and Nightjars)	Recorded onsite, however not within RSA	Likely	Negligible	Negligible	Negligible
Sterna sp.	Tern	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Petrochelidon nigricans	Tree Martin	-	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Dendrocygna arcuata	Wandering Whistling-Duck	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Aquila audax	Wedge-tailed Eagle	-	Raptors	Recorded in RSA	Probable	Moderate	High	Low
Hirundo neoxena neoxena	Welcome Swallow	-	Woodland birds (including Parrots and Songbirds)	Recorded onsite, however not within RSA	Unlikely	Negligible	Negligible	Negligible
Numenius phaeopus	Whimbrel	Migratory	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Chlidonias hybrida	Whiskered Tern	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Haliastur sphenurus	Whistling Kite	-	Raptors	Recorded in RSA	Possible	Minimal	Low	Negligible
Haliaeetus leucogaster	White-bellied Sea-Eagle	V - BC Act	Raptors	Not recorded, BioNet Records	Unlikely	Negligible	Negligible	Negligible
Artamus leucorynchus	White-breasted Woodswallow	-	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Artamus superciliosus	White-browed Woodswallow	-	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Unlikely	Minimal	Negligible	Negligible
Egretta novaehollandiae	White-faced Heron	-	Waterbirds, Seabirds and other aquatic foragers	Recorded onsite, however not within RSA	Likely	Minimal	Low	Negligible

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Scientific name	Common name	Status	Guild	Reasoning	Likelihood Collison	Consequence Collison	Risk rating Collison	Risk rating Indirect/barrier
Ardea pacifica	White-necked Heron	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Likely	Minimal	Low	Negligible
Hirundapus caudacutus	White-throated Needletail	V - BC Act V - EPBC Act	Woodland birds (including Parrots and Songbirds)	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Tringa glareola	Wood Sandpiper	-	Waterbirds, Seabirds and other aquatic foragers	Not recorded, BioNet Records	Rare	Negligible	Negligible	Negligible
Platalea flavipes	Yellow-billed Spoonbill	-	Waterbirds, Seabirds and other aquatic foragers	Recorded in RSA	Likely	Minimal	Low	Negligible

Table 63 Bat collision risk and likelihood consequence

Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
Austronomus australis	White-striped Free-tailed Bat	-	Recorded via ultrasonic detection in RSA	Prefers open foraging areas above canopy. A very common widespread species recorded in high numbers during site surveys. Recognised as an at risk bat species in relation to wind farm developments due to their foraging and flight behaviour. Due to its poor ability to detect and avoid obstacles, particularly mobile ones, such as turbine blades, White-striped Free-tail Bats are one of the most commonly recorded species in carcass monitoring at Australian wind farms. Highly susceptible to collision mortality regularly, however,	Probable	Minimal	Low	Low

Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
				populations generally secure and dense to withstand moderate instances of mortality should it occur.				
Chalinolobus gouldii	Gould's Wattled Bat		Recorded via ultrasonic detection on ground based detectors only	A common and widespread large microbat that is fast, high flier with restricted manoeuvrability. Like the White-striped Freetail Bat, this species has a poor ability to detect and avoid obstacles while pursuing prey, particularly mobile ones such as turbine blades. Highly susceptible to collision mortality regularly, however populations generally secure and dense to withstand moderate instances of mortality should it occur.	Possible	Minimal	Low	Low
Chalinolobus morio	Chocolate Wattled Bat	-	Recorded via ultrasonic detection on ground based detectors only	A relatively common and widespread microbat that is fast with increased manoeuvrability than the Gould's Wattled Bat. Generally restricted to canopies and fringing vegetation, may be susceptible to collision mortality on occasion, however populations generally secure and dense to withstand low instances of mortality should it occur.	Unlikely	Negligible	Negligible	Negligible
Chalinolobus picatus	Little Pied Bat	V- BC Act	BioNet records	A declining species that occurs in dry open forest and woodlands. The subject land is within its most easterly distribution limit. Roosts in cave and occasionally within trees hollows and other structures. Relatively confined	Unlikely	Negligible	Negligible	Negligible

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Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
				to canopies and timbered areas but may fly within RSA on occasion. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted				
Myotis macropus	Southern Myotis	V- BC Act	Species group recorded via ultrasonic detection on ground based detectors only	Generally found around riparian areas. Not known to fly within RSA and not considered to be at risk of collision due to their favoured foraging and roosting preferences in gullies and surrounding waterways	Rare	Negligible	Negligible	Negligible
Nyctophilus corbeni	Corben's Long-eared Bat	V- BC Act V- EPBC Act	Species group recorded via ultrasonic detection on ground based detectors only	Generally restricted to foraging within or beneath the canopy however may forage within open areas, in conjunction with White Cypress Pine communities. This species is a slow flying agile bat that roosts in tree hollows, crevices and under loose bark. Unlikely to fly within RSA. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.	Unlikely	Minimal	Negligible	Negligible
Nyctophilus geoffroyi	Lesser Long-eared Bat	-	Species group recorded via ultrasonic detection on	A relatively common and widespread microbat that is fast with high manoeuvrability. Generally restricted to foraging within or beneath the canopy however may forage within	Rare	Negligible	Negligible	Negligible

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Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
			ground based detectors only	open areas, especially where lights have attracted large insect numbers. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.				
Nyctophilus gouldi	Gould's Long-eared Bat	-	Species group recorded via ultrasonic detection on ground based detectors only	A relatively common and widespread microbat that is fast with high manoeuvrability. Generally restricted to foraging within or beneath the canopy however may forage within open areas or within areas fringing remnant vegetation. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.	Unlikely	Negligible	Negligible	Negligible
Ozimops petersi	Inland Free-tailed Bat	-	Recorded via ultrasonic detection in RSA	Widespread species of varying habitats, but rare within the locality. Fast and direct fliers of unobstructed air-spaces from just above to well above the canopy as well as above grasslands. All three species were recorded in low numbers within RSA at the site. Should a collision occur, it's likely only to occur to a very small number of individuals that would be impacted.	Possible	Minimal	Low	Negligible
Ozimops planiceps	South-eastern Free-tailed Bat	-	Recorded via ultrasonic detection in RSA		Possible	Minimal	Low	Negligible
Ozimops ridei	Ride's Free-tailed Bat	-	Recorded via ultrasonic detection in RSA		Possible	Minimal	Low	Negligible
Saccolaimus flaviventris	Yellow-bellied Sheathtail-	V- BC Act	Recorded via ultrasonic detection in	Widespread species within a range of habitats including rainforest, woodland and grassland. High and	Likely	Minimal	Low	Low

Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
	bat		RSA	fast flier over the forest canopy, but lower in more open areas and fringing vegetation. Roosts within tree hollows. Has potential to fly and was within RSA. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.				
Scotorepens balstoni	Inland Broad-nosed Bat	-	Recorded via ultrasonic detection on ground based detectors only	A widespread species that generally fly within riparian areas but may also fly above canopies and RSA on occasion. Highly mobile, however, not recorded within RSA and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur.	Rare	Negligible	Negligible	Negligible
Scotorepens greyii	Little Broad-nosed Bat	-	Recorded via ultrasonic detection on ground based detectors only	A common widespread species recorded regularly during site surveys. Generally, fly within riparian areas and woodland along the fringing areas of vegetation, but may also fly above canopies and RSA on occasion. Highly mobile and susceptible to collision mortality, however populations generally secure and dense to withstand moderate instances of mortality should it occur.	Unlikely	Negligible	Negligible	Negligible

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Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
Vespadelus baverstocki	Inland Forest Bat	V- BC Act	Recorded via ultrasonic detection on ground based detectors only	A poorly known species and may cover an extensive foraging area. Like other *Vespadelus*, is not considered to be at risk of collision due to their favoured foraging and roosting preferences in drier woodland habitats with bias towards riparian areas in conjunction with *Vespadelus vulturnus.*	Unlikely	Negligible	Negligible	Negligible
Vespadelus darlingtoni	Large Forest Bat	-	Recorded via ultrasonic detection on ground based detectors only	A large widespread bat with restricted manoeuvrability due to its size. Not known to fly within RSA and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur	Rare	Negligible	Negligible	Negligible
Vespadelus regulus	Southern Forest Bat	-	Recorded via ultrasonic detection on ground based detectors only	A moderate sized widespread bat. Not known to fly within RSA and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur.	Rare	Negligible	Negligible	Negligible
Vespadelus vulturnus	Little Forest Bat	-	Recorded via ultrasonic detection on	A small sized, very common and widespread bat. They are highly agile fast fliers with high manoeuvrability.	Unlikely	Negligible	Negligible	Negligible

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Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
			ground based detectors only	May fly beneath and above canopy height and on occasion within RSA. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted				
Pteropus poliocephalus	Grey-headed Flying-fox	V- BC Act V- EPBC Act	BioNet records	A declining species that inhabits wide ranging habitats and moves large distances foraging, however generally roosts/breeds close to or near riparian areas. May occur on an intermittent bases transiting through the landscape, however the occurrence of known camps and forage resources mean regular flights through the development footprint are considered unlikely. Recent instances in Victoria have seen an increased rate of collision mortality. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.	Unlikely	Minimal	Negligible	Negligible
Pteropus scapulatus	Little Red Flying Fox	-	BioNet records	May occur on an intermittent bases transiting through the landscape, however the occurrence of known camps and forage resources mean regular flights through the development footprint are considered unlikely. Should a collision occur, it is likely only to occur to a very small number of individuals that	Unlikely	Minimal	Negligible	Negligible

Species	Common name	Status	Reasoning	Habitat values and behavioural considerations	Likelihood Collison	Consequence Collison	Risk Collison	Risk Indirect/barrier
				would be impacted.				
In general:								
Open space / aerial = typically free-tail and sheath-tail bats. Fly fast. Long, narrow wings, not manoeuvrable.								
Edge space = most bats (Vespertilionids and Myotis). Fly fast to moderately slow. Moderately long and broad wings.								
Closed = gleaning bats (Phoniscus, Nyctophilus, Rhinolophus) = slow, but able to manoeuvre and hover in cluttered places. Broad, shorter wings, rounded tip, large tail membrane.								

6.2.3. 'At-risk' species

The following section summarises species considered to be at risk from collision with turbines such that impacts could occur to the species and/or population levels. A full list of species considered in the qualitative risk assessments and potentially at risk by the project is detailed in Table 62 and Table 63. A total of 23 species of birds and 7 species of bats are considered to be at more than a negligible risk of impact from turbine collisions, and thus 'at-risk' as a result of the project, summarised in Table 64.

As impacts associated with blade strike are considered somewhat uncertain in accordance with the BAM, and as previously mentioned, adaptive management is required through the preparation and implementation of an operational BBAMP that will be prepared prior to operation of the wind farm. Further information is provided in Section 8.3.4 below.

Table 64 Summary of species considered 'at-risk' of collision impacts from the project

Common name	Scientific name	Threat listing		Risk assessed species risk conclusion
		EPBC Act	BC Act	
Birds				
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Endangered	Low
Australian Magpie	*Gymnorhina tibicen*	-	-	Low
Australian Raven	*Corvus coronoides*	-	-	Low
Australian White Ibis	*Threskiornis molucca*	-	-	Low
Australian Wood Duck	*Chenonetta jubata*	-	-	Low
Black Falcon	*Falco subniger*	-	Vulnerable	Moderate
Black Kite	*Milvus migrans*	-	-	Low
Black-shouldered Kite	*Elanus axillaris*	-	-	Moderate
Brown Falcon	*Falco berigora*	-	-	Low
Fork-tailed Swift	*Apus pacificus*	-	-	Low
Galah	*Eolophus roseicapilla*	-	-	Low
Little Egret	*Egretta garzetta*	-	-	Low
Little Pied Cormorant	*Microcarbo melanoleucos*	-	-	Low
Nankeen Kestrel	*Falco cenchroides*	-	-	Moderate
Plumed Whistling-Duck	*Dendrocygna eytoni*	-	-	Low
Spotted Harrier	*Circus assimilis*	-	Vulnerable	Low
Straw-necked Ibis	*Threskiornis spinicollis*	-	-	Low
Superb Parrot	*Polytelis swainsonii*	Vulnerable	Vulnerable	Moderate
Wedge-tailed Eagle	*Aquila audax*	-	-	High
Whistling Kite	*Haliastur sphenurus*	-	-	Low
White-faced Heron	*Egretta novaehollandiae*	-	-	Low
White-necked Heron	*Ardea pacifica*	-	-	Low
Yellow-billed Spoonbill	*Platalea flavipes*	-	-	Low

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Common name	Scientific name	Threat listing		Risk assessed species risk conclusion
		EPBC Act	BC Act	
Bats				
White-striped Free-tailed Bat	*Austronomus australis*	-	-	Low
Gould's Wattled Bat	*Chalinolobus gouldii*	-	-	Low
Inland Free-tailed Bat	*Ozimops petersi*	-	-	Low
South-eastern Free-tailed Bat	*Ozimops planiceps*	-	-	Low
Ride's Free-tailed Bat	*Ozimops ridei*	-	-	Low
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	-	Vulnerable	Low
Little Red Flying Fox	*Pteropus scapulatus*	-	-	Low

6.3. Turbine risk assessment

The potential risk and consequence of turbine strike has been assessed for at-risk bird and bat species within the subject land, and is outlined above in Section 6.2. Further assessment is provided to determine which individual turbines present the highest risk of potential collisions to allow for targeted mitigation to be applied to reduce the potential risk and consequences of strikes that may occur. This assessment considered the likelihood of each turbine resulting in potential strikes, largely dependent on surrounding habitat types and proximity to operational turbines, and the potential consequence on species utilising those habitats if they were to collide with a turbine, which is largely driven by the 'at-risk' and conservation status of those species.

6.3.1. Turbine strike consequence

The severity of potential impacts of turbine strike to those species of birds and bats determined to be at more than a negligible risk from turbines strike (as outlined in Section 6.2.3 above) have been assessed, for those species rated as having more than a negligible consequence listed in Table 64 above. Table 65 below presents the risk matrix used to determine the severity of potential impacts of turbine strike, with each turbine being given a worst case scenario consequence rating, which is then used, in combination with strike likelihood, to determine the over turbine risk rating.

Table 65 Turbine strike consequence criteria

Threat status (BC Act or EPBC Act)	Bird or bat species 'at risk' rating				
	Negligible	Low	Moderate	Significant	Severe
At risk (non-threatened)	Negligible	Minor	Moderate	Moderate	Major
Migratory	Negligible	Minor	Moderate	Major	Severe
Vulnerable	Negligible	Minor	Moderate	Major	Severe
Endangered	Minor	Moderate	Major	Severe	Severe
Critically Endangered or potential SAII	Minor	Major	Major	Severe	Severe

Key habitats form the basis of the turbine strike likelihood assessment provided in Section 6.3.2 below. Key habitats include roosting / breeding opportunities for at risk species, and in the context of waterbirds species include wetland forage habitats, where habitual flights are more likely to bring individuals in closer proximity to turbine RSA, and thus increase the risk of collision.

6.3.2. Turbine strike likelihood assessment

Turbine strike likelihood has been assessed relative to the criteria outlined in the BCS Draft Turbine Risk Assessment and Avoidance Guidance (BCS 2023), with adjustments made to the recommended criteria to better suit site conditions and to focus on potential flightpaths of at-risk species.

Turbine strike likelihood criteria, developed for the project are presented in Table 66 below. The following turbine parameters have been included as the 'worst case scenario' turbine being considered for the project.

- Hub height – 180 m
- Blade length – 100 m
- RSA height – 80 m (min) – 280 m (max)

Table 66 Turbine strike likelihood criteria

Key habitat features	
• Key habitats for at-risk species that occur on one, or both, sides of a turbine, such that flights between, or into/out of, habitat features/patches are more likely to occur within, or in close proximity to, RSA. • Patches are ≥1 ha in area providing larger, higher quality habitat likely to be used more frequently, by more birds and bats, and more regularly by resident species. • Wetlands and larger watercourses (or large dams) on one, or both, sides of a turbine increasing the risk of collisions from fauna flying into or out of the habitat feature. • Blade tip distances to ephemeral wetlands and waterways, and major movement corridors. • Migratory or nomadic species habitual flight path, or key local flyways. • Stick nest potentially supporting breeding raptors.	
Relevant habitat feature and buffers to WTGs	**Likelihood of turbine strike**
• Major wetland habitats occur <200 m from WTG blade tip, on one or both sides of turbine • PCT 10, PCT 13, PCT 15, PCT 28 woodland habitats occur <200 m from WTG blade tip, on both sides of turbine • Stick nest occurs <200 m from WTG blade tip	**Probable** An event is expected to occur in most circumstances (>95%).
• Minor wetland or woodland habitats (as stated above) occur <200 m of WTG, on one side only • Minor wetland or woodland habitats (all PCT woodland habitats) occur 200 - 500 m of WTG, on both sides of turbine • Major wetland habitats occur >200 m from WTG blade tip, on one side only • Stick nest occurs >200 m from WTG blade tip • Irrigated cropping areas where flocking bird may intermittently congregate	**Possible** An event could occur during most circumstances (>50% - <95%).

• Minor deviations from the above rule set where habitats align with 'possible' likelihood assessment	
• Minor wetland or woodland habitats occur >200 m from WTG blade tip, on one side only • Minor wetland or woodland habitats occur >500 m from WTG blade tip, on both sides of turbine • Main watercourse or major wetland habitats occur >500 m from WTG blade tip, on one side only • Minor deviations from the above rule set where habitats are particularly small, isolated, or degraded	**Unlikely** An event could occur during some circumstances (>5 - <50%).
• Limited habitat features <1000 m from WTG blade tip	**Rare** An event may occur only in unusual circumstances (<5%)

The above criteria are considered to better represent the potential for turbine strike within the subject land than the recommended criteria included in the BCS guidance (BCS 2023). The majority of habitat for bird and bat species within the subject land is present as either ephemeral wooded waterways, isolated pine communities, isolated ephemeral waterbodies, irrigated cropping paddocks or along defined road corridors. Movements through the operational wind farm, with potential to put individuals at risk of collision, are more likely to occur when fauna are flying directly between patchy habitats or along major movement corridors. Therefore, focussing solely on proximity of habitats supported by treed vegetation (as recommended by the BCS guidance) may misrepresent the actual likelihood of collisions.

The above criteria also allows for consideration of birds' (and possibly to a lesser extent bats) capacity for avoidance of collisions with operational turbines, whether that occurs due to a cognitive response on the part of a bird or not. It should be noted that internationally there is little empirical evidence for the actual avoidance rate for any bird species, however the evidence that is available suggests that avoidance capacity is species-specific and that the great majority of birds have very high avoidance capability that is higher than 98 %. The avoidance rate of some large raptors in Australia has been shown to be between 95 % and 98 % (Smales et al. 2013, Smales 2017). 'Avoidance' is recognised at different spatial scales, with commonly used definitions provided by Cook et al. (2014). These different scales of avoidance include: (1) macro-avoidance, when a bird or bat responds to the presence of the entire wind farm by flying around or over it; (2) meso-avoidance, refers to the response in which birds or bats fly within the overall wind farm but avoid collisions by choosing to fly only in the airspace between turbines; and (3) micro-avoidance, when a bird or bat flying in close proximity to a turbine and that is otherwise on a collision course, does not in fact collide with the turbine (Smales 2017).

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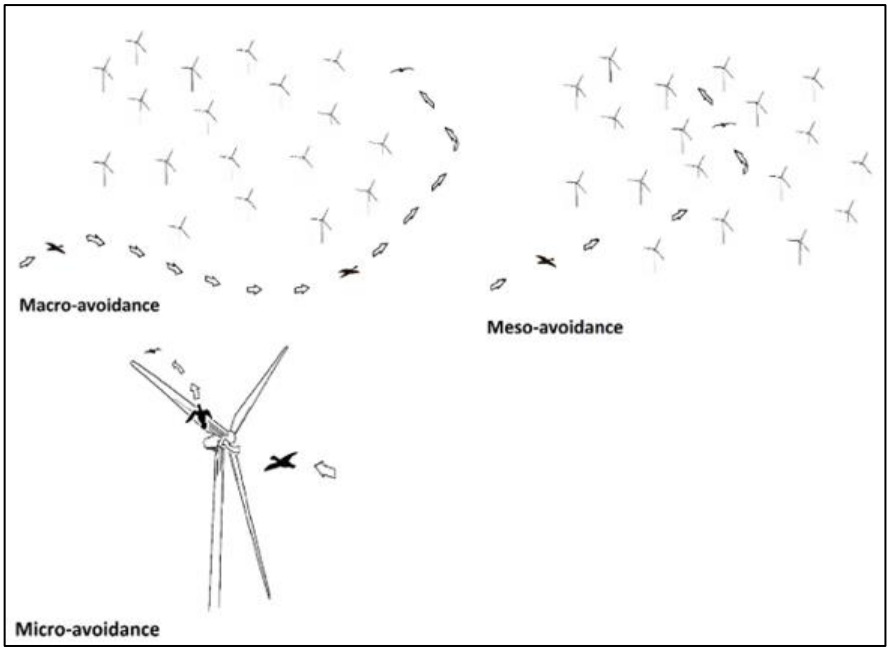


Photo 7 Types of avoidance

The turbine strike likelihood assessment buffer distances have been calculated using the formula for calculating buffers to areas of vegetation developed in *Natural England Technical Information Note TIN051 – Bats and onshore wind turbines interim guidance* (Natural England 2009). This method takes into consideration hub height, blade length, habitat feature height (i.e. tree canopies), and the horizontal distance to habitat features and provides a diagram and formula for how buffer distances between blade tips and adjacent habitat features can be calculated (refer Figure 15 below).

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

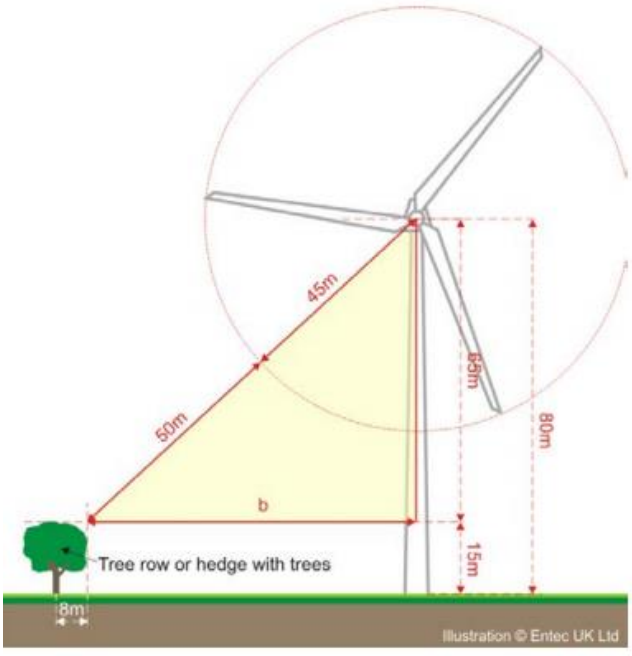


Figure 15 Extract from Technical Information Note TIN051 Bats and onshore wind turbines, showing how buffer distance is determined from top of canopy to blade tip

The above formula was used to calculate the buffer distances for assessment of the presence of key habitat features, with the following horizontal distances calculated for each of the assessed buffer distances:

- 200 m buffer distance from blade tip – 247 m horizontal buffer to key habitat feature
- 500 m buffer distance from blade tip – 575 m horizontal buffer to key habitat feature
- 1000 m buffer distance from blade tip – 1086 m horizontal buffer to key habitat feature

The above distances were calculated based on a maximum feature height of 9 metres for treed vegetation, which equates to the tallest mean canopy height value for PCTs within the subject land as outlined in the BioNet Vegetation Classification database.

6.3.3. Turbine risk assessment

Turbine risk combines the results of the assessment of turbine strike consequence and turbine strike likelihood and has again been based on the BCS Draft Turbine Risk Assessment and Avoidance Guidance (BCS 2023). Adjustments have again been made to the recommended risk rating to better reflect the habitats, aerial fauna, and movement patterns within the subject land, as well as the conclusions of the risk assessments undertaken for all at risk species.

The turbine risk assessment matrix applied to the project is outlined in Table 67.

Table 67 Turbine risk assessment matrix

Likelihood criteria	Consequence criteria			
	Severe	**Major**	**Moderate**	**Minor**
Probable	Very high	Very high	High	Moderate
Possible	Very high	High	Moderate	Moderate
Unlikely	High	High	Moderate	Low
Rare	High	Moderate	Low	Low

Final turbine risk assessment results are presented in Table 68 and Table 69, for the eastern and western portion of the development corridor respectively.

Table 68 Turbine risk assessment results – Eastern wind area (Stage 1)

WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
ET1	Unlikely	Moderate	Moderate
ET10	Unlikely	Moderate	Moderate
ET100	Rare	Moderate	Low
ET101	Unlikely	Moderate	Moderate
ET102	Unlikely	Moderate	Moderate
ET103	Rare	Moderate	Low
ET104	Rare	Moderate	Low
ET105	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
ET106	Unlikely	Moderate	Moderate
ET107	Unlikely	Moderate	Moderate
ET108	Unlikely	Moderate	Moderate
ET109	Rare	Moderate	Low
ET11	Rare	Moderate	Low
ET110	Rare	Moderate	Low
ET111	Rare	Moderate	Low
ET112	Rare	Moderate	Low
ET113	Rare	Moderate	Low
ET114	Unlikely	Moderate	Moderate
ET115	Unlikely	Moderate	Moderate
ET116	Likely	Moderate	High
ET117	Unlikely	Moderate	Moderate
ET118	Possible	Moderate	High
ET119	Unlikely	Moderate	Moderate
ET12	Unlikely	Moderate	Moderate
ET120	Possible	Moderate	High
ET122	Unlikely	Moderate	Moderate
ET123	Possible	Moderate	High
ET124	Unlikely	Moderate	Moderate
ET125	Possible	Moderate	High
ET126	Unlikely	Moderate	Moderate
ET13	Possible	Moderate	High
ET14	Unlikely	Moderate	Moderate
ET15	Possible	Moderate	High
ET16	Possible	Moderate	High
ET17	Unlikely	Moderate	Moderate
ET18	Unlikely	Moderate	Moderate
ET19	Possible	Moderate	High
ET20	Unlikely	Moderate	Moderate
ET21	Possible	Moderate	High

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
ET22	Rare	Moderate	Low
ET23	Rare	Moderate	Low
ET24	Unlikely	Moderate	Moderate
ET25	Unlikely	Moderate	Moderate
ET26	Unlikely	Moderate	Moderate
ET27	Possible	Moderate	High
ET28	Unlikely	Moderate	Moderate
ET29	Unlikely	Moderate	Moderate
ET3	Unlikely	Moderate	Moderate
ET30	Possible	Moderate	High
ET31	Unlikely	Moderate	Moderate
ET32	Rare	Moderate	Low
ET33	Possible	Moderate	High
ET34	Unlikely	Moderate	Moderate
ET35	Rare	Moderate	Low
ET36	Unlikely	Moderate	Moderate
ET37	Unlikely	Moderate	Moderate
ET38	Possible	Moderate	High
ET39	Rare	Moderate	Low
ET4	Possible	Moderate	High
ET40	Rare	Moderate	Low
ET41	Unlikely	Moderate	Moderate
ET42	Rare	Moderate	Low
ET43	Possible	Moderate	High
ET44	Rare	Moderate	Low
ET45	Unlikely	Moderate	Moderate
ET47	Possible	Moderate	High
ET48	Possible	Moderate	High
ET49	Unlikely	Moderate	Moderate
ET5	Rare	Moderate	Low
ET50	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
ET51	Rare	Moderate	Low
ET52	Unlikely	Moderate	Moderate
ET54	Unlikely	Moderate	Moderate
ET56	Rare	Moderate	Low
ET58	Possible	Moderate	High
ET59	Unlikely	Moderate	Moderate
ET6	Possible	Moderate	High
ET61	Rare	Moderate	Low
ET62	Unlikely	Moderate	Moderate
ET63	Rare	Moderate	Low
ET64	Possible	Moderate	High
ET66	Rare	Moderate	Low
ET67	Rare	Moderate	Low
ET69	Unlikely	Moderate	Moderate
ET7	Possible	Moderate	High
ET70	Rare	Moderate	Low
ET71	Unlikely	Moderate	Moderate
ET72	Possible	Moderate	High
ET73	Unlikely	Moderate	Moderate
ET74	Rare	Moderate	Low
ET75	Unlikely	Moderate	Moderate
ET76	Unlikely	Moderate	Moderate
ET77	Unlikely	Moderate	Moderate
ET78	Possible	Moderate	High
ET79	Unlikely	Moderate	Moderate
ET8	Rare	Moderate	Low
ET80	Rare	Moderate	Low
ET81	Unlikely	Moderate	Moderate
ET82	Unlikely	Moderate	Moderate
ET83	Rare	Moderate	Low
ET84	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
ET85	Unlikely	Moderate	Moderate
ET86	Unlikely	Moderate	Moderate
ET87	Rare	Moderate	Low
ET88	Unlikely	Moderate	Moderate
ET89	Unlikely	Moderate	Moderate
ET9	Possible	Moderate	High
ET90	Rare	Moderate	Low
ET91	Unlikely	Moderate	Moderate
ET92	Unlikely	Moderate	Moderate
ET93	Rare	Moderate	Low
ET94	Rare	Moderate	Low
ET95	Unlikely	Moderate	Moderate
ET96	Unlikely	Moderate	Moderate
ET97	Rare	Moderate	Low
ET98	Unlikely	Moderate	Moderate
ET99	Rare	Moderate	Low

Table 69 Turbine risk assessment results – Western wind area (Stage 2)

WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT1	Unlikely	Moderate	Moderate
WT10	Possible	Moderate	High
WT100	Unlikely	Moderate	Moderate
WT101	Unlikely	Moderate	Moderate
WT102	Unlikely	Moderate	Moderate
WT103	Unlikely	Moderate	Moderate
WT104	Unlikely	Moderate	Moderate
WT105	Unlikely	Moderate	Moderate
WT106	Possible	Moderate	High
WT108	Possible	Moderate	High
WT109	Possible	Moderate	High
WT11	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT110	Possible	Moderate	High
WT111	Rare	Moderate	Low
WT112	Possible	Moderate	High
WT113	Unlikely	Moderate	Moderate
WT114	Possible	Moderate	High
WT115	Possible	Moderate	High
WT118	Possible	Moderate	High
WT119	Unlikely	Moderate	Moderate
WT12	Rare	Moderate	Low
WT120	Rare	Moderate	Low
WT121	Unlikely	Moderate	Moderate
WT122	Unlikely	Moderate	Moderate
WT123	Possible	Moderate	High
WT124	Unlikely	Moderate	Moderate
WT125	Possible	Moderate	High
WT127	Unlikely	Moderate	Moderate
WT128	Unlikely	Moderate	Moderate
WT129	Unlikely	Moderate	Moderate
WT13	Possible	Moderate	High
WT130	Rare	Moderate	Low
WT131	Unlikely	Moderate	Moderate
WT133	Unlikely	Moderate	Moderate
WT134	Unlikely	Moderate	Moderate
WT135	Unlikely	Moderate	Moderate
WT136	Possible	Moderate	High
WT137	Rare	Moderate	Low
WT138	Unlikely	Moderate	Moderate
WT139	Unlikely	Moderate	Moderate
WT14	Unlikely	Moderate	Moderate
WT140	Rare	Moderate	Low
WT141	Possible	Moderate	High

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT142	Possible	Moderate	High
WT143	Possible	Moderate	High
WT144	Possible	Moderate	High
WT145	Unlikely	Moderate	Moderate
WT146	Unlikely	Moderate	Moderate
WT147	Unlikely	Moderate	Moderate
WT148	Rare	Moderate	Low
WT149	Unlikely	Moderate	Moderate
WT15	Rare	Moderate	Low
WT150	Unlikely	Moderate	Moderate
WT152	Unlikely	Moderate	Moderate
WT153	Unlikely	Moderate	Moderate
WT154	Rare	Moderate	Low
WT155	Unlikely	Moderate	Moderate
WT156	Unlikely	Moderate	Moderate
WT157	Unlikely	Moderate	Moderate
WT158	Unlikely	Moderate	Moderate
WT159	Probable	Moderate	Very High
WT16	Possible	Moderate	High
WT160	Unlikely	Moderate	Moderate
WT161	Unlikely	Moderate	Moderate
WT162	Unlikely	Moderate	Moderate
WT163	Unlikely	Moderate	Moderate
WT164	Unlikely	Moderate	Moderate
WT17	Unlikely	Moderate	Moderate
WT18	Rare	Moderate	Low
WT19	Rare	Moderate	Low
WT2	Unlikely	Moderate	Moderate
WT20	Unlikely	Moderate	Moderate
WT21	Unlikely	Moderate	Moderate
WT22	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT23	Unlikely	Moderate	Moderate
WT24	Rare	Moderate	Low
WT25	Rare	Moderate	Low
WT26	Unlikely	Moderate	Moderate
WT27	Rare	Moderate	Low
WT28	Rare	Moderate	Low
WT29	Unlikely	Moderate	Moderate
WT3	Unlikely	Moderate	Moderate
WT30	Probable	Moderate	Very High
WT31	Rare	Moderate	Low
WT32	Rare	Moderate	Low
WT33	Unlikely	Moderate	Moderate
WT34	Unlikely	Moderate	Moderate
WT35	Rare	Moderate	Low
WT36	Unlikely	Moderate	Moderate
WT37	Unlikely	Moderate	Moderate
WT38	Rare	Moderate	Low
WT39	Rare	Moderate	Low
WT4	Unlikely	Moderate	Moderate
WT40	Rare	Moderate	Low
WT41	Unlikely	Moderate	Moderate
WT42	Unlikely	Moderate	Moderate
WT43	Rare	Moderate	Low
WT44	Unlikely	Moderate	Moderate
WT45	Unlikely	Moderate	Moderate
WT46	Rare	Moderate	Low
WT47	Possible	Moderate	High
WT48	Rare	Moderate	Low
WT49	Unlikely	Moderate	Moderate
WT50	Possible	Moderate	High
WT51	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT52	Rare	Moderate	Low
WT53	Possible	Moderate	High
WT54	Unlikely	Moderate	Moderate
WT55	Rare	Moderate	Low
WT56	Possible	Moderate	High
WT57	Unlikely	Moderate	Moderate
WT58	Unlikely	Moderate	Moderate
WT59	Possible	Moderate	High
WT6	Unlikely	Moderate	Moderate
WT60	Rare	Moderate	Low
WT61	Unlikely	Moderate	Moderate
WT62	Unlikely	Moderate	Moderate
WT63	Possible	Moderate	High
WT64	Unlikely	Moderate	Moderate
WT66	Possible	Moderate	High
WT67	Unlikely	Moderate	Moderate
WT68	Rare	Moderate	Low
WT69	Possible	Moderate	High
WT7	Possible	Moderate	High
WT70	Possible	Moderate	High
WT71	Rare	Moderate	Low
WT72	Unlikely	Moderate	Moderate
WT73	Unlikely	Moderate	Moderate
WT75	Rare	Moderate	Low
WT76	Unlikely	Moderate	Moderate
WT77	Probable	Moderate	Very High
WT78	Rare	Moderate	Low
WT79	Possible	Moderate	High
WT80	Possible	Moderate	High
WT81	Possible	Moderate	High
WT82	Unlikely	Moderate	Moderate

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WTG #	Turbine strike likelihood	Maximum consequence	Turbine risk
WT83	Unlikely	Moderate	Moderate
WT85	Possible	Moderate	High
WT86	Possible	Moderate	High
WT87	Unlikely	Moderate	Moderate
WT88	Unlikely	Moderate	Moderate
WT89	Unlikely	Moderate	Moderate
WT9	Rare	Moderate	Low
WT90	Unlikely	Moderate	Moderate
WT91	Unlikely	Moderate	Moderate
WT92	Unlikely	Moderate	Moderate
WT93	Probable	Moderate	Very High
WT94	Rare	Moderate	Low
WT95	Unlikely	Moderate	Moderate
WT97	Possible	Moderate	High

Table 70 below summarises the number of turbines within each risk category for the project. In total, 77% of the turbines fall within a low to moderate risk category, whilst the remaining 23% fall within the high and very high category.

Table 70 Turbine risk assessment summary

Turbine risk	Total	Total %	Stage 1 sub total	Stage 1 %	Stage 2 sub total	Stage 2 %
Very High	4	1.5	0	0	4	2.7
High	59	22.0	25	21.4	34	22.7
Moderate	114	42.6	35	29.1	79	52.6
Low	90	33.7	57	48.7	33	22.0

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STAGE 2 — IMPACT ASSESSMENT

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7. Avoid and minimise impacts

This section demonstrates the efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the project in accordance with BAM, including an analysis of:

- Alternative locations' potential impacts on biodiversity values and justification for selecting the project location.
- Efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design.
- Routes that avoid and minimise impacts on biodiversity values.
- Technologies that would avoid or minimise impacts on biodiversity values.

7.1. Actions to avoid/minimise project impacts

During initial phases of the project feasibility, multiple properties and regions within the broader Riverina and South West REZ were considered. The South West REZ as a whole was chosen for multiple reasons including renewable energy resource potential, existing (and planned) electricity network (i.e. Project EnergyConnect), low human population densities and existing land use patterns. Many of the proposed renewable energy developments in the South West REZ are sited in areas that support native vegetation cover, particularly in the central to eastern portions of the REZ. The prevalence of native vegetation in these areas is due to land use practices and patterns of agricultural development. Lower rainfall areas and non-arable areas away from irrigation infrastructure still support large tracts of native vegetation where broadacre grazing takes place. Development of intensive dryland and/or irrigated agriculture has been limited by appropriate soil types and proximity to irrigation infrastructure. Government policy and community pressure has meant future renewable energy development in the South West REZ is now focussed on the undeveloped grazing land that supports native vegetation rather than on the areas of high value agricultural land. This has made complete avoidance of biodiversity impacts at a landscape and site selection level challenging within the South West REZ. The site selection process has therefore focused on avoiding higher quality woodland and forested areas and on utilising land previously disturbed by low intensity agriculture. Whilst avoidance of native vegetation is challenging in the South West REZ, a key focus was siting wind farm infrastructure and the development footprint, particularly turbine locations, outside of riparian buffers, outside of important mapped habitat areas for Plains Wanderer, and outside of the highest value biodiversity areas within the subject land as much as possible.

Similar to the Dinawan Solar Farm, the final location of the project was chosen based on (EMM 2022):

- The subject land is within the South West REZ, an area nominated for significant investment in renewable energy generation, storage and transmission projects.
- The subject land is adjacent to Project EnergyConnect (including the Dinawan Substation), which minimises the impacts and cost of transmission infrastructure required to export the electricity generated by the project directly into the grid via Project EnergyConnect.
- The subject land is relatively flat and has a very good wind yield, particularly at night, that complements the available solar resource proposed to be utilised as part of the Dinawan Solar Farm.
- The land surrounding the subject land is sparsely populated with only 22 non-associated residences within 8 kilometres of a proposed turbine.

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- The existing agricultural land use (native pasture grazing) and cropping land within and surrounding the subject land is compatible with wind energy generation.
- The subject land connects directly to Kidman Way, an approved B-Double route, with access to the Sturt and Newell Highways.

7.2. Preliminary constraints and opportunities assessment

Biosis was commissioned by Spark Renewables in late 2021 to undertake a preliminary biodiversity opportunities and constraints assessment at multiple contiguous properties totalling 54,000 hectares, as part of an overall due diligence for both potential solar and wind farm developments. Initially, the constraints and opportunities assessment was undertaken with desktop data only, followed by rapid field investigation to verify findings. The scope of this assessment was to identify high level constraints and describe biodiversity values within the subject land and neighbouring properties and allowed for recommendations to be provided in terms of avoidance, mitigation and/or further detailed assessment of biodiversity, guiding concept, preliminary and final designs. The constraints identified across the 54,000 hectare investigation area are listed in Table 71 and shown on Figure 16. **Note**, some constraints have been revised back from those indicated below and in Figure 16 following multiple field surveys, such as No-go to high constraint, and mostly around absence of Intact Weeping myall TEC or mapped wetlands. This is more prevalent for general infrastructure constraints (access tracks, cabling, compounds etc) as opposed to wind turbine locations (Figure 16a and Figure 16b).

Table 71 Constraints assessment for turbine layout and general infrastructure

Constraint category	Definition	Wind constraint value (Predominantly in regard to turbine placement)	General infrastructure constraint value
No Go areas (Constraint score – 4)	These are areas that should be avoided and if not, may seriously effect regulatory approval of the project (i.e. regulators may require significant redesign to reduce impacts).	• 200 m No-Go zone setback required around NPWS estate (Oolambeyan National Park). • Mapped NSW wetlands (DECCW 2010) with an additional 200 m buffer. • 300 m from treed watercourses that are the most likely location of raptor and parrot breeding sites. • 100 m buffer of mapped Plains Wanderer Important Habitat Areas.	• 200 m No-Go zone setback required around NPWS estate (Oolambeyan National Park). • 100 m buffer of mapped Plains Wanderer Important Habitat Areas.

Constraint category	Definition	Wind constraint value (Predominantly in regard to turbine placement)	General infrastructure constraint value
High Constraint (Constraint score – 3)	These are areas that should be avoided if possible and will require justification in a BDAR if they cannot be avoided. Likely to result in curtailment of wind turbines, and/or include areas that are likely to generate high biodiversity credit per hectare requirements that will require offsetting.	• Additional >200 m – 900 m buffer from mapped NSW wetlands (DECCW 2010) for potential of breeding migratory and/or nomadic wetland birds. • High likelihood EPBC and BC Act listed TECs. • 100 - 300 m buffer of mapped Plains Wanderer Important Habitat Areas. • Additional >300 m – 500 m buffer from treed watercourses to reduce impacts to raptor and wetland bird breeding sites • Woodland Plant Community Types (PCTs) that are more likely to provide habitat for birds (non-waders) and microbats likely to be at risk of collision with turbines • Lower likelihood TECS and/or TECs that require ground validation to confirm presence and constraint level (incl. EPBC Act Grasslands, Sandhill Pine Woodland and Box Gum Woodland) (hatched areas on figures).	• 300 m within treed watercourses are the most likely location of raptor and parrot breeding sites. • 100 - 300 m buffer of mapped Plains Wanderer Important Habitat Areas. • Any EPBC and BC Act listed TECs. • Additional >300 m – 500 m buffer from treed watercourses to reduce impacts to raptor breeding sites. • All other PCTs within 300m of a watercourse. • EPBC grassland TECs that require ground-truthing to confirm presence and constraint level (hatched areas on figures).
Moderate Constraint (Constraint score – 2)	Suitable for development. These areas do not necessarily need to be avoided but will generate a moderate biodiversity credit per hectare that require offsetting.	• All native vegetation not subject to the above constraints.	• All native vegetation not subject to the above constraints. • Non-native vegetation or areas likely to meet the definition of Category 1 land however where prescribed impacts may be possible.

Constraint category	Definition	Wind constraint value (Predominantly in regard to turbine placement)	General infrastructure constraint value
Low Constraint (Constraint score – 1)	Best suited for development. These areas are unlikely to generate biodiversity credits (exotic/cultivated/irrigated areas) or may have low biodiversity credit requirements per hectare.	• Non-native vegetation or areas likely to meet the definition of Category 1 exempt land and where prescribed impacts are considered negligible.	• Non-native vegetation or areas likely to meet the definition of Category 1 land and where prescribed impacts are considered negligible.

The development corridor and development footprint has been refined through consideration of the findings of a preliminary ecological study and identification of constraints and opportunities mapped through the environmental impact assessment process (including this BDAR). The intent of this process was to avoid impacts to the highest ecological values identified as much as possible, whilst taking into account the high proportion of native vegetation within the subject land. Although impacts to native vegetation, threatened species habitat and TECs will occur, complete avoidance of impacts wasn't possible due to the large amount of native vegetation within the subject land and broader investigation area, with instead a focus on avoidance of the highest value areas (Figure 16).

Measures to avoid and minimise impacts on highest value areas of native vegetation were considered during the planning stage of the project and designs were 'workshopped' through an iterative mapping process between Spark Renewables, EMM and the Biosis BAM Assessors and project ecologists. Other disciplines such as flooding and archaeology were also considered during multiple revisions of the development corridor to ensure highest biodiversity values, as well archaeological values and areas likely to be inundated during significant flood events were accounted for.

Overall, siting of current infrastructure and proposed design resulted in the following areas of constraints

- 1.5% of the development footprint occurring in Very High areas.
    - Primarily based on impacts (predominantly access) to important mapped areas for Plains Wanderer and non-ground truthed mapped wetlands.
- 12.8% of the development footprint occurring in highly constrained areas.
    - Primarily buffers applied to wetlands areas, treed riparian areas and buffers to important mapped areas for Plains Wanderer
- 71.6% of the development footprint occurring in moderately constrained areas.
    - Primarily due to levels of native vegetation present.
- 14.1% of the development footprint occurring in low constrained areas.

Following this, the process of further refinement once areas where ground truthed has resulted in impacts to areas of highest biodiversity value being avoided and/or minimised, which has included;

- Project design workshops were held on multiple occasions between Biosis ecologists, project designers/engineers and environmental approvals specialists to work through opportunities and constraints relating to how impacts to biodiversity values could be avoided and minimised through project design and the location of infrastructure.
- Removal of infrastructure from the Four Corners property, adjacent to Oolambeyan National Park.

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- Avoidance of impacts throughout the broader study area, and an overall reduction in loss of higher quality habitats from multiple design revisions.
- Use of existing tracks, public roads and fencelines to delineate sections of the project and used preferentially for locating access tracks and linear infrastructure.
- Relocating and combining footprints and micro-siting corridors to contain as much infrastructure as possible (e.g. collocating access tracks with electrical cabling and/or transmission line infrastructure), making a more efficient design and keeping impacts to the minimum extent necessary.
- Large scale avoidance of important mapped areas for the Plains Wanderer which is common within the subject land.
- Minimising the removal of habitat trees that may provide habitat for species such as Superb Parrot and Corbens long-eared Bat.
- Siting turbine mast locations at least 200m away from PCT 13, PCT 15, PCT 10 and PCT 28 as far as practicable, allows increased buffers from blade tip to edge of canopy.
- Removing and/or relocating turbines away from active and non-active large nests observed during the surveys.
- Removing and/or relocating turbines out of PCT 26 intact areas where vulnerable listed Painted Honeyeaters were recorded and vulnerable listed Grey-crowned Babblers were nesting.
- Avoidance and minimisation of impacts to large patches of *Swainsona murrayana* and *Swainsona sericea.*

Following turbine layout revisions, the preliminary layout was reduced from 294 turbines to 267, with 214 of the original 294 turbines relocated to some degree based on biodiversity impacts, as well as other environmental constraints.

An overall summary of the reduction of the scale of the development corridor can be seen in Table 72.

Table 72 Summary of key project refinements

Area	Preliminary investigation Area (ha)	Preliminary Development Corridor total area (ha)	Development Corridor V3 (ha) total area	Current Development Corridor V8 total area (ha)
Total hectares	54,000 ha	10,366 ha	7,956 ha	7,256 ha

As previously indicated, the principal means to reduce impacts on biodiversity values is to avoid and/or minimise the removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered in Section 9. Figure 17 shows the extent of refinements undertaken to avoid or minimise impacts on biodiversity values. The final development footprint (including construction and operation) as well as demonstrating prescribed impacts and indirect impact zones where applicable is shown in Figure 18 and Figure 19 respectively.

7.3. Hollow bearing trees

Many patches of woody vegetation dominated by Black Box within the development corridor contain a significant number of hollows, many of which are classified within the small size category, however, do contain medium to large hollows on occasion. Due to the significant number of hollow bearing trees, recording of hollow bearing tree data was focused on the medium or greater size classes that many of the

threatened fauna in the region would occupy. A concerted effort during preliminary design was to avoid Black box dominated vegetation and hollow bearing trees as much as possible, and site wind turbines at least 200 metres away from these areas. However, due primarily to access and cabling requirements, some hollow bearing trees are impacted. The project will result in the loss of 15 hollow-bearing trees, out of the 67 recorded within the development corridor that contain small, medium and large, or a combination of all three. This represents a 78% retention of woody vegetation with medium or greater sized hollows. These hollows provide denning, sheltering and breeding for a raft of hollow dependent native fauna, however observations during multiple seasonal surveys noted use of the hollows by more common fauna such as Galahs and Blue Bonnets.

Table 73 Summary of hollow bearing trees surveyed

Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
1	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
2	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
3	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
4	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
5	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Retained
6	*Eucalyptus largiflorens*	70	Yes	Yes	Yes	Retained
7	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
8	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
9	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	Yes	Retained
10	*Callitris glaucophylla*	Very Large Tree > 100cm	Yes	Yes	No	Retained
11	*Eucalyptus largiflorens*	Medium Tree 20-50cm	No	Yes	No	Retained
12	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
13	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Retained
14	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
15	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Retained
16	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained

Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
17	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	Yes	Removed
18	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
19	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
20	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
21	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
22	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
23	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
24	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
25	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Retained
26	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
27	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	No	Retained
28	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
29	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed
30	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
31	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Retained
32	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Removed
33	*Eucalyptus camaldulensis*	Large Tree 50-100cm	Yes	Yes	No	Retained
34	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
35	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
36	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	No	Removed
37	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained

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Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
38	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
39	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	No	Yes	Retained
40	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
41	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
42	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Retained
43	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Retained
44	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
45	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
46	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
47	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
48	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
49	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
50	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	Yes	Retained
51	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
52	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	Yes	Retained
53	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
54	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
55	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	No	Retained
56	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Retained
57	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Retained
58	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed

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Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
59	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed
60	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	Yes	Retained
61	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Retained
62	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
63	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Retained
64	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Removed
65	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	Yes	Removed
66	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Retained
67	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed

7.4. Avoid and minimise summary

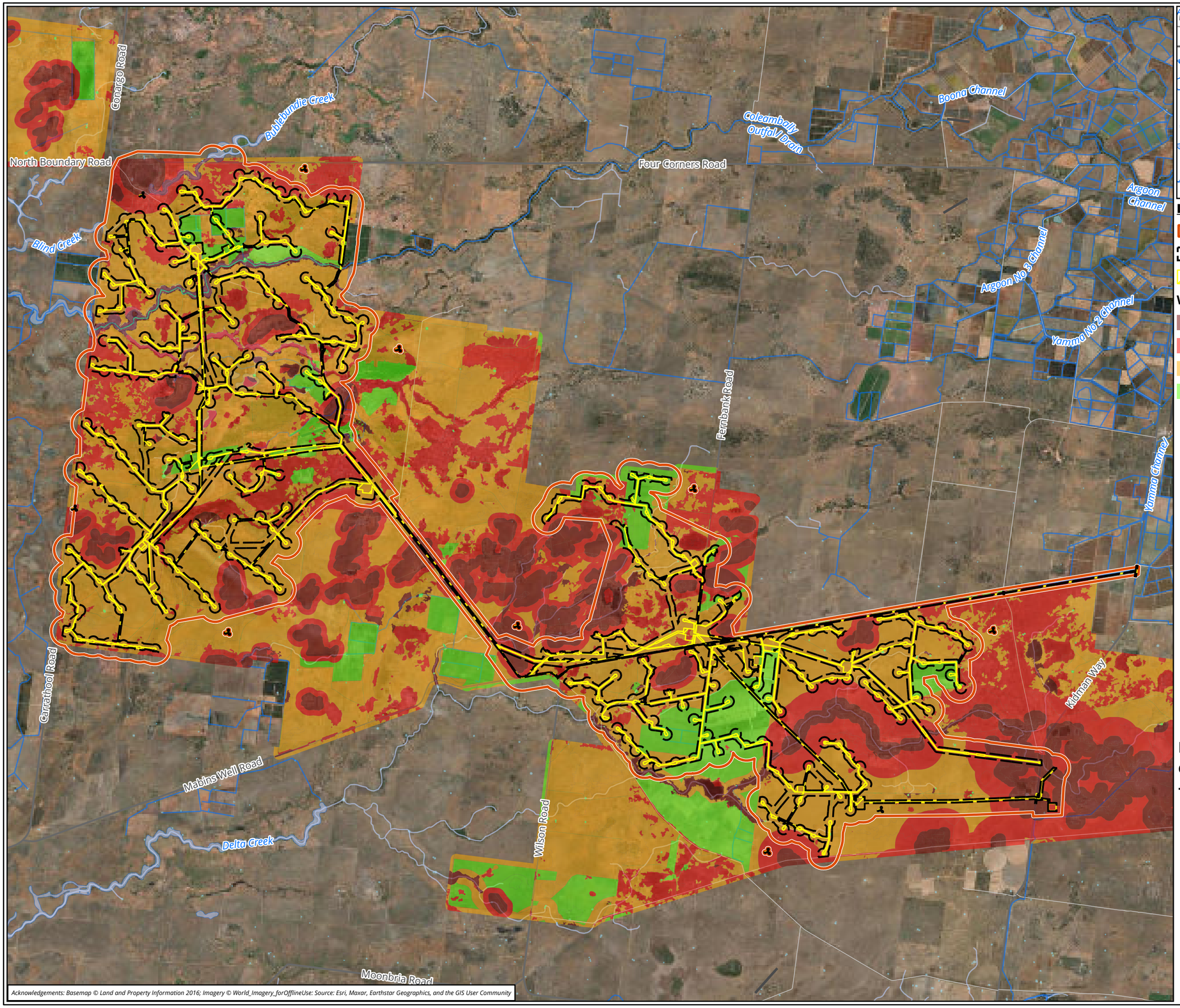
Table 74 demonstrates the application of the high level criteria for avoid and minimise in accordance with the BAM. As previously indicated, the principal means to reduce impacts on biodiversity values within a development corridor and subject land is to avoid and/or minimise the removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered (refer to Section 9. Figure 16 demonstrates the constraints modelling used to guide earlier designs, Figure 17 demonstrates further avoidance and previous footprints and development corridors and Figure 18 demonstrates the current footprint for assessment.

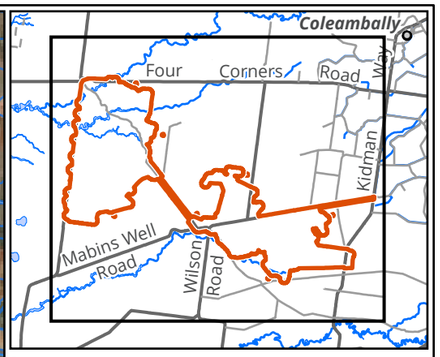
Table 74 Summary of avoidance and minimisation of impact

Avoidance and minimisation components	Action	Outcome	Timing	Responsibility
Modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology.	Investigate modes or technologies that would avoid or minimise impacts on biodiversity values. High turbine masts and hub height.	High turbine masts and hub height currently selected allow for at least an 80m horizontal distance from blade tip to canopy tip.	Project design	Spark Renewables

Avoidance and minimisation components	Action	Outcome	Timing	Responsibility
Routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route.	Utilisation of existing public roads and access tracks as far as possible. Good access to existing local and regional roads.	Minimise clearing impacts. Avoidance of higher biodiversity values.	Project design Construction	Spark Renewables
Alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	Site selection. Location next to Dinawan Substation and Project EnergyConnect.	Minimise clearing impacts. Avoidance of higher biodiversity values.	Project design	Spark Renewables
Alternative sites within a property on which the project is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.	Constraints and opportunities assessment undertaken. Adapting project design to avoid areas of highest biodiversity value.	Avoidance of higher biodiversity values as much as practicable. Minimising impacts to key habitat for Plains Wanderer. Minimising impacts to hollow bearing trees.	Project design	Spark Renewables
Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design.	Constraints and opportunities assessment undertaken. Adapting project design to avoid areas of highest biodiversity value.	Avoidance of higher biodiversity values as much as practicable. Minimising impacts to key habitat for Plains Wanderer. Minimising impacts to hollow bearing trees. Relocating wind turbines away from key nesting sites and breeding habitat for threatened avian fauna. Allowing for movement corridors and fly paths, minimising barrier effects.	Project design	Spark Renewables
Identification of any other site constraints that the proponent has considered in determining the	Conduct surveys to identify site constraints and opportunities to avoid and minimise.	Avoidance and minimising impacts to confirmed areas of *Swainsona murrayana* and *Swainsona sericea* patches. Relocating wind turbines away from key active nesting	Project design Construction	Spark Renewables

Avoidance and minimisation components	Action	Outcome	Timing	Responsibility
location and design of the project.		sites and breeding habitat for threatened avian fauna.		





Legend

- Subject land
- Development corridor
- Development footprint

Wind constraints

- No-go
- High
- Moderate
- Low

Figure 16A Preliminary wind constraints to inform design - Overview

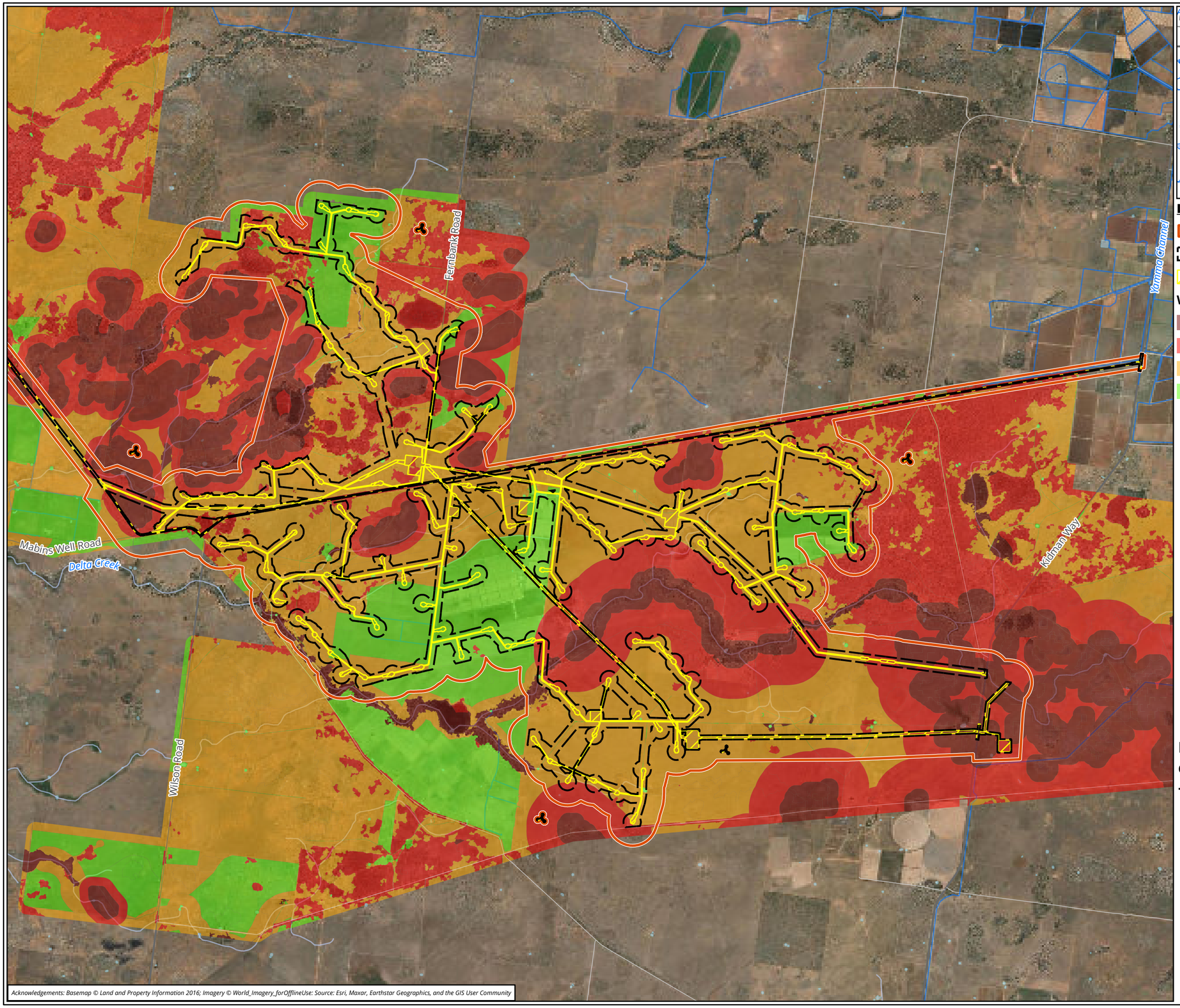
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Kilometers
Scale: 1:130,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

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GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F15A_ConstraintsWind



Legend

- Subject land
- Development corridor
- Development footprint

Wind constraints

- No-go
- High
- Moderate
- Low

Figure 16A Preliminary wind constraints to inform design - Stage 1

0 1 2 3

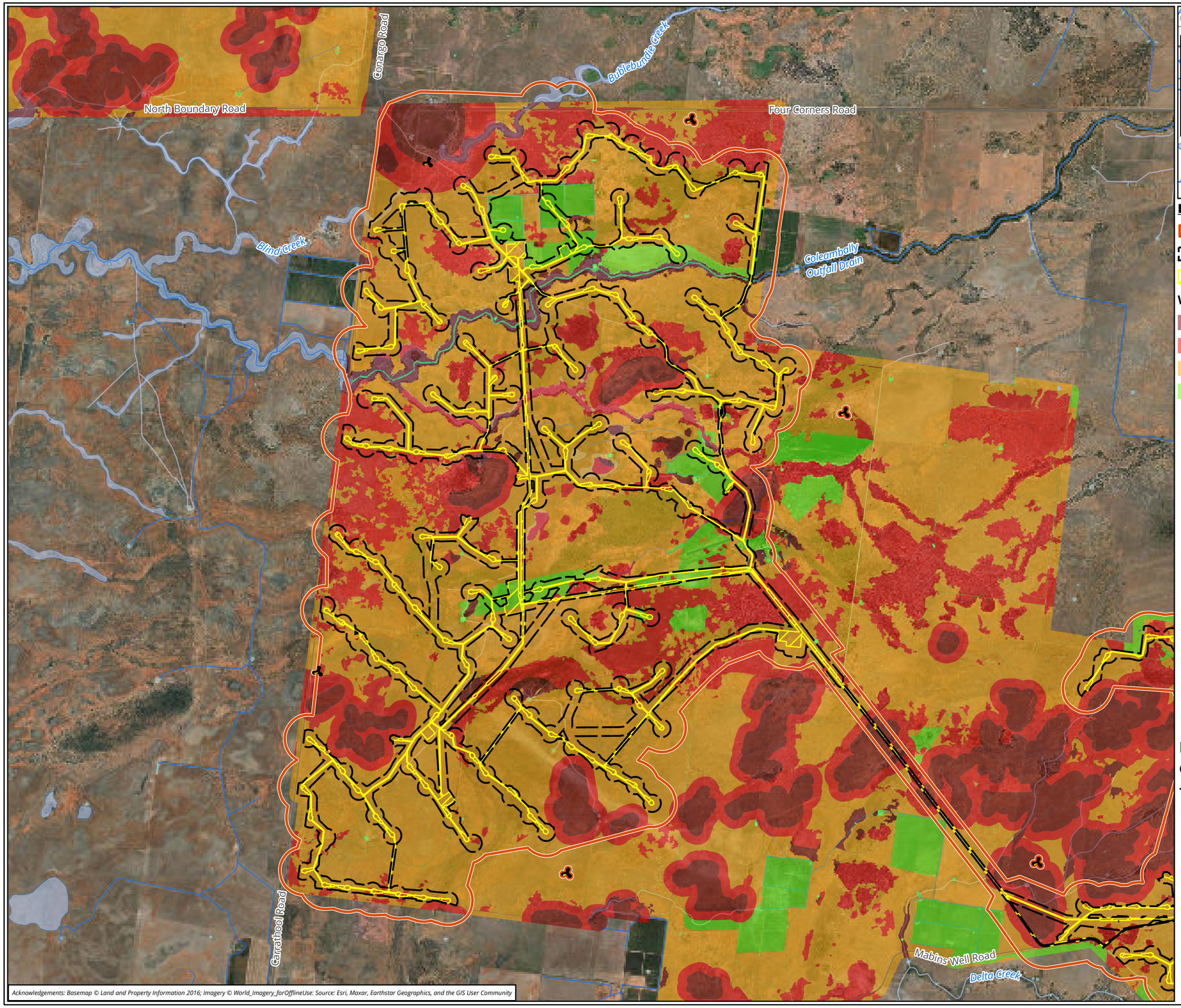
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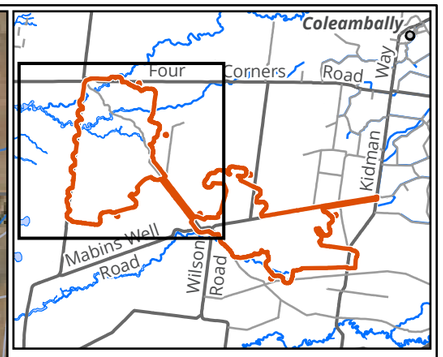
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Layout: 37263_Wind_F15A_ConstraintsWind

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Legend

- Subject land
- Development corridor
- Development footprint

Wind constraints

- No-go
- High
- Moderate
- Low

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Figure 16A Preliminary wind constraints to inform design - Stage 2

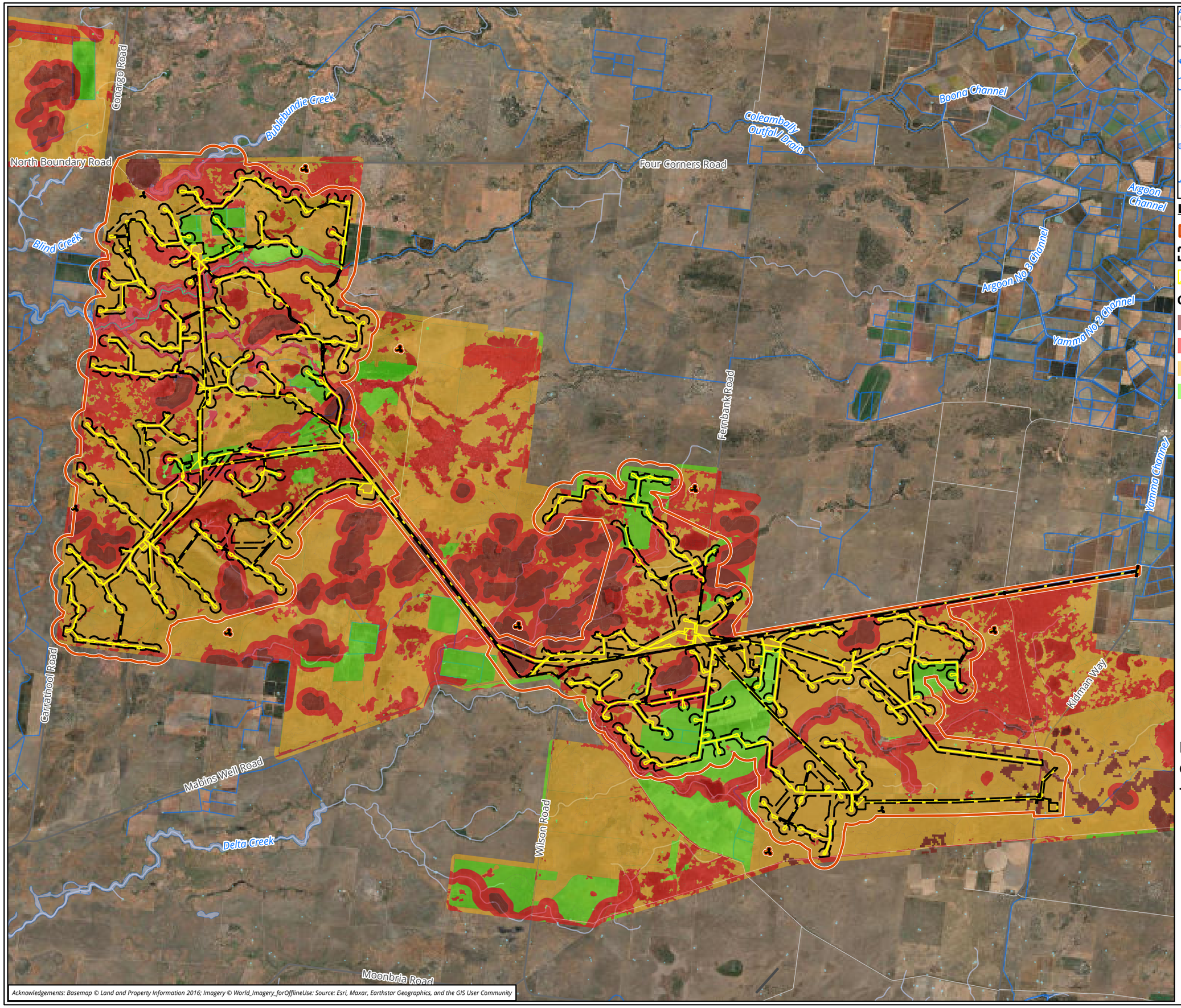
0 1 2 3

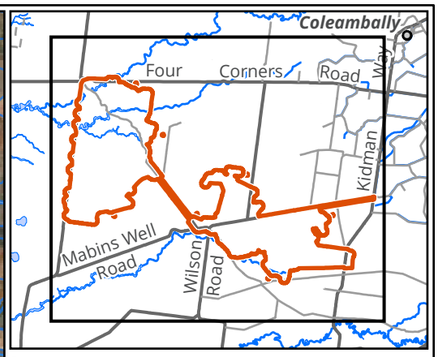
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Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F15A_ConstraintsWind





Legend

- Subject land
- Development corridor
- Development footprint

Civil constraints

- No-go
- High
- Moderate
- Low

Figure 16B Preliminary civil constraints to inform design - Overview

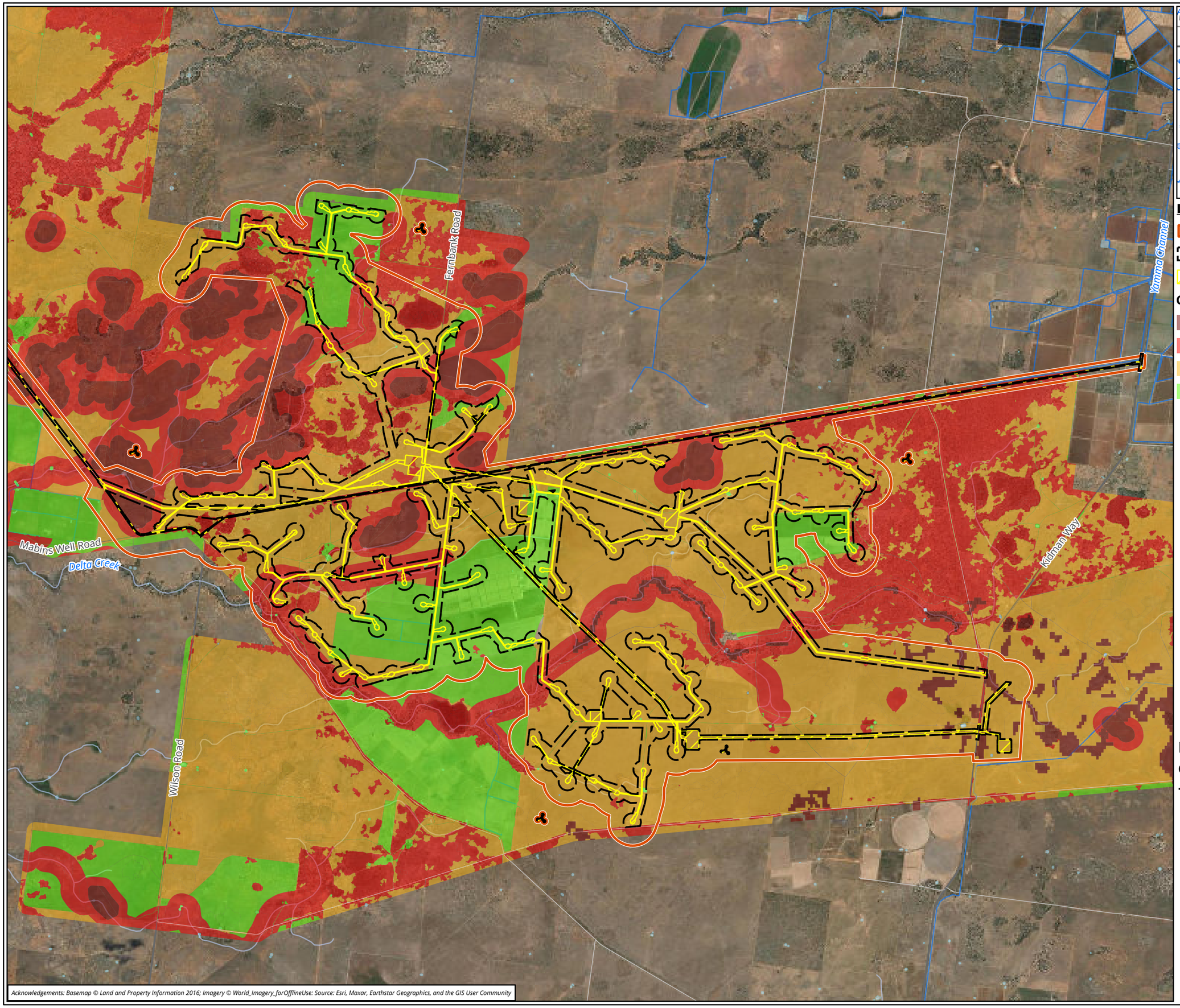
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Kilometers
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Coordinate System:
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biosis

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37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F15B_ConstraintsCivil



Legend

- Subject land
- Development corridor
- Development footprint

Civil constraints

- No-go
- High
- Moderate
- Low

Figure 16B Preliminary civil constraints to inform design - Stage 1

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
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37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F15B_ConstraintsCivil

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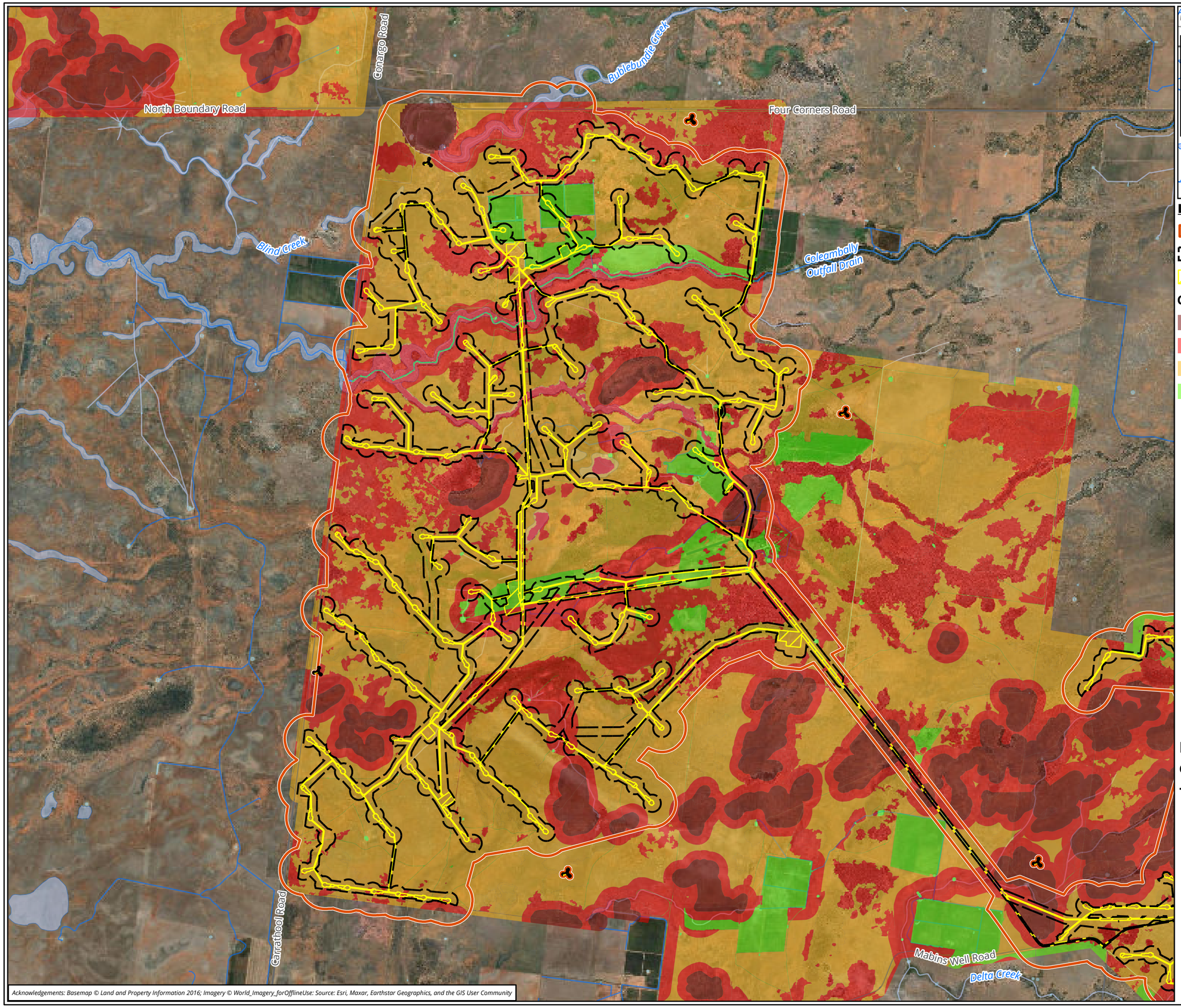
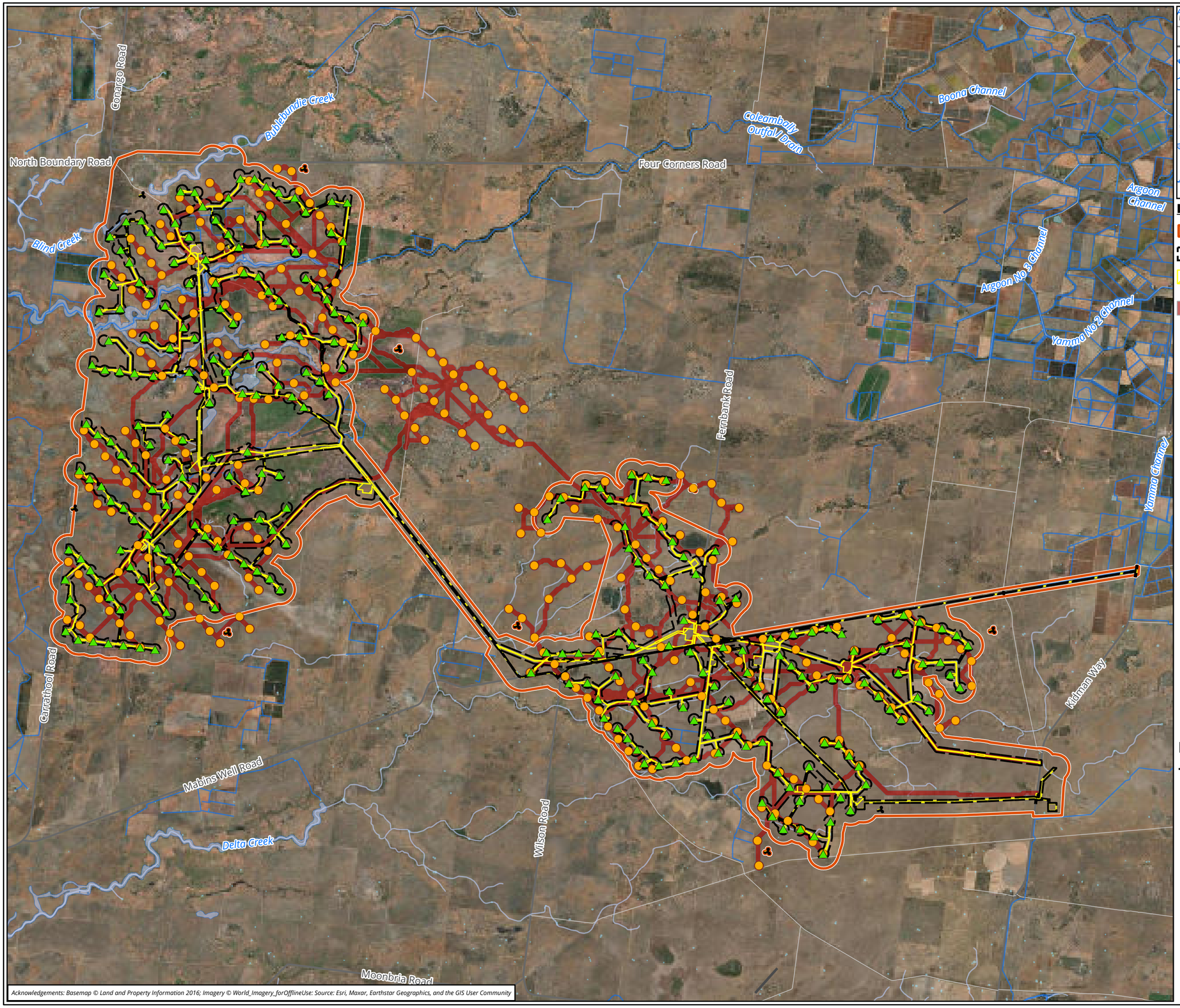
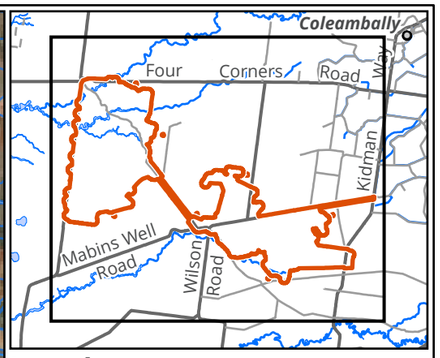


Figure 16B Preliminary civil constraints to inform design - Stage 2

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Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F15B_ConstraintsCivil





Legend

- Subject land
- Development corridor
- Development footprint
- Development footprint alternative option
- Wind turbine
- Wind turbine alternative option

Figure 17 Alternative options - Overview

0 1 2 3 4 5

Kilometers

Scale: 1:130,000 @ A3

Coordinate System: GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
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Layout: 37263_Wind_F16_AltOptions

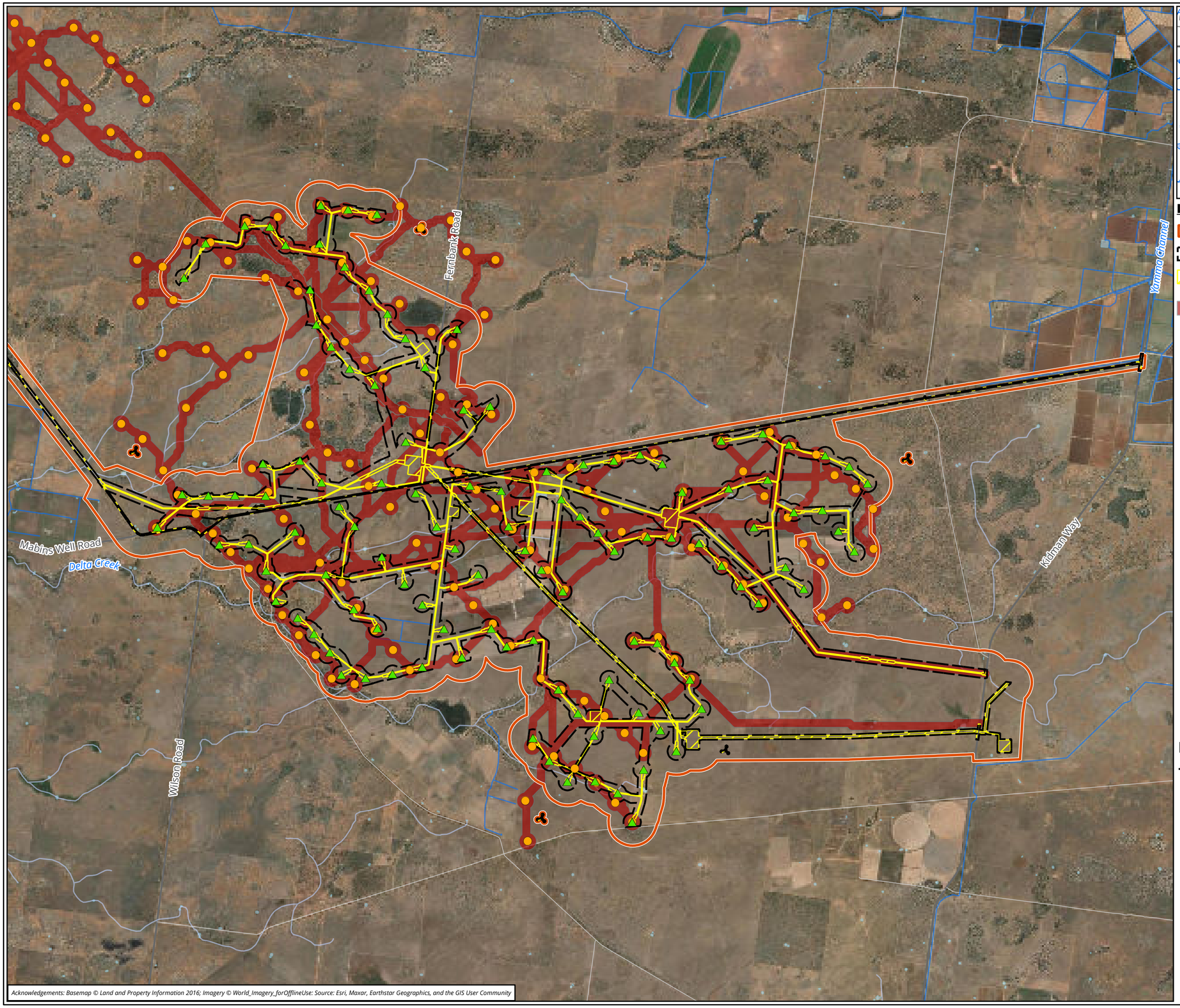
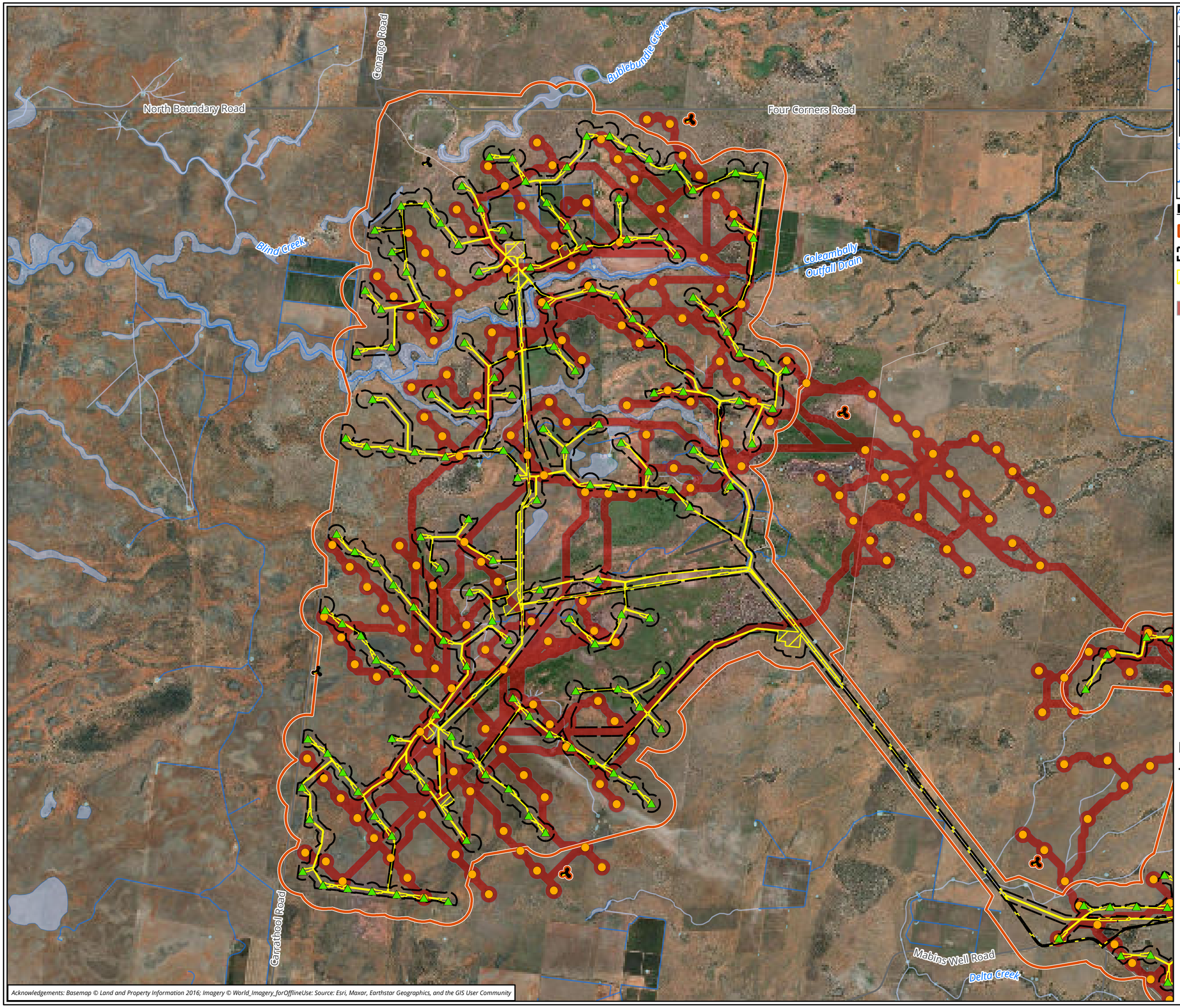
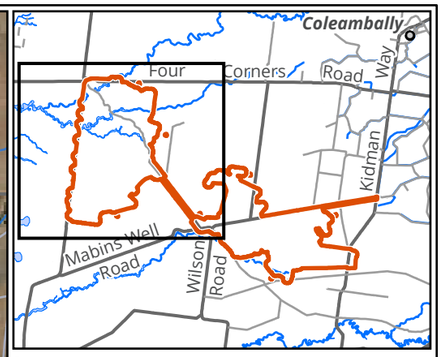


Figure 17 Alternative options - Stage 1





Legend

- Subject land
- Development corridor
- Development footprint
- Development footprint alternative option
- Wind turbine
- Wind turbine alternative option

Figure 17 Alternative options - Stage 2

0 1 2 3

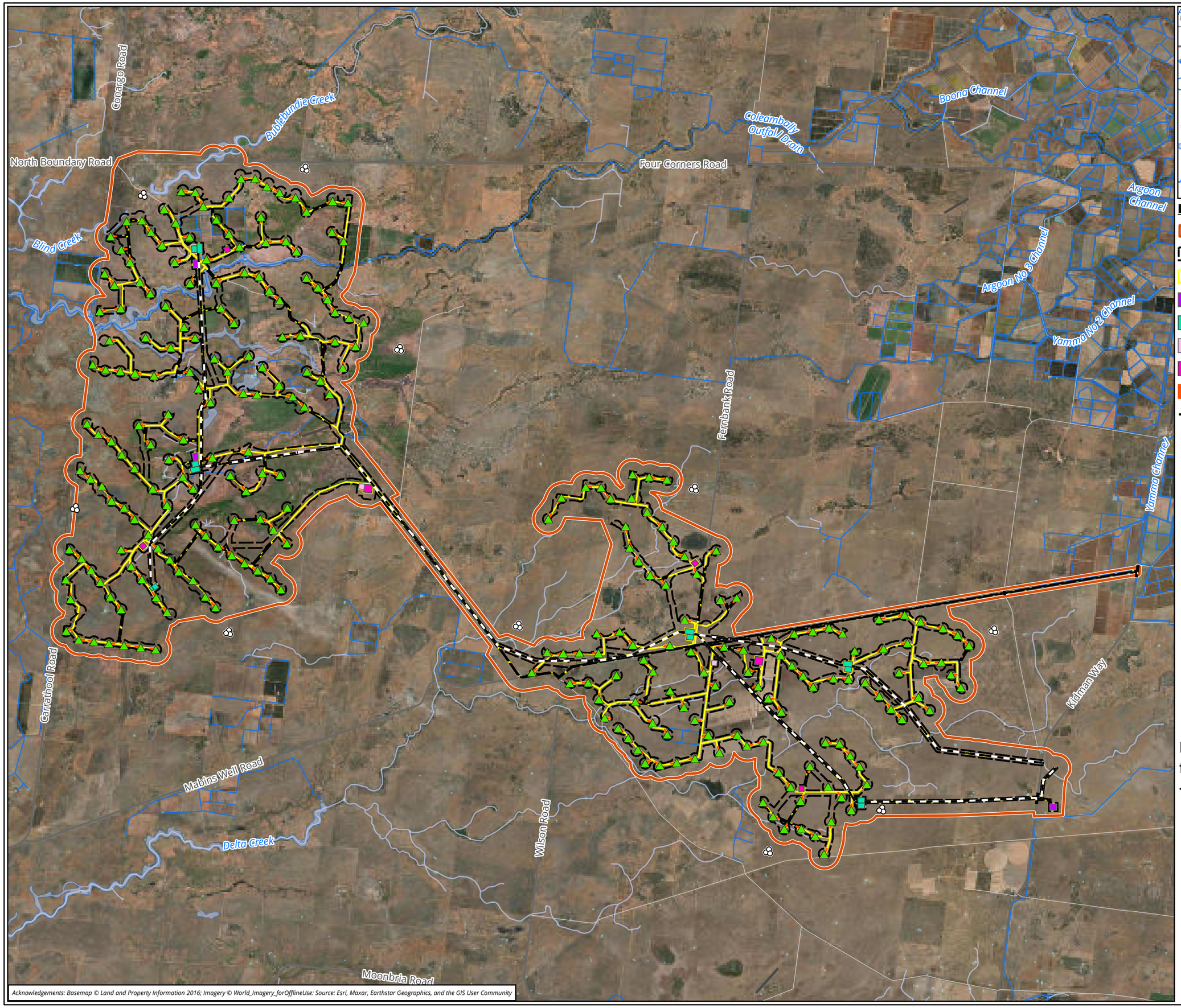
Kilometers
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Coordinate System:
GDA2020 MGA Zone 55

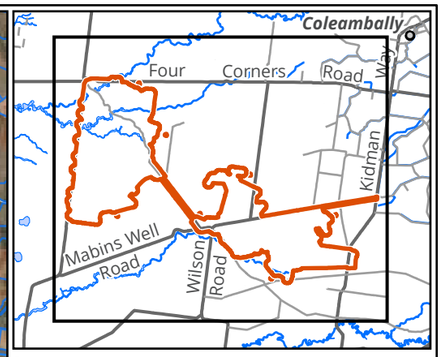
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37263_Dinawan_BDAR_Wind_F11-16.aprx
Layout: 37263_Wind_F16_AltOptions

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Legend

- Subject land
- Development corridor
- Development footprint
- Accommodation camp
- Collector substation
- O&M Facility
- Construction compound
- Wind turbine generator
- Transmission line
- Permanent mast
- Wind turbine

Figure 18 Development footprint and corridor - Overview

0 1 2 3 4 5

Kilometers
Scale: 1:130,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
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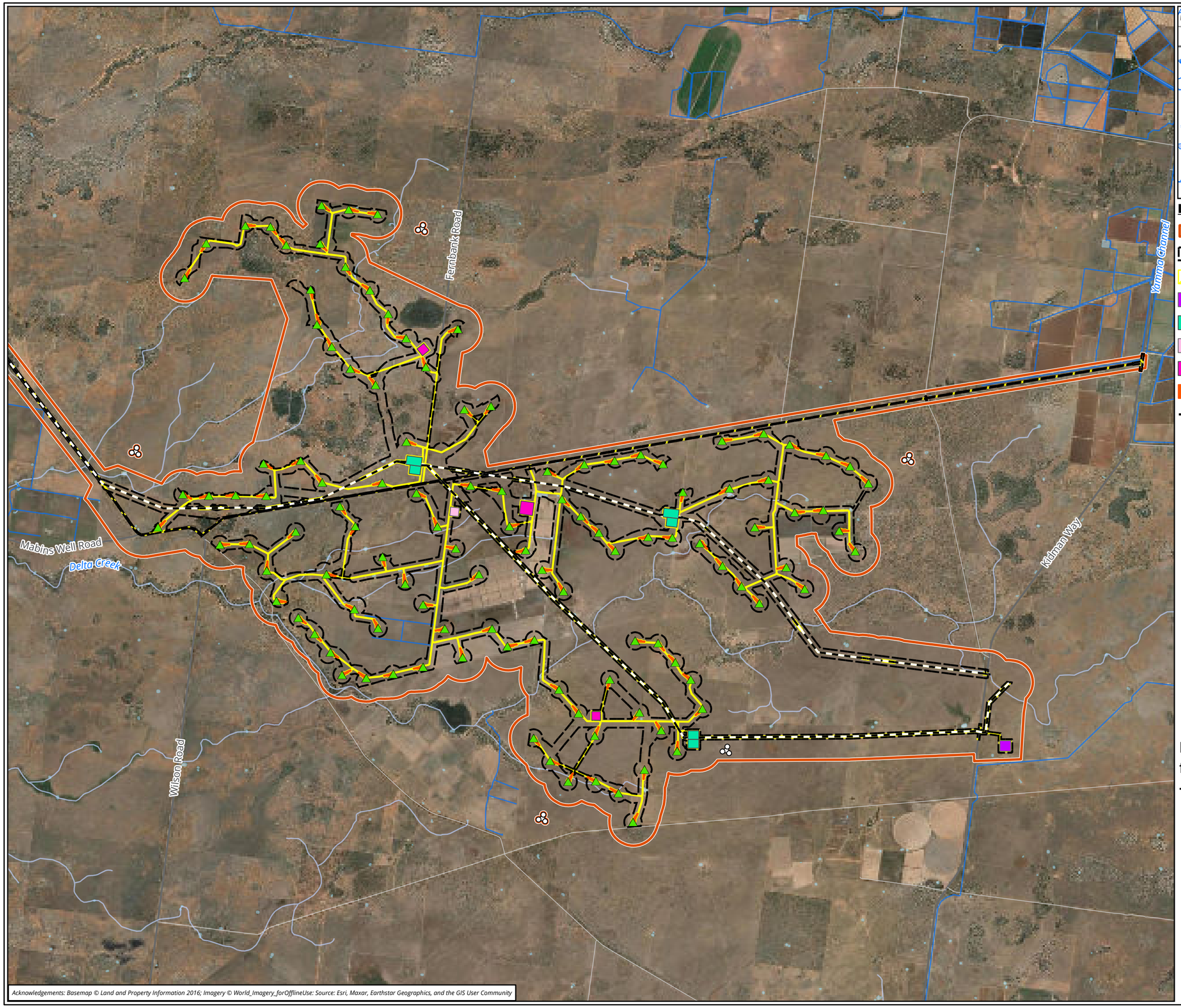


Figure 18 Development footprint and corridor - Stage 1

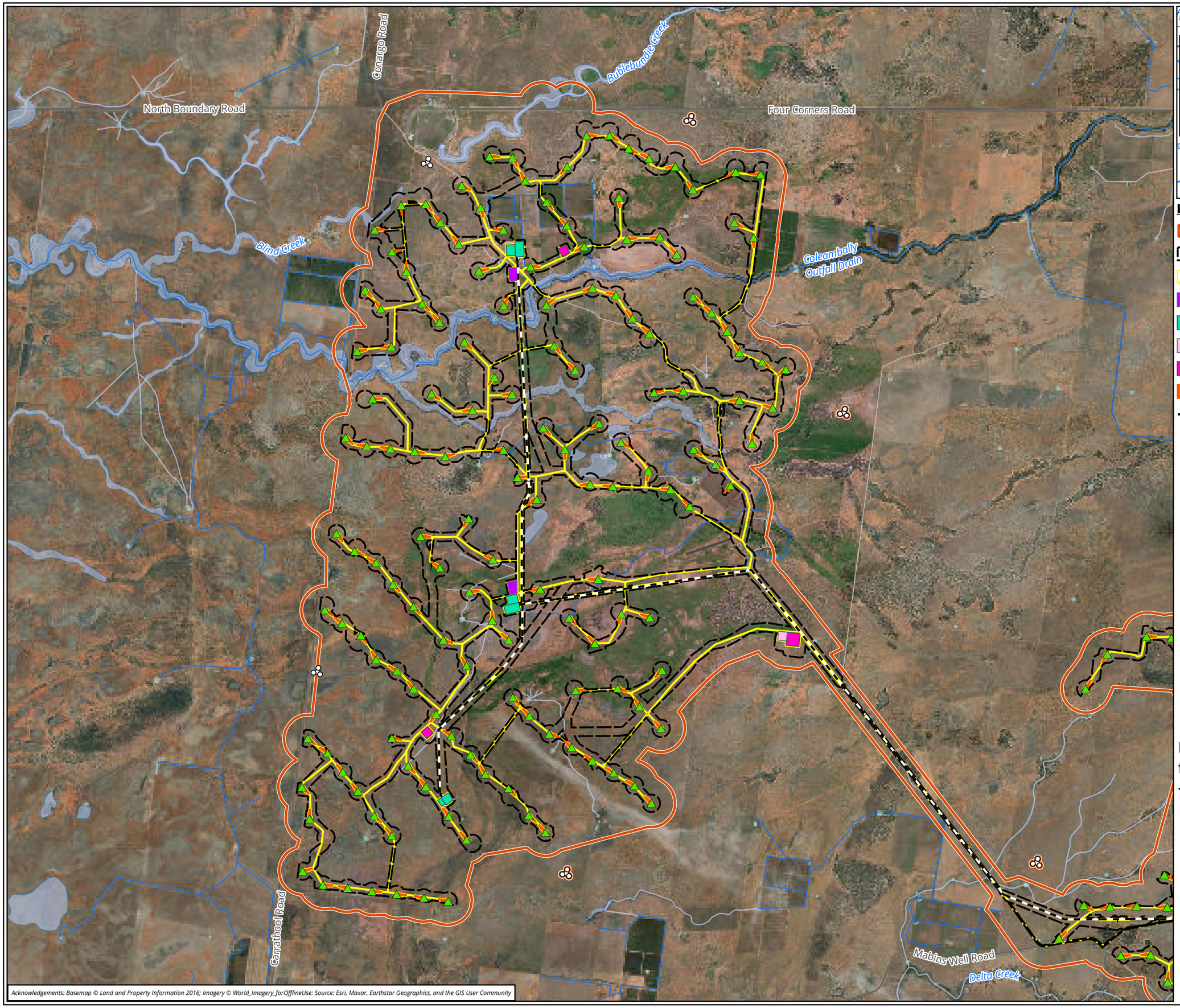
0 1 2 3

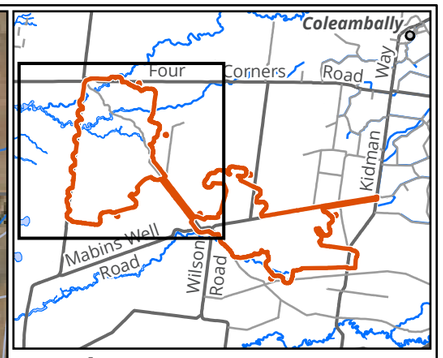
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Scale: 1:80,000 @ A3
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GDA2020 MGA Zone 55

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GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F18_DFDC





Legend

- Subject land
- Development corridor
- Development footprint
- Accommodation camp
- Collector substation
- O&M Facility
- Construction compound
- Wind turbine generator
- Transmission line
- Permanent mast
- Wind turbine

Figure 18 Development footprint and corridor - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
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Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F18_DFDC

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8. Assessment of impacts unable to be avoided

Assessment of direct and indirect impacts unable to be avoided has been undertaken in accordance with the BAM (DPIE 2020a). The following direct and indirect impacts are unable to be avoided in progressing the project.

8.1. Direct impacts

Direct impacts include vegetation clearing calculated from within the development footprint including WTG hardstands, electrical cabling, access roads, public road upgrades, APZs, and other infrastructure such as construction compounds.

A breakdown of direct impacts arising from the project include:

- Impacts to up to 0.33 ha of PCT 10 River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion
- Impacts to up to 13.97 ha of PCT 13 Black Box – Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion).
- Impacts to up to 7.8 ha of PCT 15 Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion).
- Impacts to up to 2.93 ha of PCT 17 Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion).
- Impacts to up to 0.23 ha of PCT 24 Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains
- Impacts to up to 945.67 ha of PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, comprising the following:
    - 395.93 ha to PCT 26 DNG (41%).
    - 416.60 ha to PCT 26 sparse (44%).
    - 133.14 ha to PCT 26 intact (14%).
- Impacts to up to 54.98 ha of PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone.
- Impacts to up to 8.83 ha of PCT 45 Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion.
- Impacts to up to 105.59 ha of PCT 46 Curly Windmill Grass – speargrass – wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion.
- Impacts to up to 4.91 ha of PCT 160 Nitre Goosefoot shrubland wetland on clays of the inland floodplains.

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- Impacts to up to:
    - 549.75 ha of Weeping Myall TEC listed under the BC Act (i.e. areas mapped as PCT 26 Sparse and Intact) and 150.46 ha (133.14 ha of Intact and 17.31 ha of Sparse) of Weeping Myall woodland listed under the EPBC Act.
        - Stage 1 - 301.64 ha Weeping Myall TEC listed under the BC Act and 77.41ha listed under the EPBC Act.
        - Stage 2 – 248.11 ha Weeping Myall TEC listed under the BC Act and 73.05 ha listed under the EPBC Act.
    - 114.42 ha of grasslands considered to align with the Natural Grasslands of the Murray Valley TEC listed under the EPBC Act (ie areas mapped as PCT 45 and PCT 46).
        - Stage 1 – 15.18 ha listed under the EPBC Act.
        - Stage 2 – 99.24 ha listed under the EPBC Act.
    - 54.98 ha of Sandhill Pine woodland TEC listed under the BC Act.
        - Stage 1 – 0.50 ha listed under the BC Act.
        - Stage 2 – 54.49 ha listed under the BC Act.
    - Impacts to 2.7 ha of confirmed *Swainsona murrayana* and *Swainsona sericea* habitat as well as 8.79 ha of assumed habitat.
    - Impacts to 4.02 ha of important mapped areas for Plains Wanderer, including
        - Stage 1 – 0.30 ha of important mapped habitat.
        - Stage 2 – 3.72 ha of important mapped habitat. Note this includes 0.99 ha of important mapped habitat that occurs across the existing public road (Goolgumbla Road).
    - Impacts to 95.1 ha of habitat and associated buffers considered suitable for Southern Bell Frog.
    - Impacts to 40.01 ha of habitat and associated buffers considered suitable for Superb Parrot.
    - Assumed impacts to 28.31 ha of habitat considered suitable for Masked Owl and Barking Owl.
    - Assumed impacts to potential habitat where representative and adequate survey is yet to be undertaken for
        - Austral Pilwort.
        - Austrostipa wakoolica.
        - Mossgiel Daisy.
        - Convolvulus tedmoorei.
        - Yellow Gum.
        - Winged Peppercress.
        - Lanky Buttons.

A summary and assessment of the above impacts are provided in Table 75 and Table 76, as well as Table 77 and Table 78, with many of these impacts considered permanent, relating to the development footprint, and

will occur over the course of the construction phase of the project. Mitigation measures outlined in Section 9 will help to minimise the potential impacts to biodiversity values that remain present within the subject land.

To mitigate impacts to native vegetation as a result of temporary impacts, site rehabilitation and ecological restoration works will be completed in areas such as temporary construction laydown areas and trenching for underground cabling. A Biodiversity Management Plan (BMP) will also look at opportunities for revegetation and restoration plans to buffer areas of important habitat, such as the adjacent retained areas and to provide for biodiversity corridors through the subject land and ensure improve and maintain principles are delivered to these areas.

8.1.1. Summary of direct impacts

A summary of direct impacts to native vegetation as a result of the project are provided in Table 75, impacts to species credit species are provided in Table 76, and impacts to scattered trees are provided in Table 77 below.

Table 75 Summary of direct impacts to vegetation for the entire development footprint

Zone	PCT	TEC	Area impacted (ha)	VI Score
PCT 10_moderate	River Red Gum - Black Box woodland wetland	No	0.33	29.2
PCT 13_moderate	Black Box - Lignum woodland	No	4.83	63.9
PCT 13_thinned		No	9.14	72.4
PCT 15_moderate	Black Box open woodland wetland	No	6.20	71.5
PCT 15_thinned		No	1.61	63.3
PCT 17_mod_good	Lignum shrubland wetland	No	1.84	70.8
PCT 17_moderate		No	1.09	42.1
PCT 24_moderate	Canegrass swamp tall grassland wetland	No	0.23	29.0
PCT 26_DNG	Weeping Myall open woodland	No	395.93	19.6
PCT 26_intact		Yes – Weeping Myall Woodlands	133.14	64.2
PCT 26_sparse			416.60	39.5
PCT 28_low	White Cypress Pine open woodland	Yes - Sandhill Pine Woodland	54.0	42.6
PCT 28_moderate			0.98	76.4
PCT 45_mod_good	Plains Grass grassland	Yes – Natural Grasslands (EPBC ACT ONLY)	8.83	92.1
PCT 46_moderate	Curly Windmill Grass - speargrass - wallaby grass grassland		105.59	84.3
PCT 160_mod_good	Nitre Goosefoot shrubland wetland	No	4.07	81.8
PCT 160_moderate		No	0.84	39.5

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Table 76 Summary of direct impacts species credit habitat or individuals

Species	Biodiversity Risk Weighting	Area impacts (ha)
Austrostipa wakoolica	2	0.98 (assumed)
Brachyscome papillosa **Mossgiel Daisy**	2	10.93 (assumed)
Convolvulus tedmoorei	3	3.13 (assumed)
Eucalyptus leucoxylon subsp. Pruinosa **Yellow Gum**	2	4 individuals (assumed)
Lepidium monoplocoides **Winged Peppercress**	2	10.93 (assumed)
Leptorhynchos orientalis **Lanky Buttons**	2	0.23 (assumed)
Litoria raniformis **Southern Bell Frog**	2	95.1
Ninox connivens **Barking Owl**	2	28.31 (assumed)
Pedionomus torquatus **Plains-wanderer**	3	4.02 of important mapped area
Pilularia novae-hollandiae **Austral Pillwort**	3	8.78 (assumed)
Polytelis swainsonii **Superb Parrot**	2	40.01 (assumed)
Swainsona murrayana **Slender Darling Pea**	2	2.7 (confirmed) 8.79 (assumed)
Swainsona sericea **Silky Swainson-pea**	2	2.7 (confirmed) 8.79 (assumed)
Tyto novaehollandiae **Masked Owl**	2	28.31 (assumed)

Table 77 Summary of direct impacts to scattered trees

Scattered tree class	No. trees impacted
1	0
2	23
3	6
Associated TEC impacts*	
Trees conforming to Weeping Myall Woodland	19
Trees conforming to Sandhill Pine Shrubland	3

***Trees noted as TECs are included in those listed above, 29 scattered trees are impacted in total**

Direct impacts per stage is shown in Table 78.

Table 78 Summary of direct impacts per stage

Veg Zone or Species	Total footprint	Stage 1 (east)	Stage 2 (west)
Vegetation zones			
PCT 10_moderate	0.33	-	0.33
PCT 13_moderate	4.83	-	4.83
PCT 13_thinned	9.14	3.36	5.78
PCT 15_moderate	6.20	0.35	5.85
PCT 15_thinned	1.61	-	1.61
PCT 17_mod_good	1.84	1.71	0.14
PCT 17_moderate	1.09	0.03	1.05
PCT 24_moderate	0.23	0.23	-
PCT 26_DNG	395.93	170.65	225.28
PCT 26_intact	133.14	70.84	62.31
PCT 26_sparse	416.60	230.80	185.81
PCT 28_low	54.00	0.50	53.50
PCT 28_moderate	0.98	-	0.98
PCT 45_mod_good	8.83	4.00	4.83
PCT 46_moderate	105.59	11.18	94.42
PCT 160_mod_good	4.07	-	4.07
PCT 160_moderate	0.84	-	0.84
Species			
Austrostipa wakoolica	0.98 (assumed)	-	0.98 (assumed)
Brachyscome papillosa	10.93 (assumed)	3.63 (assumed)	7.30 (assumed)
Convolvulus tedmoorei	3.13 (assumed)	1.96 (assumed)	1.17 (assumed)
Eucalyptus leucoxylon subsp. Pruinosa	4 individuals (assumed)	1 individual	3 individuals
Lepidium monoplocoides	10.93 (assumed)	3.63 (assumed)	7.30 (assumed)
Leptorhynchos orientalis	0.23 (assumed)	0.23 (assumed)	-
Pilularia novae-hollandiae	8.78 (assumed)	0.35 (assumed)	8.44 (assumed)
Swainsona sericea	2.7 (confirmed), 8.79 (assumed)	0.35 (assumed)	2.7 (confirmed), 8.44 (assumed)
Swainsona murrayana	2.7 (confirmed), 8.79 (assumed)	0.35 (assumed)	2.7 (confirmed), 8.44 (assumed)
Southern Bell Frog	95.06	38.22	56.84
Barking Owl	28.31 (assumed)	4.25 (assumed)	24.67 (assumed)
Plains-wanderer	4.02 of important mapped area	0.3 of important mapped area	3.72 of important mapped area

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Veg Zone or Species	Total footprint	Stage 1 (east)	Stage 2 (west)
Superb Parrot	40.01	6.48	33.57
Masked Owl	28.31 (assumed)	4.25 (assumed)	24.67 (assumed)

8.1.2. Loss of hollow bearing trees

Many patches of woody vegetation dominated by Black Box, with occasional River Red Gum and White Cypress Pine communities, within the development corridor contain a significant number of hollows. The project will result in the loss of 15 hollow-bearing trees, out of the 67 recorded within the development corridor that contain small, medium and large hollows, or a combination of all three. This represents a 72% retention of woody vegetation with medium or greater sized hollows. A summary of the hollow bearing trees to be removed is provided in Table 79.

Table 79 Hollow bearing trees unable to be avoided

Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
1	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
2	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
4	*Eucalyptus largiflorens*	Large Tree 50-100cm	No	Yes	No	Removed
12	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
17	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	Yes	Removed
23	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
29	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed
32	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	No	Yes	Removed
36	*Eucalyptus largiflorens*	Very Large Tree > 100cm	Yes	Yes	No	Removed
58	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed
59	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	Yes	Removed
62	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed
64	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	No	Yes	Removed
65	*Eucalyptus largiflorens*	Medium Tree 20-50cm	Yes	Yes	Yes	Removed

Tree number	Species	Diameter at breast height (Dbh) class	Small	Medium	Large	Proposed impact
67	*Eucalyptus largiflorens*	Large Tree 50-100cm	Yes	Yes	No	Removed

8.2. Indirect impacts

This section details potential indirect impacts associated with the construction and operation of the project following the implementation of proposed avoidance and minimisation measures. Indirect impacts are considered to potentially occur in areas outside the development footprint, but within the development corridor. In accordance with the BAM, a proponent can retire credits to offset indirect impacts that cannot be avoided or adequately minimised. All indirect impacts can be adequately mitigated within a BMP via active management and improve and maintain principles. Potential indirect impacts arising from the project are outlined and addressed in Table 80.

Table 80 Assessment of indirect impacts

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
Inadvertent impacts on adjacent habitat or vegetation	All PCT/zones All ecosystem credit species assumed present Weeping Myall TEC (BC Act and EPBC Act listings) Natural grasslands TEC (EPBC Act listing) Sandhill Pine Woodland TEC (BC Act listing) *Swainsona murrayana* *Swainsona sericea* Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot forging habitat	Within the retained vegetation surrounding the final development footprint within an approximate 30 m – 50 m buffer.	Ongoing in a staged manner for the life of the project (up to 35 years).	Long-term	Construction, operation and Decommissioning	Low. Impacts to adjacent vegetation during construction and operational phase can be prevented or minimised through appropriate exclusion fencing of sensitive areas, implementation of a detailed Biodiversity Management Plan (BMP). A Construction Environmental Management Plan (CEMP) or similar detailing best practice environmental protection measures, strict water quality practices and stormwater controls, and by ensuring any lighting is directed towards the developed area, rather than towards adjacent retained habitat will be implemented.
Reduced viability of adjacent habitat due to edge effects	All PCT/zones All ecosystem credit species assumed present Weeping Myall TEC (BC Act and EPBC Act listings)	Within the retained vegetation surrounding the final development footprint within an approximate	Ongoing in a staged manner for the life of the project (up to 35 years).	Long-term	Construction and operation	Low. Adjacent habitats are currently subject to disturbance via clearing and existing agricultural land use. Improve and maintain principles will apply within the BMP to ensure retained areas of adjacent habitat do not decline or are subjected to adverse impacts.

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
	Natural grasslands TEC (EPBC Act listing) Sandhill Pine Woodland TEC (BC Act listing) *Swainsona murrayana* *Swainsona sericea* Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot forging habitat	30 m – 50 m buffer.				
Reduced viability of adjacent habitat due to noise, dust or light spill	All PCT/zones All ecosystem credit species assumed present Weeping Myall TEC (BC Act and EPBC Act listings) Natural grasslands TEC (EPBC Act listing) Sandhill Pine Woodland TEC (BC Act listing) *Swainsona murrayana* *Swainsona sericea*	Within the retained vegetation surrounding the final development footprint.	Temporary – Construction	Short-term	Predominantly construction	Negligible. It is predicted that the adjacent habitat may be impacted in a small way by noise, dust, compaction and light spill, during construction and operation. It is expected that the majority of noise and dust impacts will occur during the construction phase, with a reduction to near-normal levels following completion of construction. However, this will be managed via best practices outlined in a BMP and CEMP or similar. Improve and maintain principles will apply within the BMP to ensure retained areas of adjacent habitat do not decline or are subjected to adverse impacts.

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Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
	Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot forging habitat					
Transport of weeds and pathogens from within the development footprint to adjacent vegetation	All PCT/zones All ecosystem credit species assumed present Weeping Myall TEC (BC Act and EPBC Act listings) Natural grasslands TEC (EPBC Act listing) Sandhill Pine Woodland TEC (BC Act listing) *Swainsona murrayana* *Swainsona sericea* Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot forging habitat	Within the retained vegetation surrounding the final development footprint within an approximate 30 m – 50 m buffer.	Ongoing in a staged manner for the life of the project (up to 35 years).	Long-term	Construction, operation and rehabilitation	Low. Weeds occurring within the development corridor are consistent with those occurring within adjacent vegetation to be retained. Increased transport of pathogens and weeds is unlikely to occur but will be managed by biosecurity measures outlined in the CEMP or similar. During both the construction and the operational phases of the project, regular monitoring and management (weed control) will occur within retained areas adjacent to the development footprint.
Increased risk of starvation, exposure and loss of shade or shelter	Plains Wanderer important mapped areas Southern Bell Frog	Loss of 15 Hollow bearing trees	Ongoing for the life of the project	Temporary, Possibly long-term	Construction and operation	Low. Improve and maintain principles will apply within the BMP to ensure retained areas of adjacent habitat do not decline or are subjected to adverse impacts. While the removal of sheltering vegetation within the

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
	All ecosystem credit species assumed present	Impacts to 4.02 ha of important mapped areas of Plains Wanderer habitat Loss of intact vegetation	(up to 35 years).			development footprint is linear in nature, and a small proportion of the commensurate habitat available within the subject land and broader study area, the removal of potential roost/sheltering sites is a more adverse impact, but not one that is likely to result in mortality of individuals, however, may result in an increase of competition for remaining habitat features. The level of change is minimal in the context of the subject land and broader locality and the ecosystem is unlikely to be at carrying capacity such that displaced fauna cannot continue to persist in adjacent retained areas.
Loss of breeding habitats	Hollow dependent fauna Southern Bell Frog All ecosystem credit species assumed present At risk bird avian fauna and microbats	Within the retained vegetation surrounding the final development footprint within an approximate 30 m – 50 m buffer. Estimated zone of disturbance behind turbine blade, approximately 50m	One-off	Long-term	Construction and operation	Low. 15 hollow-bearing trees will be removed by the project. Indirect impacts associated with the loss of breeding habitats are not considered likely to be substantial or significant to any locally occurring threatened, or non-threatened, species. Breeding habitats supported by hollow-bearing trees and nest trees have the potential to be indirectly impacted during construction of the project via noise, dust, vibration, lights etc, and during operation by the noise, movement and potential changes to air pressure surrounding operational turbines. Where nests occur adjacent to the development footprint of the wind farm indirect impacts may occur. Impacts will be managed and mitigated through monitoring and adaptive management via the BBAMP, BMP and operational/construction restrictions may occur if breeding is confirmed.

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
Trampling of threatened flora species	*Swainsona murrayana* *Swainsona sericea* Species assumed present	Areas of known and potential habitat within retained vegetation.	Ongoing for the life of the project (up to 35 years).	Temporary	Construction and operation	Low. Majority of individuals recorded within the subject land have been avoided. Species that occur within retained vegetation will be protected, improved and maintained. Principals will apply within the BMP to ensure retained areas of adjacent habitat and individuals do not decline or are subjected to adverse impacts. Grazing within and adjacent to known records of threatened flora species will be managed wherever possible to ensure potential trampling from livestock is minimised.
Inhibition of nitrogen fixation and increased soil salinity	N/A	N/A	N/A	N/A	N/A	Negligible. Not expected to result from the project. May be associated with ongoing treatment of nearby agricultural land unrelated to the project. Any future excavations or soil disturbance resulting from the project within the development corridor would be largely restricted to areas having undergone significant previous disturbance through cattle grazing and vehicular traffic. As such it is not considered likely that the future development of the subject land would result in substantial changes to the level of nitrogen fixation or soil salinity in the locality.
Fertiliser drift	N/A	N/A	N/A	N/A	N/A	Negligible. The subject land has a long history of grazing over its total extent. Grazing is still active in all areas. Exotic species dominance and presence is common. No fertiliser is proposed to be used.
Rubbish dumping	N/A	N/A	N/A	N/A	N/A	Negligible. Standard environmental controls for the project will ensure potential impacts are minimised. Works will follow an approved

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
						CEMP or similar and specific waste and water management requirements.
Wood collection	N/A	N/A	N/A	N/A	N/A	Negligible. Not expected to result from the project. Future development proposed within the subject land is unlikely to increase access to any retained vegetation, beyond current access capacity. Based on the future use of the subject land, future landholders are not expected to be likely to undertake wood collection beyond existing rural approvals within the retained vegetation to a level that it will have a detrimental effect. Unauthorised access and collection of wood is expected to be negligible.
Removal and disturbance of rocks, including bush rock	N/A	N/A	N/A	N/A	N/A	Negligible. The development corridor does not support bush rock.
Increase in predators and pest animal populations	Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot All ecosystem credit species assumed present	Areas of known and potential habitat within retained vegetation.	Ongoing for the life of the project (up to 35 years).	Long-term	Construction and operation	Moderate. Foxes *Vulpes vulpes* are noted and have been observed regularly during this assessment, however this is a common occurrence in this rural area. The project is not expected to increase numbers with required mitigation, however movement through the subject land may be considered to be exacerbated with construction and improved access roads through the subject land. European Rabbit *Oryctolagus cuniculus* is also known to occur within the soft sandhills. The BMP and BBAMP will detail pest management regimes in order to control foxes and other pests within the subject land during construction and operations.

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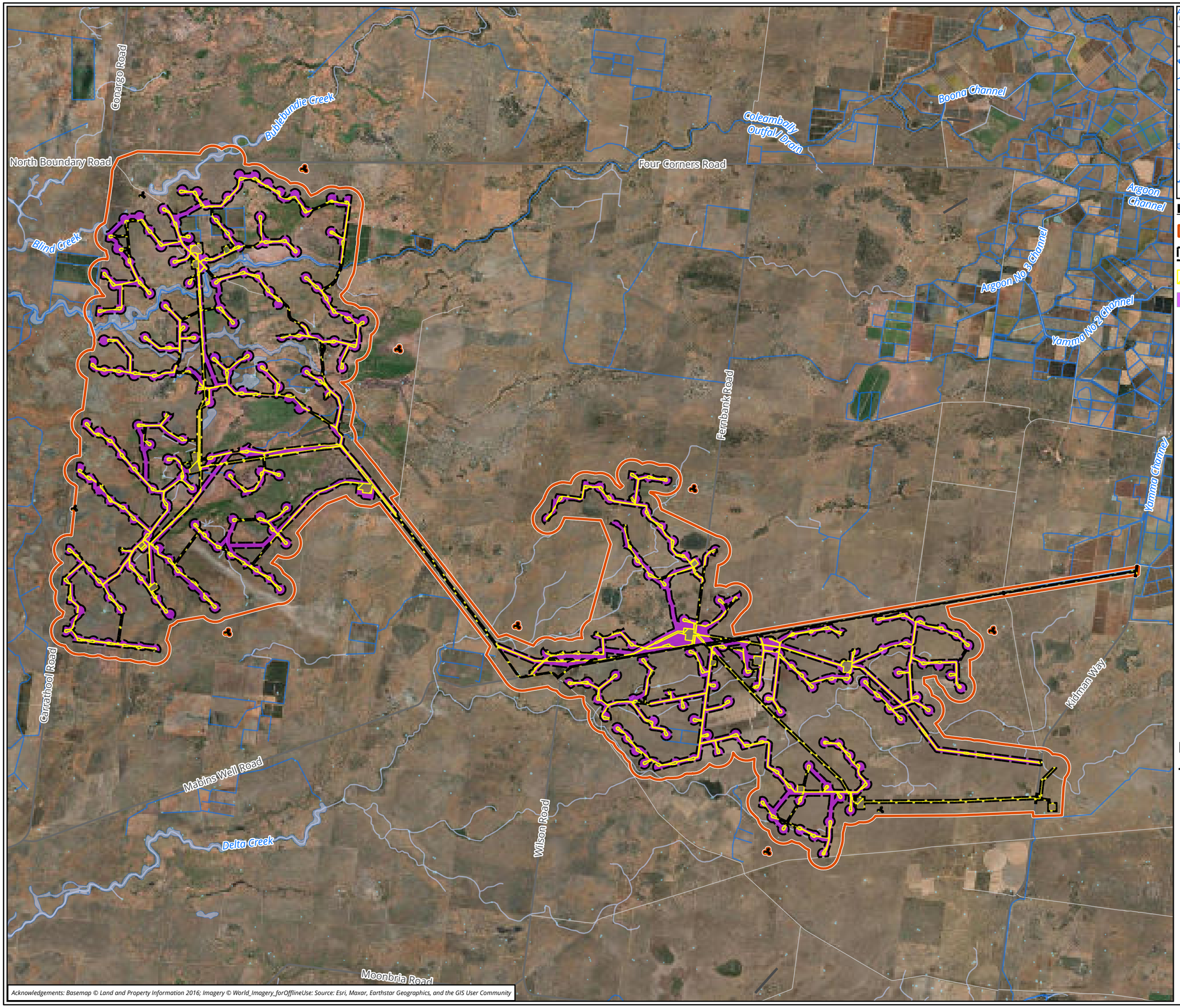
Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
Changed fire regimes	Unlikely to occur	N/A	N/A	N/A	N/A	Low. Appropriate asset protection zones and fire mitigation systems will be implemented for the project and the implementation of bushfire management and mitigation measures for the project will help to manage risk of fire within the subject land.
Disturbance to specialist breeding and foraging habitat, e.g. important mapped areas	Plains Wanderer important mapped areas All ecosystem credit species assumed present	Areas of known and potential habitat within retained vegetation. 11.8 ha of retained important mapped areas for plains wanderer in the development corridor 645 ha within the subject land	One-off	Long-term	Construction and operation	Moderate. Mapped Important Areas for Plains Wanderer occur within the development footprint, development corridor and subject land, and impacts have been limited to 4.02 ha of linear removal, and potential indirect impacts to a further 7.78 ha. Approximately 0.99 ha also occurs across an existing formed public road. Improve and maintain principles will apply within the BMP to ensure retained important mapped areas and adjacent potential habitat do not decline or are subjected to adverse impacts. See Section 10.2 and Appendix 5 for further assessment of these impacts in the associated SAII assessment.
Fragmentation of movement corridors	All PCT/zones All ecosystem credit species assumed present Weeping Myall TEC (BC Act and EPBC Act listings) Natural grasslands TEC (EPBC Act listing)	Areas of known and potential habitat within retained vegetation. Flyways and movement corridors	Ongoing for the life of the project (up to 35 years).	Long-term	Construction and operation	Low. Patches utilised for movement of ground dwelling fauna and canopy fliers have been maintained within the development corridor as far as practicable. However, the removal of vegetation associated with the project may impact upon movement corridors at the site scale and the landscape scale for at risk avian fauna and microbats due to meso and macro avoidance. Improve and maintain principles will apply within the BMP to ensure retained

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Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
	Sandhill Pine Woodland TEC (BC Act listing) *Swainsona murrayana* *Swainsona sericea* Plains Wanderer important mapped areas Southern Bell Frog Superb Parrot forging habitat At risk avian fauna Australasian bittern movement					adjacent habitat does not decline or is subjected to adverse impacts. Perimeter fencing will be limited to surrounding critical infrastructure for safety reasons (eg. Substations) and not through the entire development corridor. In some areas, this may disturb the movement of larger ground dwelling fauna such as Kangaroos and Emus, but overall, this effect is not likely to be substantially exacerbated beyond the existing rural impacts installed currently.
Impacts to Oolambeyan National Park and the South West Woodland Nature Reserve (Kulki Precinct)	Biodiversity values present in the conservation reserves. Populations of species that occur within the subject land and extend to the conservation reserves.	Within the subject land and local conservation reserves.	Ongoing for the life of the project (up to 35 years).	Long-term	Construction and operation.	Low. Oolambeyan National Park occurs 10 km to the north-west of the subject land, with South West Woodland Nature Reserve (Kulki) Precinct) occurring eight km north to northeast of the subject land. It is conceivable that highly mobile species utilise habitats within these conservation reserves as well as the subject land as part of their larger home ranges, and that habitat removal within the development footprint may reduce the total habitat available to these mobile species. The removal of habitat as a result of the project is not considered to be substantial enough to result in the constriction of habitat available to these mobile species, that would be substantial enough to increase

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
						the abundance of the species with the reserves to above their carrying capacity. Sufficient habitat supporting similar values will remain within the forage range of any such species to prevent the conservation reserves becoming unsustainable refuge islands. The distance between the development footprint and the conservation reserves is also great enough to prevent any impacts associated with construction and operation of the project, such as noise, light, dust, vibration, from impacting upon the reserves and the habitats and populations they support.
Collision (transmission line strike), electrocution, and exposure to electrical and magnetic fields due to installation of powerlines	Bird and bat species utilising the habitats within the subject land	Transmission line to be constructed within the disturbance corridor	Ongoing for the life of the project (up to 35 years).	Long-term	Construction and operation.	Low. The potential exists for threatened species of birds and bats to be impacted via direct collision (transmission line strike), electrocution, and exposure to electrical and magnetic fields as result of this aspect of the project. Small and large transmission lines currently exist in or adjacent to the development corridor. Birds and bats have high ability to avoid collisions with birds generally accepted as having between a 95 % to 98 % avoidance rate for the dynamic components of operational turbines, and a 99 % avoidance rate for the static components such as towers. It is acknowledged that transmission lines are likely to be less visible to birds and bats and therefore avoidance potential will not be as high as for large static turbine towers, however it can be assumed

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase/ timing of impact	Likelihood and consequences
						that the vast majority of the time a bird or bat flies in the vicinity of a powerline it will not result in a collision. Transmission line towers are often used for nesting in this landscape. Collisions are considered likely to be infrequent and will be mitigated by including measures such as those outlined in Section 9 below.



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Legend

- Subject land
- Development corridor
- Development footprint
- Indirect impacts

Figure 19 Indirect impacts - Overview

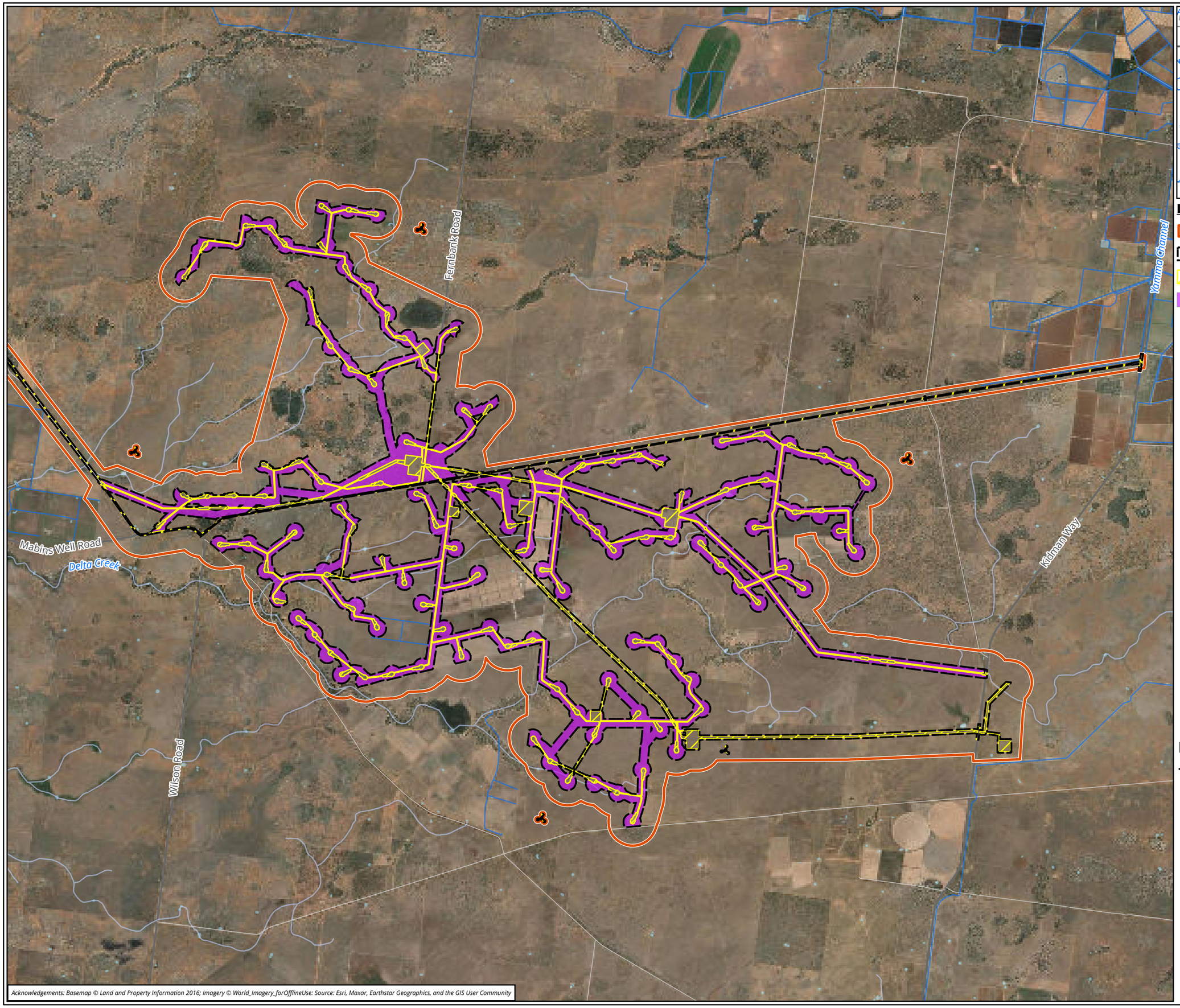
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Kilometers
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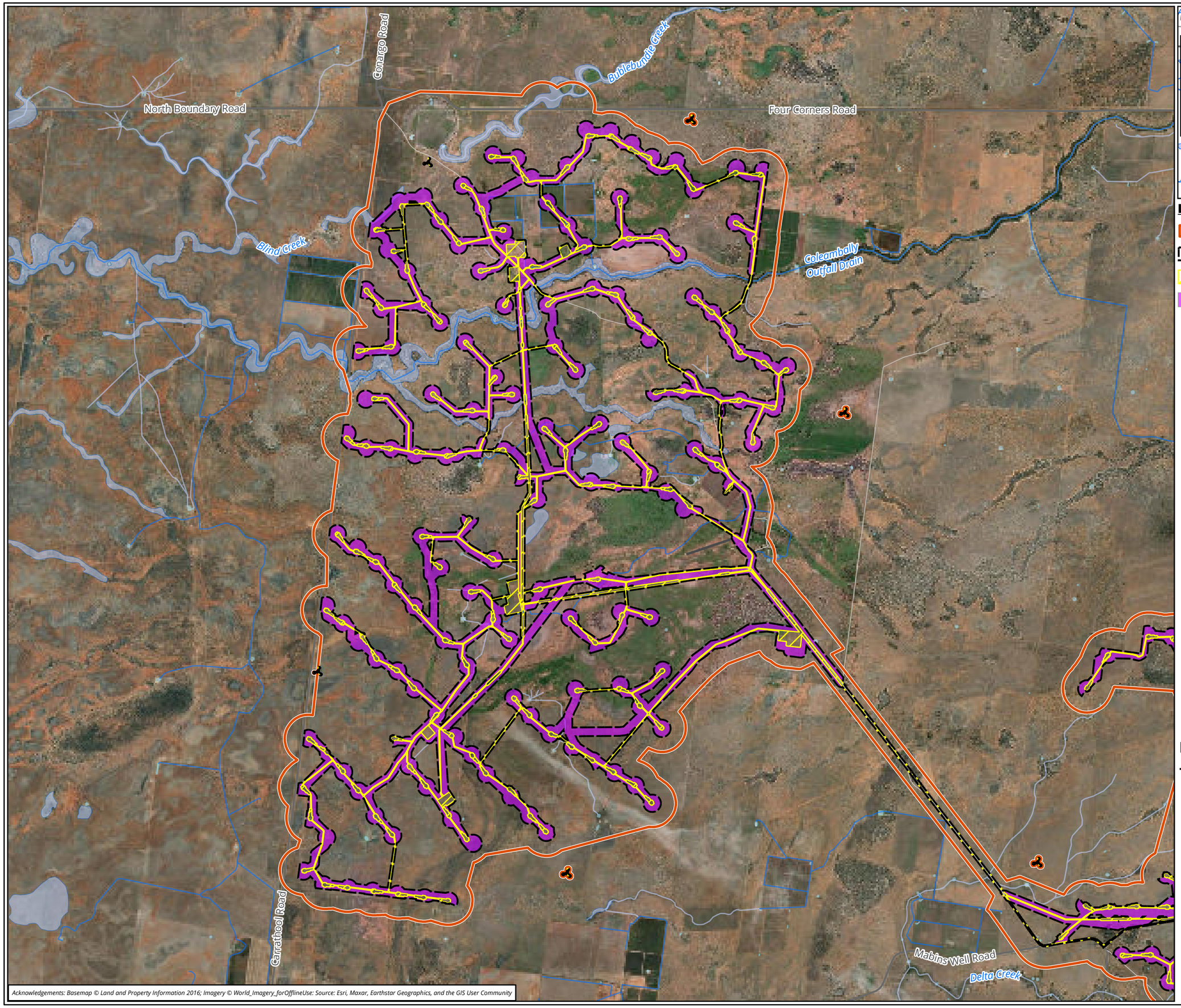
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GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F19_IndirectImpacts

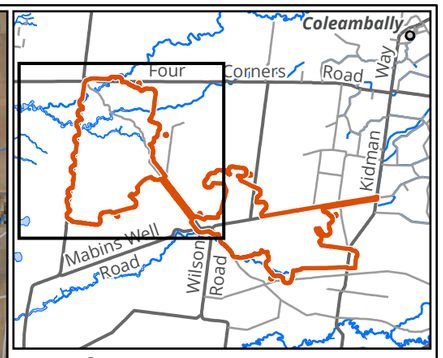


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Figure 19 Indirect impacts - Stage 1

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Legend

- Subject land
- Development corridor
- Development footprint
- Indirect impacts

Figure 19 Indirect impacts - Stage 2

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Kilometers
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Coordinate System:
GDA2020 MGA Zone 55

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Layout: 37263_Wind_F19_IndirectImpacts

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8.3. Prescribed impacts

Identification and assessment of prescribed biodiversity impacts are outlined in the section below, and shown in Figure 20.

8.3.1. Human-made structures and non-native vegetation

Nature and Extent

Approximately 10% of the development corridor occurs within areas supporting non-native vegetation such as irrigated and dryland cropping areas. Other agricultural practices and disturbance such as rural storage sheds, farm tracks, dams and irrigation channels occur within or adjacent to the development corridor. Existing small and large transmission lines and towers dissect the subject land and development corridor on occasion.

Duration

Roads, farm tracks and fences may be subject to modification and upgrade from the outset of the project. It is not anticipated that rural storage sheds or shearing sheds will be impacted. Existing transmission lines may be temporarily impacted during construction but reinstated should impacts occur. Upgrades to existing water crossings and culverts along the Coleambally Outfall Drain will be temporary in nature during construction, and provides a source of artificial habitat upon operation.

Consequences

Avian fauna species are known to utilise artificial, and human made structures such as transmission towers for nesting due to historic clearing of native vegetation. Numerous small and moderate sized nests were recorded on manmade structures within the subject land, but not within the development corridor. The consequence of the removal of these features is considered to be low.

Exotic vegetation, including cropped land is known to be utilised by fauna species, such as parrots, raptors, waterbirds and large mammals (e.g., Kangaroo) for foraging. Exotic vegetation, although utilised by some fauna species is considered to have a low biodiversity value. Impacts to non-native vegetation will not have more than a negligible impact to threatened and non-threatened species.

Dams and irrigation channels are utilised by fauna species, such as waterbirds and Southern Bell Frog, as permanent water resources throughout the year, some dams are created in areas that likely originally supported natural ephemeral billabongs. Where possible, features such as dams and irrigation channels are to be avoided during micro-siting of the project as they aid in supporting, mainly fauna, populations within the subject land. The consequence of removing dams and troughs, within the broader landscape is considered low, as other large water features will remain in the area. However, at a microscale, any fauna species present in dams such as Southern Bell Frog and other common amphibians, yabby or turtle species may be required to relocate to nearby areas of similar habitat. Any dams to be removed should be subject to mitigation measures, including draining several days prior to removal, and should have an appropriately qualified individual present to relocate any large fauna such as turtles.

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8.3.2. Habitat connectivity

Nature and extent

Loss of native vegetation and habitat has potential to affect landscape connectivity permanently or temporarily during construction and operation. Habitat connectivity primarily through ephemeral riparian areas, pine sandhills and intact native vegetation occurs throughout the subject land and development corridor. The vast majority of fauna species move through these areas, with exception to more disturbance tolerant species, such as Australian Raven, Galahs as well as Raptor species, which utilise and move throughout more open areas as well.

Within the broader landscape, watercourses such as Coleambally Outfall drain, Delta Creek, Blind Creek and Bublebundie Creeks, as well as smaller unnamed watercourses form part of a large network of ephemeral and non-ephemeral creeks and waterbodies.

Vegetated roadsides also provide critical movement corridors for majority of fauna species.

Duration

Impacts are considered long-term as they will occur over the 30-year life of the project and subject to stringent mitigation measures.

Consequences

Habitat connectivity is critical for maintaining healthy populations, as it promotes biological diversity through the exchange of genes. Due to linear nature of the impacts generally, areas of more abundant and mature woody vegetation, as well as lower lying ephemeral grasslands and drainage lines, have been prioritised for avoidance, with retained areas subject to improvement within criteria set out in a BMP. Retained woody areas within the subject land, create stepping stones for mobile fauna to actively move through the subject land, as well as promoting movement of genetic floristic material into adjacent areas of habitat such as riparian areas, retained grassland areas and roadside vegetation. This would continue to allow for the uninterrupted movement of the majority fauna species to be possible during construction and operation of the project. Perimeter or non-rural exclusion fencing of areas within the development corridor if installed may cause disruption to large ground dwelling fauna such as Kangaroos and Emus. This will primarily be around critical infrastructure only. Overall, this effect is not likely to be substantially exacerbated beyond the existing rural impacts installed currently.

Roadside vegetation corridors contain intact remnant vegetation, predominately Weeping Myall and occasional Black Box patches, that act as a conduit to larger intact patches throughout the broader landscape.

While the project would diminish local scale connectivity, this is unlikely to prevent genetic exchange of the threatened entities known, or assumed to be, inhabiting the subject land and broader assessment area.

Impacts associated with barrier effects and collision risk as discussed in Section 8.3.4.

8.3.3. Water bodies, water quality and hydrological processes

Nature and Extent

The development corridor is largely within a flat uniform landscape on poorly drained red clay soils with minor ephemeral drainage lines or slightly lower lying grey clay depressions which are seasonally and infrequently inundated. Current water quality and hydrological process (how water flows and is distributed across the subject land) contribute to the sustenance and resilience of the vegetation present, and in turn, the flora and fauna species that rely on said vegetation. Watercourse crossings and instream works, where required, will be designed, and constructed to minimise potential impacts to watercourses and water quality. No material impacts to river flow objectives are anticipated as the quantity and timing of runoff leaving the project is expected to be similar to that which currently occurs.

The project will require excavation below existing surface levels to establish suitable foundation conditions for infrastructure, and for the installation of underground services, with primary risk to groundwater quality during construction and operations as a result of accidental spillage of wastewater, fuel or other hazardous materials used to support site activities that may infiltrate through soils to groundwater. Appropriate controls to effectively manage these activities, consistent with best practice and relevant guidelines, will be incorporated CEMP.

Duration

The extent of this impact is considered to be minor. No significant direct impacts are considered to occur to major water ways in the region, change hydrological flow, or contribute to the degradation of waterways within the subject land or broadly.

Consequences

If unmanaged, ground disturbance during earthworks and other site activities (e.g. material handling, installation of WTGs, new buildings, new substations, trenching for services and grading for new access roads) may lead to exposure of soils and potential erosion and mobilisation of sediment into receiving watercourses.

The development corridor generally lies outside the 1% AEP flood extent following consideration of flooding constraints during preliminary design (EMM, 2024). A number of services and access corridors cross predicted flooding flow paths; however, flooding at these interactions is typically shallow and low hazard. On this basis, there is low potential for adverse flooding impacts either within or downstream of the development corridor for events up to 1% AEP. The development corridor is likely to have interactions with approximately 29 watercourses. The number of required watercourse crossings has been minimised through the utilisation of the existing access roads and tracks of the existing agricultural operations. Where instream works are proposed (i.e. construction or upgrade of watercourse crossings), these works will be designed and constructed to consider local hydraulic conditions, minimise local flooding impacts, and will be consistent with relevant guidelines.

Contamination of surface water as a result of accidental spillage of materials such as fuel, lubricants, herbicides and other chemicals used to support construction activities could also adversely impact water quality. In the event of flooding that impacts, construction work sites or compounds, either as a result of mainstream flooding along watercourses or local overland flooding, there is potential for entrainment of sediment, vegetation, plant/equipment, hazardous substances/chemicals and other debris in floodwaters that is carried downstream. This risk can be adequately managed by suitable construction site planning that considers flood risk, avoids use of higher risk areas (i.e. subject to more frequent and/or severe flooding) and

implements suitable controls for areas subject to lower risk (i.e. less frequent and/or less severe flooding). Appropriate controls to effectively manage these activities, consistent with best practice and relevant guidelines, will also be incorporated into the CEMP.

Groundwater is not expected to be intercepted by excavations.

8.3.4. Collision risk associated with wind farm developments

Mathematical CRM has been undertaken for the project over a 24 month period and eight seasons worth of BUS data, and therefore predictions of flight movements at risk and timing can be estimated for some species (i.e. those recorded flying at RSA height during BUS). Where this data is not available, risk assessments have been undertaken as demonstrated in Section 6.2 and Section 6.3.

A summary of at risk avian fauna and potential for prescribed impacts is shown Table 81.

Table 81 Prescribed impact assessment – wind farm developments

Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
Australasian Bittern	No	Turbine strike and macro avoidance	• Due to flight behaviour, it is less probable than not that the risk event could occur in any year (< 50%). • Collisions more likely to occur between spring and autumn. • High risk turbines near waterways, wetlands and irrigation channels.	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years. • Macro avoidance or changes in flight paths to avoid turbines possible, but not substantial.	Likely – further addressed below	Low	Low. Not considered substantial or significant.
Australian Magpie	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 4-6 movements per annum at risk.
Australian Raven	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 4-6 movements per annum at risk.
Australian Painted Snipe	No	Meso and/or macro avoidance	• An event may occur only in unusual circumstances (less than 5 %). The risk event is only theoretically possible, or would require exceptional circumstances to occur. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability	Likely – further addressed below	Low	Low. Not considered substantial or significant.
Australian White Ibis	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%).	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible

Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
			• Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.				1-2 movements per annum at risk.
Australian Wood Duck	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1 movement on average per annum at risk.
Black Falcon	No	Turbine strike and meso and/or macro avoidance	• It is equally probable that the risk event could or could not occur in any year (50%). • Collision more likely to occur between spring and autumn • High risk turbines, particularly turbine WT109, WT81, WT63, WT 56, ET43, ET48 where sightings and potential nesting may be occurring	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.	Likely – further addressed below	Moderate	Low. Not considered substantial or significant 1 movement on average per annum at risk.
Black Kite	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1-3 movements per annum at risk.
Black-shouldered Kite	No	Turbine strike and meso and/or macro avoidance	• It is more probable than not that the risk event could occur in any year (>50%) • Collisions may occur year round. • High and moderate risk turbines	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.	Likely – further addressed below	Moderate 1 individual at risk of collision per annum	Low. Not considered substantial or significant

Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
							1 movement on average per annum at risk.
Brown Falcon	No	Turbine strike	• It is very probable that the risk event could occur in any year (>95%). • Collisions may occur year round. • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1 movement on average per annum at risk.
Fork-tailed Swift	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%) • Collision more likely to occur between spring and early autumn, or prior cold fronts and storm events • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible – species presence infrequent due to the irregularity of its occurrence, and the small numbers possibly affected
Galah	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 8 movements on average per annum at risk.
Little Egret	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions more likely to occur between spring and autumn.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible

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Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
			• High risk turbines near waterways, wetlands and irrigation channels.				
Little Pied Cormorant	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions more likely to occur between spring and autumn. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible
Nankeen Kestrel	No	Turbine strike and meso and/or macro avoidance	• It is very probable that the risk event could occur in any year (>95%). • Collisions may occur year round. • High risk turbines	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.	Likely – further addressed below	Moderate 2-5 individuals at risk of collision per annum	Low. Not considered substantial or significant 2-5 movements on average per annum at risk.
Plumed Whistling-Duck	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 2-5 movements on average per annum at risk.
Spotted Harrier	No	Turbine strike and meso and/or macro avoidance	• It is more probable than not that the risk event could occur in any year (>50%) • Collisions may occur year round. • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Low Not considered substantial or significant

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Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
							1 movement on average per annum at risk.
Straw-necked Ibis	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1-2 movements per annum at risk.
Superb Parrot	No	Turbine strike and meso and/or macro avoidance	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions more likely to occur between spring and autumn, less likely in Winter • High risk turbines, particularly turbine WT13, WT7, WT86, ET 47, E48 and E43.	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.	Likely – further addressed below	Moderate	Low. Not considered substantial or significant 1-3 movements per annum at risk.
Wedge-tailed Eagle	No	Turbine strike and meso and/or macro avoidance	• It is very probable that the risk event could occur in any year (>95%). • Collisions may occur year round. • High and moderate risk turbines	• Moderate loss in numbers of individuals, leading to minor reduction in population viability for between one and five years.	Likely – further addressed below	High 3-6 individuals at risk of collision per annum	Low. Not considered substantial or significant 3-6 movements per annum at risk.
Whistling Kite	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%) • Collisions may occur year round.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible

Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
			• High risk turbines near waterways, wetlands and irrigation channels.				1 movement on average per annum at risk.
White-faced Heron	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible
White-necked Heron	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1 movement on average per annum at risk.
Yellow-billed Spoonbill	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collisions may occur year round. • High risk turbines near waterways, wetlands and irrigation channels.	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible 1 to 3 movements on average per annum at risk.
White-striped Free-tailed Bat	No	Turbine strike	• It is very probable that the risk event could occur in any year (>95%). • Collisions may occur year round. • High and moderate risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Low. Not considered substantial or significant
Gould's Wattled Bat	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%)	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Low.

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Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
			• Collisions may occur year round. • High risk turbines				Not considered substantial or significant
Inland Free-tailed Bat	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%) • Collision more likely to occur over spring and summer. • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible
South-eastern Free-tailed Bat	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%) • Collision more likely to occur over spring and summer • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible
Ride's Free-tailed Bat	No	Turbine strike	• It is more probable than not that the risk event could occur in any year (>50%) • Collision more likely to occur over spring and summer • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Negligible
Yellow-bellied Sheathtail-bat	No	Turbine strike	• It is equally probable that the risk event could or could not occur in any year (50%). • Collision more likely to occur over spring and summer • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Low	Low. Not considered substantial or significant

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Protected / threatened species	SAII entity	Predicted impact	Rate & timing of impact per turbine per year	Consequences	Cumulative impact	Likelihood and nature of collision impacts	Impact of avoidance behaviour - nomadic and migratory movement
Little Red Flying Fox	No	Turbine strike	• It is less probable than not that the risk event could occur in any year (< 50%). • Collisions may occur year round, depending on flowering resources • High risk turbines	• Repeated loss of small number of individuals but no reduction in population viability.	Likely – further addressed below	Negligible	Negligible

a) Predict the impact on species living in, or likely to fly over, the proposed development site, including bat or bird strike and barotrauma.

Impacts that have the potential to occur to bird and bat species within the subject land during the operational phase of the project are associated with turbine strike, as outlined in Table 81 above.

The level at which turbine strike is likely to occur is difficult to predict prior to commissioning of turbines, and as such impacts are considered uncertain. A monitoring and adaptive management approach has been developed to ensure any impacts that may occur are realised as early as possible, mitigation measures are implemented (where possible) to minimise the potential for the impact to reoccur, and where relevant, calculate an offset requirement for the impacted entity.

As outlined in Table 81 above:

- For 12 at risk bird and bat species, it is considered more probable than not that a strike event could occur in any year (>50%).
- For 16 at risk bird and bat species, it is considered equally probable that a strike event could or could not occur in any year (50%).
- For two at risk bird species, it is considered less probable than not that a strike event could occur in any year (<50%).
- For one at risk bird species, it is considered that an event may occur only in unusual circumstances (less than 5 %).

When the consequence of predicted strike events is considered, all of the above at risk species are predicted to be subject to:

- Repeated loss of a small number of individuals but no reduction in population viability, or
- Moderate loss in numbers of individuals, leading to a minor reduction in population viability for between one and five years.

Generally, those with the highest risk of collision are more common raptor species, such as Wedge-tailed Eagles and Nankeen Kestrels, common high flying microbat species, as well as common flocking waterbirds that may congregate in areas of more permanent water. Although collision likelihood is higher, these populations are stable and unlikely to have substantial consequences in the long term. Other less common species, such as the Black Falcon and Superb Parrot, may have a less likelihood of strike, however the consequence of the potential loss of a few individuals is higher.

For Australasian Bittern, satellite tracking and changes in local densities indicate Australasian Bitterns undertake seasonal and dispersive movements between breeding and non-breeding habitats, and as local habitat suitability conditions change (Bitterns in Rice Project 2017, Department of the Environment and Energy 2019). Satellite tracking of the species recorded juveniles and adult males moving from the Riverina rice-growing areas inland, to coastal wetlands in South Australia, Victoria and New South Wales post-breeding season (Bitterns in Rice Project 2017). Wetland habitat, including breeding habitat, is not likely to be impacted by the project. Given the distribution of potential and known habitat south and north of the subject land and the likely local and seasonal movements, a portion of Australasian Bitterns using the wetlands between Victoria and Coleambally/Leeton areas may possibly fly through the subject land, however the potential occurrence and thus potential for collisions still considered low.

Whilst impacts to microbat species may occur as a result of turbine strike, it is considered unlikely that additional impacts will occur as a result of barotrauma. A paper published in December 2020 in the journal PLOS One, by Lawson et al, describes how mortality as a result of barotrauma is unlikely to occur

due to the areas where exposure to the level of pressure variation required to cause mortality are present only in the immediate vicinity of the turbine blades, and that flight paths required for bats to be exposed to these areas are highly improbable. As such, even a small change in flight path would result in the bat being hit by the blade or experiencing a much smaller pressure change. Furthermore, the magnitude of the low-pressures bats could experience when flying near wind turbines is approximately 8 times smaller than the pressure that causes mortality in rats, the smallest mammal for which data are available. The magnitude of the high-pressures that bats may experience are approximately 80 times smaller than the exposure level that causes 50% mortality in mice, which have a body mass similar to several bat species that are killed by wind turbines in the United States (Lawson et al 2020).

The study concludes that, if bats have a physiological response to rapid low- and high-pressure exposure similar to that of other mammals, that it is unlikely that barotrauma is responsible for a significant number of turbine-related bat fatalities, and that impact trauma is the likely cause of the majority of wind-turbine-related bat fatalities. (Lawson et al 2020)

b) Predict the rate and timing of impact per turbine per year for species likely to be affected.

The predicted rate and timing of potential impacts from turbine strike to at risk bird and bat species per turbine per year are outlined in Table 81 above. These predictions are based on the risk assessments completed/summarised in Sections 6.1 and 6.3 above.

c) Predict the consequences of impacts for the persistence of populations.

The predicted consequences of potential impacts from turbine strike to populations of at-risk bird and bat are outlined in Table 81 above. These predictions are based on the risk assessments completed/summarised in Sections 6.1 and 6.3 above.

d) Predict the cumulative impacts of the proposed development alongside existing wind farms, on species mortality, movement patterns and use of adjacent habitat.

As wind farms developments increase in NSW, and in particular the South West REZ, bird and bat species with the potential to move over larger distances can be subject to impacts at multiple wind farms (Biosis, 2006). Wind farms are proposed within 150 kilometres of the project. These are:

- Yanco Delta Wind Farm – adjacent to the subject land
    - Up to 208 wind turbines
- Argoon Wind Farm – adjacent to the subject land
    - Up to 106 wind turbines.
- Pottinger Wind Farm – 45 km south-east of Hay.
    - Up to 247 wind turbines.
- Bullawah Wind Farm – 50 km south-east of Hay.
    - Up to 170 wind turbines.
- Tchelery Wind Farm – 70km south-east of Balranald.
    - Up to 120 wind turbines.
- The Plains Wind Farm – 40 km north-west of Hay.
    - Up to 226 wind turbines.

- Keri Keri Wind Farm – 40 km south-east of Balranald.
    - Up to 170 wind turbines.
- Wilan Wind Farm – 40 km north-east of Balranald.
    - Up to 138 wind turbines.
- Baldon Wind Farm – 60 km south-east of Balranald.
    - Up to 162 wind turbines.
- The Plains Wind Farm – 40 km north-west of Hay.
    - Up to 226 wind turbines.

Each of these wind farms are considered to have the potential to result in some level of mortality to wide ranging aerial species, however there would be limited overlap in species populations for more sedentary species between these wind farms due to their distal locations in the landscape. There is however likely to be a somewhat substantial loss of species' habitats within the region if the numerous large-scale projects are constructed. This cumulative habitat loss will affect all species to some degree, although those most affected (i.e., those with habitat spanning all, or the majority of, the proposed developments) are also those species better able to adapt and utilise a wide range of unimpacted habitats across a region where native dominated habitats are prevalent, albeit in a historically generally degraded state.

The project will operate an estimated 200 turbines, over an area of approximately 7,256 hectares development corridor and 31,384 hectare subject land. If all of the above wind farms are approved and operate at their proposed capacities (i.e. numbers of turbines, estimated at 1,773 in total) and are built at similar densities, the project would contribute approximately 11 % of the numbers of operational turbines and area covered by operation wind farm within approximately 150 kilometres. The project could therefore be considered to contribute a similar percentage to the potential cumulative impacts to bird and bat species in the region.

The majority of the species considered at risk of collision from the project are considered common, widespread and secure species and cumulative impacts would be unlikely to result in substantial impacts to local, regional or national populations. The exception being impacts to Wedge-tailed Eagles, predominantly juveniles and dispersing immature individuals within new ranges, and White Striped Free-tailed Bat, that are consistently impacted by wind farms in Australia. Additionally, Spotted Harrier, Superb Parrots, Black Falcon, and potentially Australasian Bittern, are listed as threatened in NSW and/or federally and cumulative impacts to these species could be more substantial.

Nomadic movements of Australasian Bittern and Black Falcon are likely to put populations at relatively frequent risk of cumulative impacts associated with turbine strike and avoidance of habitat adjacent to operational turbines across multiple operational wind farms. It could reasonably be expected that this risk would be greatest during the initial years of operation before birds have been able to habituate to the turbines in the landscape.

Detailed and adaptive management plans, such as BBAMP, will be required to be developed and implemented consistently to provide an effective monitoring program and strategy to manage and mitigate operational issues relating to the potential cumulative impacts from multiple sites. A coordinated effort will be required to ensure issues that may occur at one wind farm site, and which could be prevented at another, are consistently reported upon and mitigation strategies consistently applied.

e) **Predict the likelihood and nature of impacts on aerial species living in, or likely to fly over, the proposed development site, including barriers to migratory pathways, and breeding, feeding and resting resources.**

The predicted rate and timing of potential impacts from turbine strike to at risk bird and bat species per turbine per year are outlined in Table 81. These predictions are based on the CRM and risk assessments completed/summarised in Section 6.

f) **Predict the impact of avoidance behaviour for migratory species relative to migration distances, and the availability of suitable habitat for breeding, feeding and resting over the migration route.**

Analysis of nomadic and migratory species' flight paths relevant to the subject land is provided in Section 5, Section 6 and illustrated on Figure 13 and Figure 14. Further assessment is provided in Table 81.

The project is not expected to result in substantial avoidance behaviour in species undertaking longer distance nomadic or migratory flights due to these flights generally occurring over RSA height, or to species undertaking local-scale movements due to the layout of the project allowing sufficient blade-free areas allowing movement corridors through the operational wind farm.

g) **Map the disturbance zone around wind turbines, and the significant landscape and habitat features within that zone, for species likely to be affected, e.g. hollow bearing trees and important habitat for migratory species.**

The project's development corridor was assessed and mapped as the potential disturbance zone around operational wind turbines. Refer to Section 8.1 for direct impacts to landscape and habitat features. Flight paths and discussion of disturbance to migratory species is location within Section 5.2 and Section 6.

The zone of disturbance can be considered to comprise two separate parts, those being the RSA, and an area of air disturbance extending past the blade tip. Potential impacts to aerial species within the RSA are largely associated with blade strike and possibly barotrauma, the risk and likelihood of which has been assessed for bird and bat species in Section 5.2.1 and Section 6 of this BDAR.

Impacts associated with the area of air disturbance, past the end of the blade tips, are less clear but are likely associated with avoidance behaviour and barrier effect due to alteration of forces acting on aerial species, potentially leading to additional indirect habitat loss due to expected avoidance behaviour. It is expected that smaller species would be more likely to experience disturbance from smaller changes in air pressure (etc), and therefore experience disturbance further from the blade tips, when compared to larger species likely to be more tolerant of smaller changes, and thus experiencing disturbance closer to the tips of the blades.

Within the combined zone of disturbance, equating to the RSA and the additional area of air disturbance, habitat features likely to be utilised by aerial fauna include open grassy areas, scattered trees and intact saltbush and mallee vegetation supporting hollows, small dams and watercourses. All of these features are potentially utilised for foraging, roosting and breeding habitat (for some species).

As outlined above, the project has limited potential to result in impacts to habitat connectivity for some species potentially flying through the wind farm to access habitats as part of migratory movements or long-range foraging. However as noted, habitat connectivity is maintained surrounding the development corridor and the likelihood of regular migratory movements through the wind farm at RSA height is considered low.

8.3.5. Vehicle strikes

Nature and extent

The project has the potential to result in increased vehicle strikes during the construction and operational phase of the project as a result of increased vehicle moments, and in particular heavy vehicles, predominantly during construction. However, the existing public roads, such as Kidman Way as well McLennons Bore Road and Carrathool Road currently act as a major and minor conduit respectively of heavy vehicle traffic in the region. Upgrades to rural fencing and gates may be required in some circumstances however, perimeter fencing will primarily be only required around critical infrastructure only. Overall, small areas of perimeter/exclusion fencing is not likely to be substantially exacerbated beyond the existing rural impacts installed currently

Duration

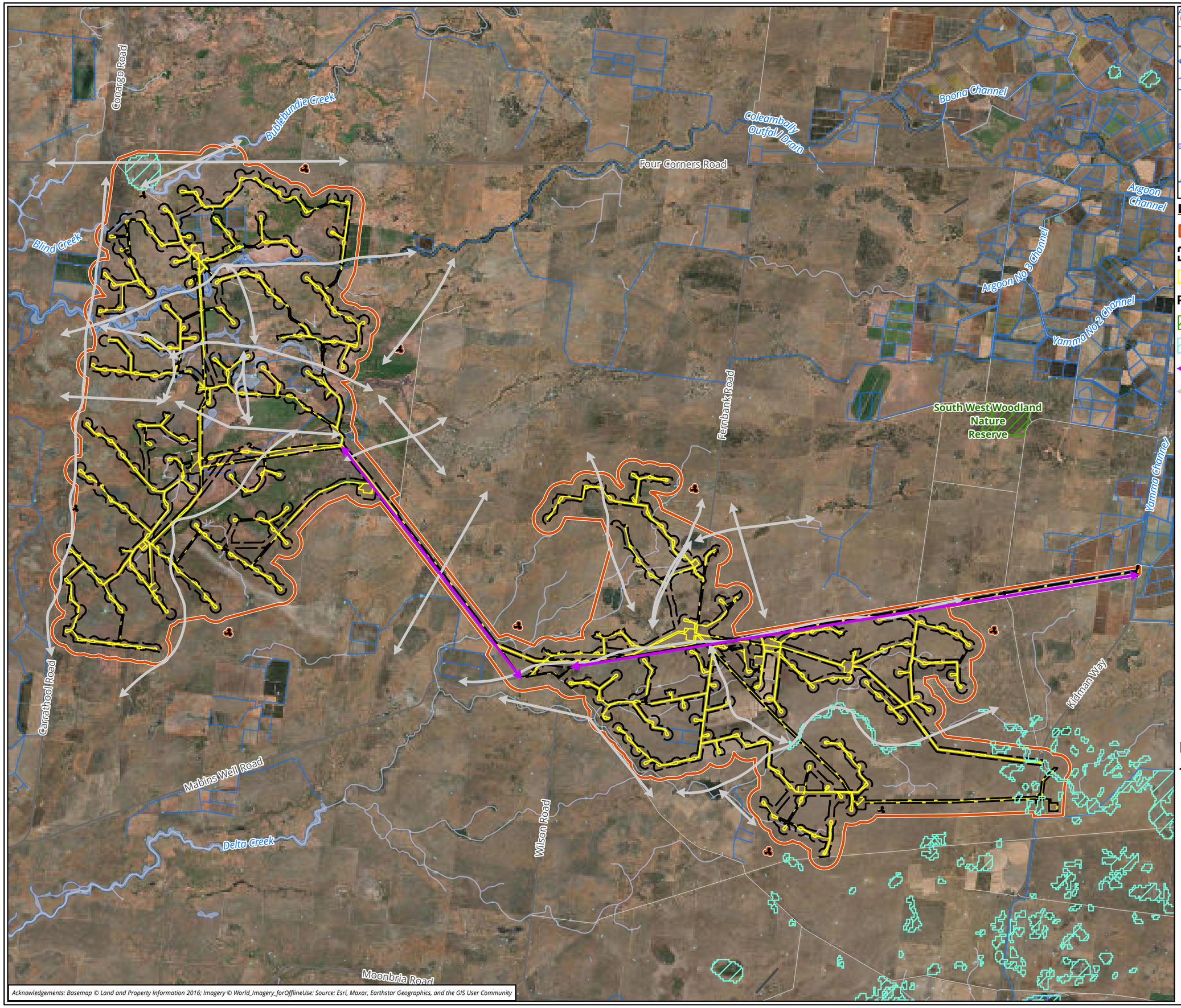
This impact would be ongoing but temporary, limited to predominantly construction stages. No substantial impacts as a result of perimeter fencing of critical infrastructure or upgrading of rural infrastructure is anticipated.

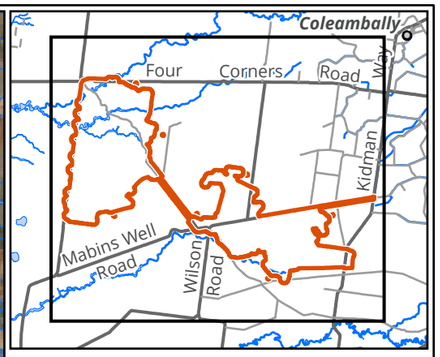
Consequences

Non-threatened, ground dwelling fauna known to inhabit the general area, particularly macropods such as Emu, Eastern Grey Kangaroo and Red Kangaroo are notoriously prone to vehicle strike. Vehicle strike of macropods is likely to be an impact already in place due to the existing road network and traffic levels, which may be exacerbated during construction.

Low flying ground foraging birds such as Grey-crowned Babblers, Red-rump parrots, Blue Bonnets, as well as potentially Superb Parrots when foraging along roadside corridors, are also prone to increased collision due to increase in traffic during construction due to foraging or flying close to road verges. Repeated vehicle impacts to threatened species such as Superb Parrots could cause an impact to local population, however the likelihood of repeated strikes is considered low.

It can be reasonably expected that the potential for vehicle strikes can be effectively managed through driver awareness training on the potential for fauna to occur, as well as on-site measures such as reduced speed limits and signage and education programs for staff. As such, the project is not expected to result in any substantial or significant impacts associated with vehicle strikes outside of what already exists due to the project's proximity to a major regional road corridor.





Legend

- Subject land
- Development corridor
- Development footprint

Prescribed impacts

- National Park/Reserve
- Local wetlands
- Vehicle impacts
- Connectivity

Figure 20A Prescribed impacts - Overview

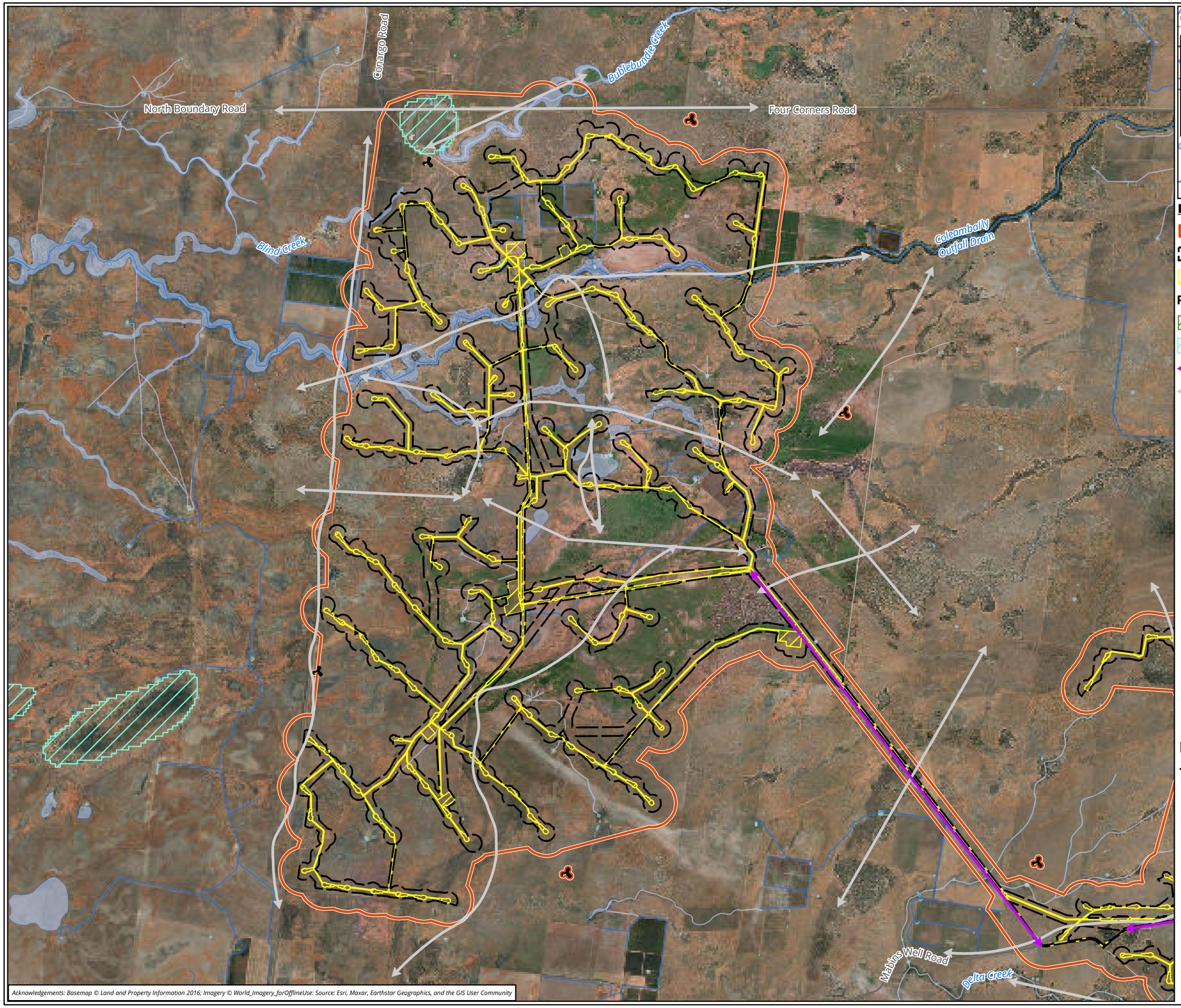
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Kilometers
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37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
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Legend

- Subject land
- Development corridor
- Development footprint

Prescribed impacts

- National Park/Reserve
- Local wetlands
- Vehicle impacts
- Connectivity

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Figure 20A Prescribed impacts - Stage 2

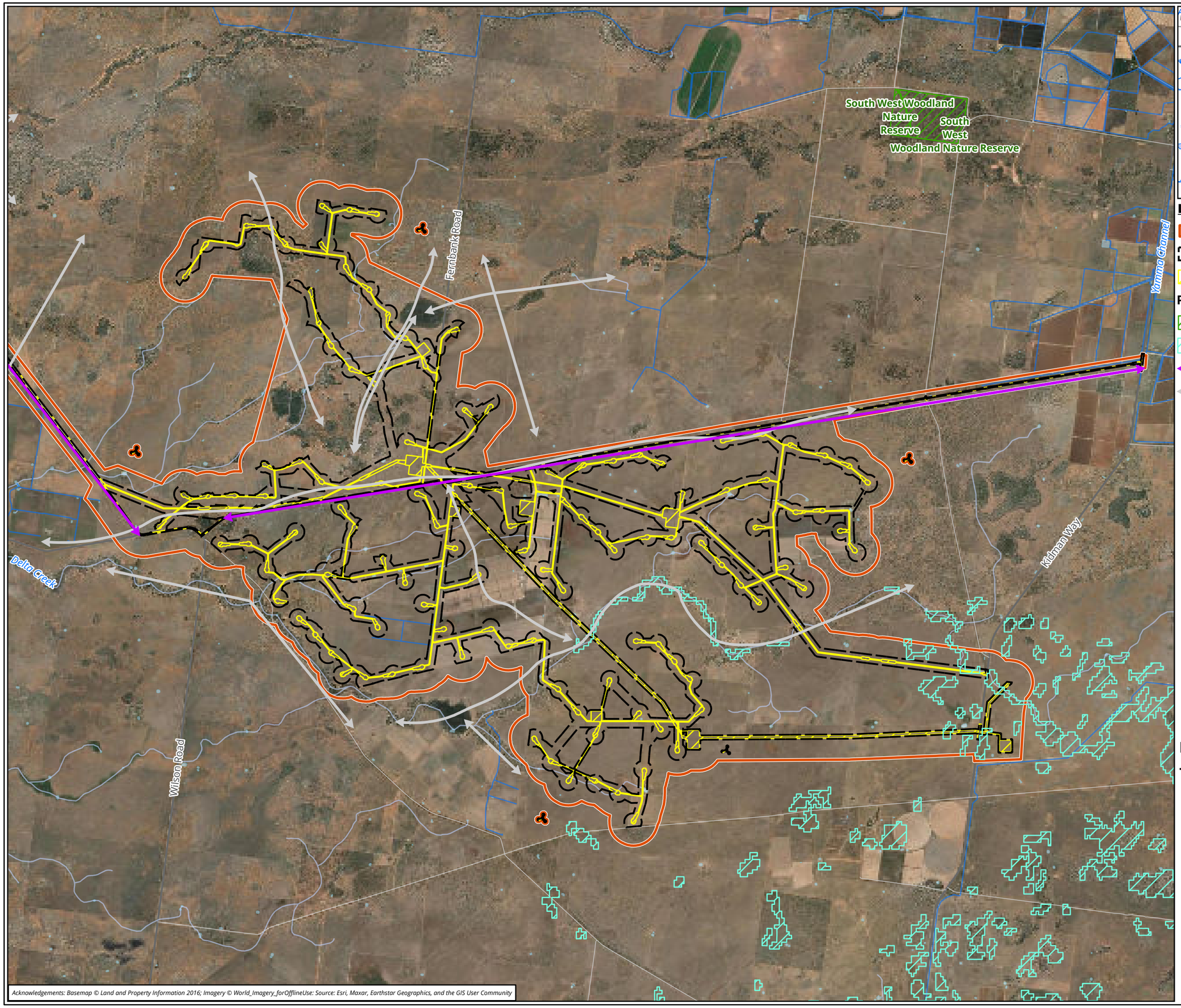
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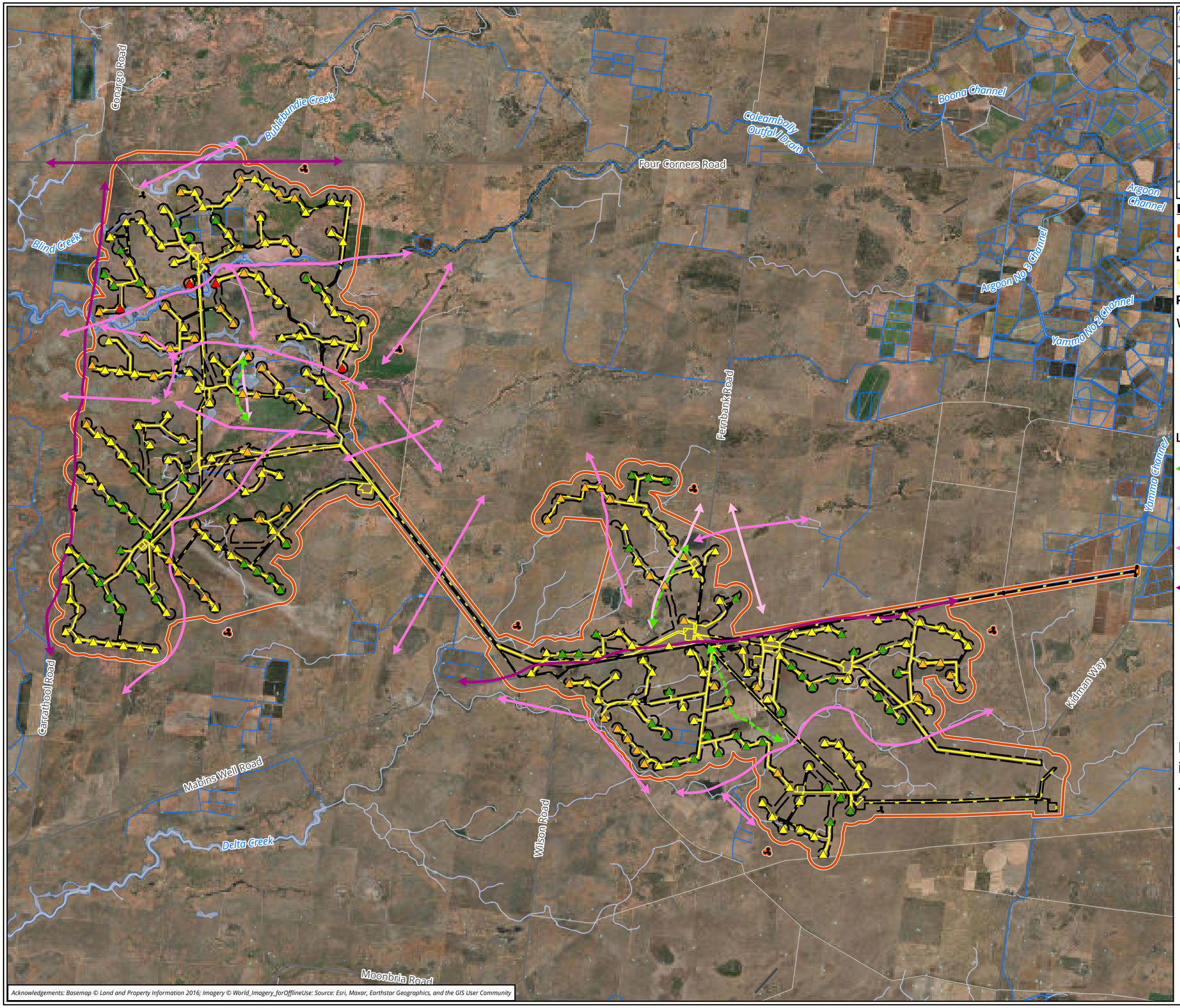
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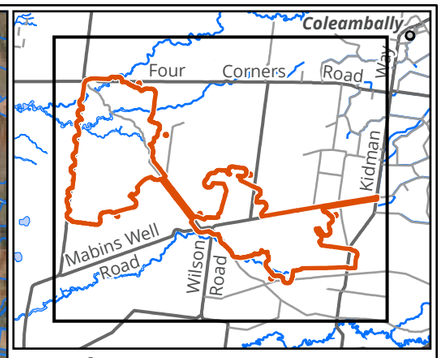
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Figure 20A Prescribed impacts - Stage 1

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Layout: 37263_Wind_F20A_PrescribedImpacts



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Legend

- Subject land
- Development corridor
- Development footprint

Prescribed impacts

Wind turbine constraint

- Very High
- High
- Moderate
- Low

Local flight paths

- Minor pathway - Observed local at risk species
- Minor pathway - Woodland and waterbirds fliers
- Major pathway - Woodland and waterbirds fliers
- Roadside pathway - Woodland and waterbirds fliers

Figure 20B Prescribed impacts (wind only) - Overview

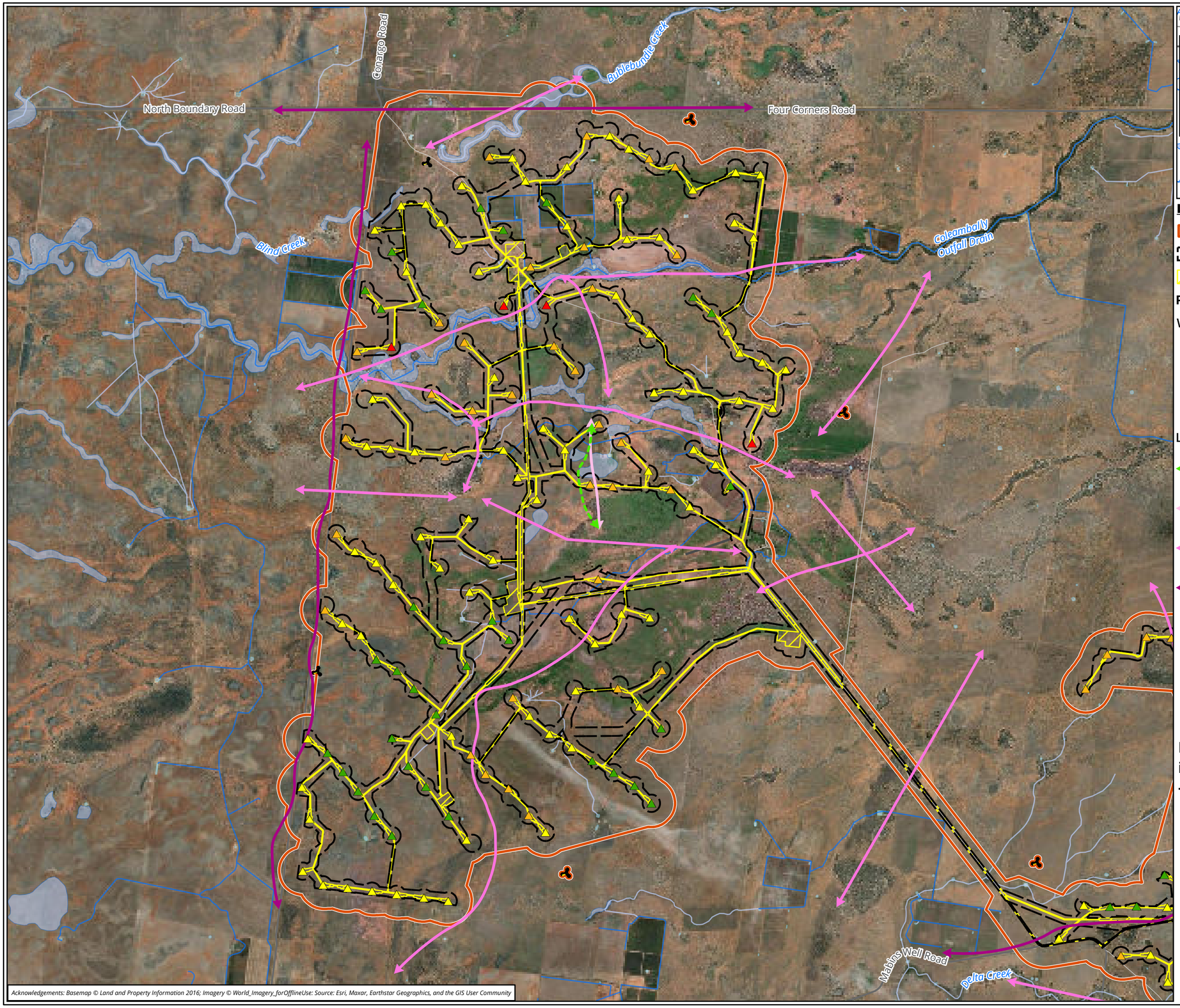
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Kilometers
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Coordinate System:
GDA2020 MGA Zone 55

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Legend

- Subject land
- Development corridor
- Development footprint

Prescribed impacts

Wind turbine constraint

- Very High
- High
- Moderate
- Low

Local flight paths

- Minor pathway - Observed local at risk species
- Minor pathway - Woodland and waterbirds fliers
- Major pathway - Woodland and waterbirds fliers
- Roadside pathway - Woodland and waterbirds fliers

Figure 20B Prescribed impacts (wind only) - Stage 2

0 1 2 3

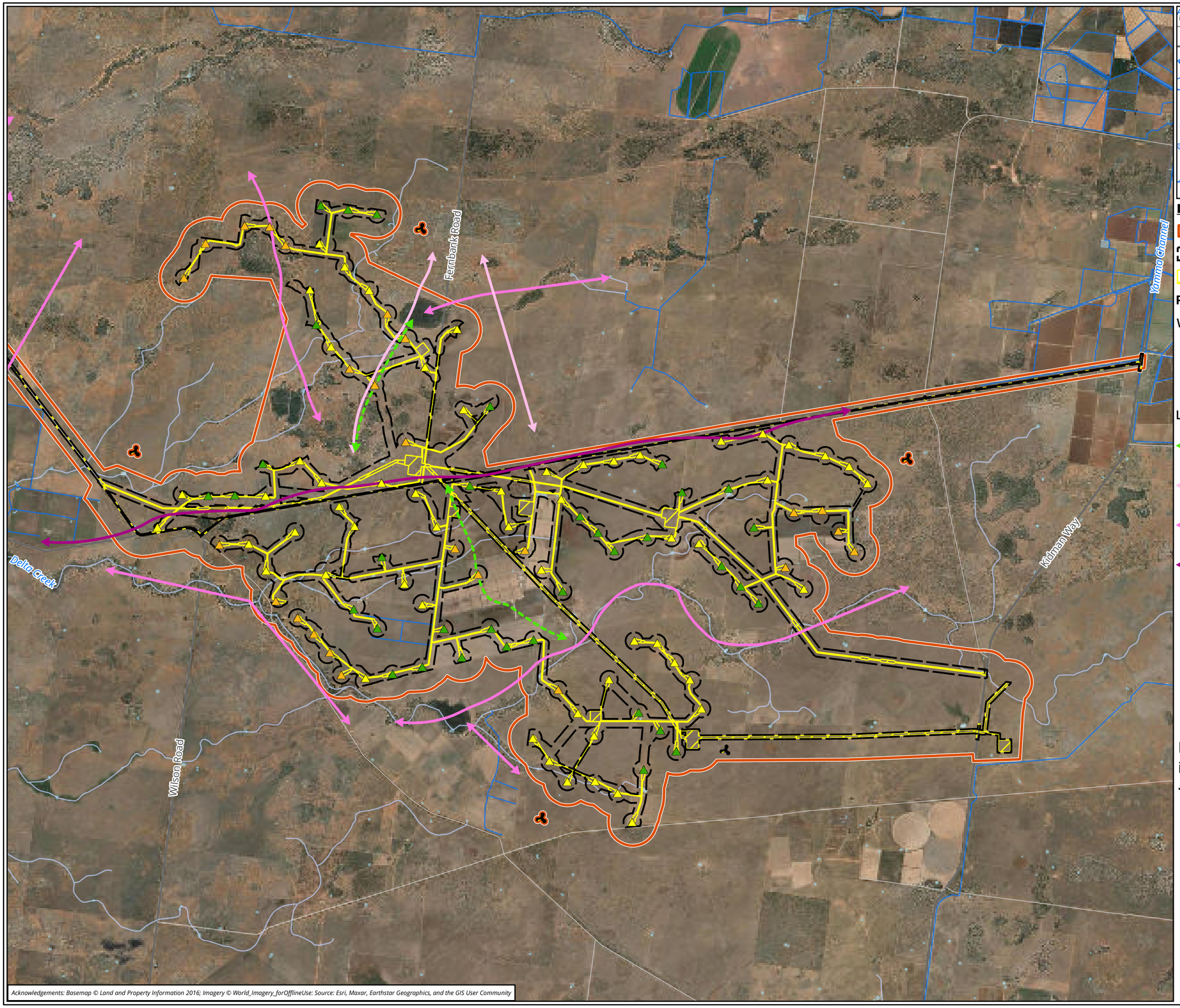
Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

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Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F20B_Prescribed_Wind

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © World_Imagery_forOfflineUse: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

- Subject land
- Development corridor
- Development footprint

Prescribed impacts

Wind turbine constraint

- High
- Moderate
- Low

Local flight paths

- Minor pathway - Observed local at risk species
- Minor pathway - Woodland and waterbirds fliers
- Major pathway - Woodland and waterbirds fliers
- Roadside pathway - Woodland and waterbirds fliers

Figure 20B Prescribed impacts (wind only) - Stage 1

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

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Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F20B_Prescribed_Wind

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © World_Imagery_forOfflineUse: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

8.4. Impacts to Groundwater Dependent Ecosystems (GDE)

GDEs are ecosystems that are partially or completely dependent on underground water, or the surface expression of this water, for their existence or health. These ecosystems include flora and fauna species and communities that are dependent on water discharge to the surface at a level where they can access, to persist in permanently wet environments, or to persist during times of extended low rainfall via the access to subsurface water reserves. The mapped GDEs intersecting the development corridor are typically associated with River Red Gum, Lignum and Canegrass wetland vegetation communities.

The project construction activities are not anticipated to intersect the regional water table. No material impacts to water quality objectives are anticipated as the water quality of runoff leaving the project is expected to be similar to the water quality of the receiving environment during discharge. No material impacts to groundwater are expected. Groundwater will form a source of non-potable water supply for the project; however, this is proposed to be temporary and consumed as part of an existing landowner entitlement linked to approved works.

8.5. Impacts considered uncertain

Operational impacts to bird and bat species associated primarily with collision risk and to a lesser extent potential barrier effects, are predicted as stringently as possible, however, are still considered uncertain at this stage. As such, a monitoring and adaptive management strategy has been developed for the project to ensure any negative effects are realised early, mitigated where possible, and offset if required. The monitoring and adaptive management strategy is summarised in Section 9.

8.6. Cumulative impacts

An assessment of proposed and current renewable and other projects within similar PCTs, habitats and sited in the South West REZ has been carried out to provide a summary of potential cumulative impacts to biodiversity (Table 82). Nineteen large scale renewable energy related projects in the South West REZ, all impacting upon similar PCTs, habitats and threatened species have been considered.

It is important to recognise that the South West REZ is currently a highly competitive landscape for renewable energy development and project outcomes will largely be determined by the NSW Government allocation of access rights to the limited transmission infrastructure present. For example, the NSW Government registration of interest for the South West REZ received 49 registrations, representing 34 gigawatts of electricity (more than 13 times the intended 2.5 gigawatts capacity) from potential generation and storage projects. Access to the South West REZ transmission lines will be managed by the NSW Government in accordance with the NSW Electricity Infrastructure Investment Act 2020 (EII Act). A competitive tender process for transmission "access rights" will be administered by AEMO Services (ASL). The mix of technologies and size of projects that will be built in the South West REZ will, to a large extent, be determined by the outcomes of this competitive auction process. This process would limit the scale of development within the South West REZ and means that the cumulative impacts required to build the South West REZ to its maximum capacity would be less than that predicted for the full extent of all projects currently proposed.

The Dinawan Energy Hub as a whole also includes the Dinawan Solar Farm currently under a separate assessment. Overall impacts related to the solar farm are currently under assessment, with a detailed description of potential biodiversity impacts provided within the Dinawan Solar Farm BDAR (Biosis, 2023). Dinawan Solar Farm is currently within the RTS phase and a revised BDAR will be submitted as part of an amendment report that includes a reduction to the size of the development footprint.

Generally, impacts resulting from the project are largely consistent with impacts that are considered to occur at other nearby proposals, more so with those occurring within 50km or less.

The summary of biodiversity impacts from publicly available information was reviewed to gain an understanding of the main biodiversity impacts and how these may contribute to cumulative impacts when considering the development of the project.

Table 82 Cumulative Impacts

Project, description and location	Distance	Overview	Potential biodiversity impacts
Dinawan Solar Farm (RTS stage)	0 km	Includes construction and operation of 800 MW solar farm on approximately 2,000 ha.	Potential impacts to 1,777 ha of native vegetation, including six PCTs and two TECs. Weeping Myall and Natural Grasslands impacts are anticipated. Minor impacts to *Swainsona murrayana* and *Swainsona sericea*. Impacts to dispersal habitat for *Litoria raniformis,* however impacts to primary habitat has been minimised.
Project EnergyConnect (Approved project)	0 km	Includes construction and operation of 330 kV and 500 kV transmission line and Dinawan Substation.	38 PCTs directly impacted. 1,615.20 ha of native vegetation. 232.16 ha of TECs, including 101 ha of Weeping Myall. Loss of habitat of 74 ecosystem species. 20 candidate species impacted.
Argoon Wind Farm (Scoping stage)	1 to 5 km southeast	Up to 106 wind WTGs, battery storage facilities and associated infrastructure	18 PCTs potentially directly impacted including PCT 10, PCT 13, PCT15, PCt 24, PCT, PCT 45 and PCT46. Study area of 10,888 ha. Cumulative impacts to “at risk birds”.
Yanco Delta Wind Farm (Approved project)	1 to 5 km south	Includes construction and operation of 1.5 GW wind farm, including approximately 225 WTGs across 24,000 ha.	10 PCTs directly impacted. 173.4 ha of native vegetation. 88.3 ha of EPBC listed natural grassland TEC impacted. 29.69 ha of Weeping Myall TEC impacted. Loss of habitat of 14 threatened species. Impacts to 1.78 ha of Plains Wanderer habitat. Cumulative impacts to “at risk birds”.
Coleambally BESS (Approved project)	30 km north	Includes construction and operation of 100 MW capacity BESS across 4 ha	Impacts to 2.75 ha of PCT 16 Black Box woodland 2.86 ha of PCT 26 Weeping Myall woodland. Impacts to 0.45 ha of Superb Parrot

Project, description and location	Distance	Overview	Potential biodiversity impacts
			breeding habitat.
Coleambally Solar Farm (Approved project)	30 km north	Includes 150 MW solar farm constructed on 570 ha formerly used to support irrigation cropping	Impacts to 0.74 ha of native vegetation including 0.66 ha PCT 16 Black Box woodland and 0.08 ha of PCT 26 Weeping Myall woodland.
Bullawah Wind Farm (Scoping stage)	38 km north west	Includes construction and operation of 1 GW wind farm, including approximately 170 WTGs across 33,000 ha.	Estimated impacts to 1012.6 ha of native vegetation including impacts to Weeping Myall Woodland and Natural grasslands. Cumulative impacts to "at risk birds".
Darlington Point Solar Farm (Approved project)	45 km north	Includes 275 MW solar farm (constructed) and 200 MW BESS (under construction) on 1,042 ha formerly used for grazing.	Impacts to PCT 45 Plains Grassland and impacts to PCT 16 Black Box woodland.
Woodland BESS (Scoping stage)	45 km north	Includes construction and operation of 200 MW BESS across 16 ha.	Potential impacts to 5 TECs and 17 threatened species.
Yarrabee Solar Farm (Approved project)	45 km south	Includes construction and operation of 900 MW solar farm and BESS on approximately 2,600 ha	Impacts to 3 PCTs, including one TEC. Impacts to two threatened species.
Pottinger Wind and Solar Farm (EIS stage)	50 km west	Includes construction and operation of 750 GW wind farm, 300 solar farm and 500 MW BESS., including approximately 108 WTGs across approximately 15,160 ha.	Impacts to 470 ha of native vegetation for the wind farm and 630 ha for the solar farm, including potential impacts to Weeping Myall Woodland and Natural Grasslands TECs. Cumulative impacts to "at risk birds".
Currawarra Solar Farm (Approved project)	60 km south	Includes construction and operation of 195 MW solar farm and BESS on approximately 472 ha.	Impacts to three PCTs, including one TEC totalling 3.8 ha of native vegetation.
Tarleigh Park Solar Farm (Approved project)	75 km south	Includes construction and operation of 90 MW solar farm and BESS on approximarely 250 ha.	Impacts to three PCTs, including one TEC totalling 3.37 ha of native vegetation.
Tchelery Wind Farm (EIS stage)	>100km west	Includes construction and operation of 800 MW wind farm, including approximately 120 WTGs	Potential impacts to 16 PCTs, 4 TECs including Weeping Myall Woodland. Potential impacts to seven flora species and five fauna species known to occur. Cumulative impacts to "at risk birds".

Project, description and location	Distance	Overview	Potential biodiversity impacts
Baldon Wind Farm (EIS stage)	>100 km west	Includes construction and operation of 1 GW wind farm, including approximately 162 WTGs across approximately 42,000 ha.	Potential impacts to 17 PCTs including Natural grassland TECs. Potential impacts to 3 threatened species, including the Plains Wanderer. Cumulative impacts to "at risk birds".
The Plains Wind Farm (EIS Stage)	>100km north west	Includes construction and operation of 1.8 GW wind farm, including approximately 226 WTGs across approximately 58,000 ha.	Potential impacts to 558 ha of native vegetation 15 PCTs and two TECs, including Weeping Myall Woodland. Potential impacts to Plains Wanderer habitat. Cumulative impacts to "at risk birds".
Wilan Wind Farm (EIS stage)	>100 km west	Includes construction and operation of 800 MW wind farm, including approximately 138 WTGs	Potential impacts to 607 ha of native vegetation, including 12 PCTs. Potential impacts to two threatened flora species. Cumulative impacts to "at risk birds".
Keri Keri Wind Farm (EIS stage)	>100 km west	Includes construction and operation of 1 GW wind farm, including approximately 176 WTGs and 200 MW BESS.	Potential impacts to 2625 ha of native vegetation including 9 PCTs and one TEC, and one threatened flora species. Cumulative impacts to "at risk birds".
Junction Rivers Wind Farm (EIS stage)	>100 km west	Includes construction and operation of 750 MW wind farm, including approximately 96 WTGs	Impacts to 68.16 ha of native vegetation including seven PCTS and two TECs. Cumulative impacts to "at risk birds".

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9. Mitigation and management of impacts

Residual impacts occur once all efforts have been made to avoid and minimise impacts through the design phase of the project. Mitigation of unavoidable impacts is the next step in the impact reduction hierarchy and includes commitments made by the proponent to further minimise impacts to biodiversity.

Identification of measures to mitigate or manage impacts has been undertaken in accordance with the BAM (DPIE 2020a), including considerations such as:

- Techniques, timing, frequency and responsibility.
- Identification of measures for which there is risk of failure.
- Evaluation of the risk and consequence of any residual impacts.
- Documentation of any adaptive management strategy proposed.

Identification of measures for mitigating impacts related to:

- Displacement of resident fauna.
- Indirect impacts on native vegetation and habitat.
- Mitigating prescribed biodiversity impacts.
- Protecting threatened flora and fauna habitat, especially threatened flora populations identified within the subject land, but outside the development footprint.
- Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain.

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Table 83 Measures to mitigate and manage impacts

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
	Direct and indirect impacts			
B1	Removal of native vegetation and TECs	• Wherever possible the project will look to avoid impacts to native vegetation and TECs through minimisation of clearing footprint during detailed design and preferentially locating infrastructure/plant/materials etc in areas of existing disturbance. • Prescriptions for mitigation of potential impacts of construction activities on retained native vegetation and habitat will be addressed in a site-specific CEMP and BMP sub-plan. The plan will include all measures outlined below: o Minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. o Where possible, limit clearing to trimming rather than the removal of whole plants. o Micro-siting of all construction related access roads, stockpiles, vehicle parking and site compounds should occur and where possible these should be located in areas that do not contain native vegetation or fauna habitat. o Physically delineate vegetation to be cleared and/or protected on site and install appropriate signage prior to works commencing. o No-Go Zones should be erected during the construction phase at the extent of clearing works in patches of vegetation to ensure clearing limit is not exceeded and no vehicle or plant equipment movement occurs outside the clearing limit. These areas should be checked as part of the pre-clearing survey. o Protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites. o Do not damage tree roots unless absolutely necessary, and engage a qualified arborist where roots >50mm are impacted within the Tree Protection Zone. o Retain dead tree trunks, bush rock or logs in-situ unless they are in the development footprint and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites. Dead wood and Coarse Woody Debris (CWD) should be lifted and placed into adjacent vegetation, not pushed. o Undertake pre-clearance inspections by a licenced ecologist of vegetation to ensure all no-go areas are appropriately fenced. o If any threatened species (flora or fauna) is discovered during the works, stop work immediately at the site of species identification and notify the onsite Manager. Work will	Prior to construction – during construction	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		only recommence once the impact on the species has been assessed and appropriate control measures provided. ○ If any damage occurs to vegetation outside of the impact area (as shown in the CEMP), notify the onsite Manager and Environmental Representative so that appropriate remediation strategies can be developed. • A biosecurity management plan will be prepared as part of the project's CEMP and will detail measures to prevent the spread of weeds and pathogens, and other biosecurity items into or out of the impact area upon implementation. • Secure biodiversity offsets in accordance with the NSW BOS.		
B2	Removal of fauna and flora habitat Removal of threatened fauna habitat	• Wherever possible the project will look to avoid removal of hollow-bearing trees and trees supporting nests during detailed design. • The CEMP will include a plan for pre-clearance surveys. Pre-clearance surveys will include: ○ Fauna general: ▪ Survey of all areas to be cleared prior to construction to identify and mark all fauna habitat to be impacted including hollow-bearing trees (HBTs) ▪ All HBTs to be removed will follow a two-stage removal process, including knocking of the tree to be removed 24 hours prior to removal. ▪ All fauna habitat to be removed will be surveyed by a suitably qualified ecologist, prior, during and after removal. ▪ Active nests will be avoided by clearing. ▪ If native fauna is likely to be present, a licenced ecologist should inspect the removal and undertake fauna relocation. ○ Flora general: ▪ All vegetation to be removed is to be clearly marked for removal. ▪ No-Go fencing is to be erected along the clearing extent where partial clearing of a patch it to occur. No-Go fencing is to be retained until the completion of the construction phase. • If native fauna is encountered on site, stop work and allow the fauna to move away un-harassed. Engage a licenced ecologist if assistance is required to move fauna.	Prior to construction – during construction	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		Hollow dependent fauna • Further baselines surveys of areas of expected high use for Superb Parrot are to be undertaken once the final development footprint has been determined at least one month prior to scheduled vegetation removal. • Pre-clearance surveys are to be undertaken to determine if these areas of habitat are being used by the species 24-48 hours before vegetation removal. • Removal of hollow bearing trees to occur outside breeding season for Superb Parrot, September to November, as far as practicable, and potentially prior to the main vegetation clearing program. It would be ensured that this would not result in the removal of potential nest trees more than one breeding season prior to the main vegetation clearing program. • Two-staged tree removal under ecologist supervision is required for the removal of all trees within potential Superb Parrot high use areas.		
		Threatened raptor species (incl. non-threatened at risk species) • All potential raptor nests within 200 metres of the finalised development footprint are to be mapped at least one month prior to vegetation removal. • Pre-clearance surveys are to be undertaken within one week of scheduled vegetation removal to determine whether nests are in use by threatened raptors, **or** non-threatened at risk raptors (See Section 6.2.3). • Clearing of raptor nests with juveniles present will not be undertaken. • Removal of potential nest trees could occur as early works, outside breeding season, and prior to the main vegetation clearing program. It would be ensured that this would not result in the removal of potential nest trees more than one breeding season prior to the main vegetation clearing program. • Clearing of vegetation within 200 m of raptor nests with juveniles present will be avoided wherever possible. • Two-staged tree removal under ecologist supervision is required for the removal of all raptor nests.		
		Southern Bell Frog • Construction within waterbodies and irrigation channels if required will be preferentially undertaken when dry as far as practicable.		

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		• A suitable location for the relocation of Southern Bell Frog outside the development corridor should be determined prior to clearing taking place, ensuring any areas proposed for relocation do not contain *Gambusia* species. • Engaging a qualified and licensed ecologist to be present during dewatering of farm dams is required, to undertake fauna relocation (e.g. turtles, frogs, etc.) into an appropriate nearby habitat. • Once dewatering is complete, dams are to be left for a minimum of 48 hours to allow species such as frogs and yabbies to naturally relocate. Where possible, dewatered dams should be left dry for a minimum of 1 week.		
		Plains Wanderer • Pre-clearance nocturnal surveys will be undertaken when vegetation removal is proposed within PCT 46 or impacted Important Mapped Areas. • BMP to include priorities and strategies to reduce predators such as foxes and weed ingress. • During final design, maximise connectivity opportunities where impacts to optimal habitat and Important Mapped Areas are predicted.	Prior to construction – during construction	Proponent / Principal contractor
		Other threatened species (MNES) • Pre-clearance surveys will be undertaken when vegetation removal is proposed during the breeding season of threatened species (for example between July – October for Southern Whiteface). • Survey results will trigger the implementation of mitigation measures to minimise impacts to breeding individuals, to be further detailed in the BMP.		
B3	Construction adjacent to identified threatened flora populations	**Swainsona Species** • Ensure No-Go Zones are established early and maintained throughout the life of the construction phase of the project. • Regular monitoring of the health of the retained population will be undertaken throughout the life of the project as guided by the BMP and, if identified, negative pressures acting on the population will be subject to management.	Prior to construction – during construction	Proponent / Principal contractor
B4	Indirect impacts on retained native vegetation, habitat and native species	• Project fencing will be designed so as not to create barriers to fauna movement, nor to funnel fauna species into dead ends. Egress points will be provided for fauna that do enter the project site (both construction and operational). • Ensure all works areas and access routes are clearly delineated and sign-posted from the outset of the project construction phase to avoid unauthorised/accidental access to retained areas.	Prior to construction – during construction	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility

		• Develop and implement specific erosion and sediment controls described in a CEMP, such as:
		  ○ Minimising the area and duration of soil disturbance.
		  ○ Progressively rehabilitate disturbed areas.
		  ○ Temporary or permanent earth banks and silt fences. Trench blocks (i.e. trench/sack breakers) and compaction of backfilled soils to be used to prevent subsurface erosion.
		  ○ Specific Erosion and Sediment Control Plans for waterway crossings.
		• All material stockpiles, vehicle parking and machinery storage, and other ancillary works are to be located within areas considered within the current assessment and not be located within retained vegetation outside the development footprint.
		• A waste management plan will be developed to ensure rubbish and construction waste are properly managed, and do not attract pest species.
		• Cleared vegetation, which may be mulched or stored for re-use on site, should be:
		  ○ Stockpiled separately from topsoil in a manner which facilitates respreading or salvaging, avoids damage to adjacent live vegetation and does not impede wildlife.
		  ○ Where possible, mulch produced from native vegetation should be reused for landscaping and site rehabilitation and spread <10cm deep to aid in retention of native seed bank.
		• Commit to undertaking ongoing pest animal control in conjunction with a local/regional pest control program (or providing a monetary contribution towards), and relevant landowners, to ensure a strategic approach can be achieved.		

B5	Reduced viability of adjacent habitat due to edge effects	• The CEMP will include a landscaping and rehabilitation management plan that will ensure areas of temporary disturbance are rehabilitated via best practice ecological restoration techniques. • Re-use felled vegetation (logs ad tree-hollows) and other habitat features such as rocks/boulders to increase the habitat values of any retained and adjacent vegetation. • Any revegetation / rehabilitation or vegetation screening works within and/or contiguous with areas of native vegetation are to use locally sourced (local provenance) seed stock only. All species installed are to be locally indigenous and suitable and characteristic of the surrounding PCTs.	Prior to construction – during construction	Proponent / Principal contractor

B6	Reduced viability of adjacent habitat due to noise, dust or light spill	• The CEMP will include a plan to ensure:
		  ○ Minimisation of the amount of time that noise, light and vibration impacts are occurring.
		  ○ Ensure the smallest machinery that can complete the required works are used to reduce potential noise and vibration impacts.
			Prior to construction – during construction	Proponent / Principal contractor

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	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		○ Regularly train workers and contractors to use equipment in ways to minimise noise. ○ Site managers periodically check the site and nearby residences for noise problems so that solutions can be quickly applied. ○ All plant and equipment will be turned off when not in use. ○ Known breeding habitat such as tree hollows and nests adjacent to works areas will be considered in noise management strategies. • The CEMP will include dust suppression to be undertaken as required using water sprays, water carts or other media on: ○ Unpaved work areas subject to traffic or wind. ○ Sand, spoil and aggregate stockpiles. ○ During the loading and unloading of dust generating materials. • Lighting will be designed in general accordance with Australian Standard 4282-1997 Control of the obtrusive effects of outdoor lighting and the good lighting design Principals documented in Dark Sky Planning Guideline. • Lighting will be designed so as not to shine onto adjacent retained vegetation and habitats where possible.		
B7	Transport of weeds and pathogens to/from the site to/from adjacent vegetation	• A biosecurity management plan will be prepared as part of the project's CEMP and will detail measures to prevent the spread of weeds and pathogens, and other biosecurity items into or out of the impact area upon implementation. • The plan will include prescriptions for regular monitoring and control of weeds.	Prior to construction – during construction	Proponent / Principal contractor
B8	Adaptive management strategies proposed to monitor and respond to impacts on biodiversity values that are uncertain	• All plans will be progressively reviewed and updated throughout operations. • All adaptive management strategy plans, including the BMP, will form part of an overarching Environmental Management Strategy (EMS).	Prior to construction – during construction-operation	Proponent / Principal contractor
		• Preparation of a BMP will ensure mitigation strategies are properly implemented during construction and operation of the project. ○ The BMP will be prepared by a qualified ecologist or consulting company in consultation with regulators including NSW DCCEEW (BCS). ○ The BMP will be implemented for all stages of the project (pre-construction, construction, operation and decommissioning).	Prior to construction – construction – operation.	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		○ Mitigation strategies included in the plan will include (but are not limited to): ▪ Permit system for the clearing of native vegetation. ▪ Installation of no-go zones and delineation of vegetation to be removed/retained. ▪ Pre-clearance procedures for vegetation to be removed. ▪ Unexpected finds procedure that includes strategies to minimise, mitigate and potentially offset unexpected impacts to threatened species not recorded during the preparation of the BDAR. ▪ Details of protection procedures for direct impacts on threatened flora. ▪ Requirements for revegetation or screening works including suitable species and requirements around local provenance and seed sources, and the re-use of felled vegetation and salvaged habitat features. ▪ Fencing requirements for No-Go Zones. ▪ Management requirements for stockpiles, vehicle parking, machinery storage, other ancillary works. ▪ Pest management requirements. ▪ An adaptive management strategy and timing of regular review/updates. ▪ Further detail as provided in Section 9.1.1 below. • The BMP will also provide detail on survey requirements prior to micro-siting of infrastructure components within the development corridor and provide criteria that must be met to ensure there are no increase to biodiversity impacts as a result of micro-siting during detailed design.		
B9		• A BBAMP will be prepared to measure any operational impacts on bird and bat species, and ensure suitable mitigation and adaptive management strategies are implemented. The plan will: ○ Address the prescribed impacts associated with blade strike impacts and include trigger levels to manage impacts during operations. ○ Provide guidance and develop a framework for monitoring of impacts, including baseline and ongoing monitoring requirements, including for nesting sites on man-made structures. ○ Utilise survey data and complete statistical analysis of species, and develop triggers for number of species incidents. ○ Develop strategies on consultation with NSW DCCEEW (BCS) for reducing bird and bat collision risk.	Prior to construction – construction – operation.	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		○ Identify additional mitigation measures, further detailed in Section 9.1.2 below.		
B10		• Preparation of a Groundwater and Soil and Water Management Plan (or similar) that will: ○ Describe measures that will be employed to minimise soil erosion and the discharge of sediment and other pollutants from the site during construction and operation of the project. ○ Describe how water will be managed to achieve compliance with consent and EPL licence conditions. ○ Establish responsibilities and reporting requirements. ○ Establish surface water quantity and quality monitoring requirements. ○ Establish trigger action response plans to enable progressive improvement.	Prior to construction – construction – operation.	Proponent / Principal contractor
	Prescribed impacts			
B11	Turbine strike and barriers to movements	• All turbines considered high risk or greater, as initial shown in Section 6.3.3, or during adaptive management strategies, will be feathered at wind speeds below operational cut-in speeds as a form of proactive mitigation strategy to minimise the potential for turbine strike impacts. • Seasonal curtailment - During rare flood events, it is possible that habitat provided by larger ephemeral waterbodies may increase in area such that suitable habitat for 'at-risk' waterbirds occurs in close proximity to operational turbines. If this occurs, it is recommended that: ○ Monitoring of turbines within 500m of ephemeral waterbodies and creek lines increases during major flooding events. The criteria for what is considered a major flooding event would be determined during preparation of the BBAMP, but likely to be considered to be once extensive inundation of structures and roads occurs from prolonged rainfall within the Mabins Well locality. ○ Turbines may be curtailed to reduce the risk of turbine collision when suitable habitat occurs within 500m of a blade tip of a turbine during the flooding event. ○ End of curtailment would be determined via field survey confirmation that birdlife and habitat value had reduced significantly enough back to pre-flood conditions for operation of the turbines to not increase collision risk for 'at risk' species. Further information is provided in Section 9.1.2. • Consideration of an automated avian detection systems at high risk or greater turbines to allow for detection of bird species and the triggering of curtailment of high risk turbines, such as the IdentiFlight avian detection system (IDF), or other technologies, as a means of pre-emptively reducing any potential mortality events. Installation at the construction phase of the project, is	During construction - operation	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		expected to allow IDF to have captured enough data to be able to recognise target species such as Wedge-tailed Eagle with a high level of confidence. Further information is provided in Section 9.1.2. • Consideration of SMART (Song Meter with Analysis and Remote Transfer) system by Wildlife Acoustics for microbats at turbines within 500m of ephemeral Blackbox dominated vegetation. • Pest animal control to reduce the occurrence of foxes, cats and dogs, likely to scavenge microbat carcasses, potentially skewing the results or searches. • Establishment of lighting systems that reduce insect (prey) attraction. • Minimising availability of raptor perches on infrastructure within close proximity to turbines and overhead powerlines. • Prompt animal carcass removal within 200m of a turbine (within 24 hrs of discovery) to minimise raptor scavenging opportunities and reviewed annually. • Annual reporting requiring accounting for all events over the preceding 12 months and reinvestigation of the effectiveness of the current mitigation strategy. • Where blade strike impacts are found to occur, implement adaptive management strategies as outlined in Section 9.1.2 below.		
B12	Vehicle strikes	• Speed limit for construction vehicles along McLennons Bore Road, Fernbank Road, Wilsons Road and Goolgumbla Road, should be reduced to minimise increased risk of vehicle strike on fauna. • Speed limits within the subject land should be enforced for the life of the project. • Fauna species (particularly threatened species) susceptible to vehicle strike will be included in project inductions to increase knowledge of the wildlife occurring within the subject land. • A vehicle strike protocol, including details of local WIRES contacts will be created and made available to all staff. • Suitable speed limit reductions will be determined during preparation of the BMP.	During construction - operation	Proponent / Principal contractor
B13	Construction in waterways & removal of dams	• Construction within waterbodies will be preferentially undertaken when dry. • During the micro siting process, where possible, construction in wet areas including dams, drainage lines and creek lines should be avoided. • Where avoidance or undertaking works when waterbodies are dry is not possible, all areas containing water, e.g. dams, must be surveyed as part of the pre-clearance and clearing survey outlined in the CEMP including:	Prior to construction – during construction.	Proponent / Principal contractor

	Measures to mitigate and manage impacts	Action	Timing	Responsibility
		○ Engaging a qualified and licensed ecologist to be present during dewatering of farm dams, to undertake fauna relocation (e.g. turtles, frogs, etc.) into an appropriate nearby habitat. ○ Once dewatering is complete, dams are to be left for a minimum of 48 hours to allow species such as frogs and yabbies to naturally relocate. Where possible, dewatered dams should be left dry for a minimum of 1 week.		
B14	Fragmentation of movement corridors	• Investigate the establishment of Biodiversity Stewardship Sites in the immediate locality of the project to ensure local habitats outside the project are improved and conserved in perpetuity. • Ensure ongoing protection of roadside corridors as far as practicable and prevent indirect impacts through implementation of the BMP. • The following opportunities will be fully explored as a part of the detailed design: ○ Opportunities to further minimise the development footprint and clearing within important movement corridors for fauna. ○ Opportunities for post-works restoration of habitat connectivity within important movement corridors for fauna. ○ Areas subject to temporary disturbance will be rehabilitated using a native species planting schedule as much as practical considering any operational and safety constraints. ○ The total area exposed and cleared at any one time will be minimised and planned to allow for fauna movement during construction and periods of temporary disturbance	Prior to construction – construction.	Proponent / Principal contractor

9.1. Adaptive management strategy

Construction and operational management plans will all contain an adaptive management component. Adaptive management strategies will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and are key to the successful implementation of crucial objectives yet also allow flexibility to changing dynamics and ongoing feedback and results. This includes measures to monitor predicted and uncertain impacts which will trigger adaptive management actions and allow for effective and quick responses.

It is expected that an overall EMS would be developed with specific sub management plans that will entail an adaptive management strategy component. Those sub management plans in relation to biodiversity include but are not limited to a:

- Biodiversity Management Plan (BMP).
- Bird and Bat Adaptive Management Plan (BBAMP).

Adaptive management plans (or components of pans) will include the following key components:

- Framework and objectives.
- Baseline information.
- Monitoring methods, frequency and Before After Control Impact (BACI) design.
- Trigger-level and unacceptable impacts for further investigation and responsive adaptive management.
- Monitor and report on the effectiveness of impacts and trigger levels.
- Operational mitigation measures.
- Residual prescribed impacts, compensatory measures and additional offset calculation framework.
- Compliance management and summary.

9.1.1. Biodiversity Management Plan (BMP)

A BMP would be implemented demonstrating adaptive management strategies to ensure key milestones are achieved including the following project commitments:

- Measures will be implemented to protect vegetation and fauna habitat outside the development footprint, including minimising indirect impacts, especially to known threatened flora species and potential fauna species.
- Demarcation of retained areas of vegetation and particularly important mapped areas or potential optimal habitat for Plains Wanderer.
- Fauna monitoring and management protocols including identification and reporting of fauna mortalities to the relevant BCS office.
- Collection of detailed baseline weed data and ensuring no increase of key emerging weeds or invasive pests.

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- Commit to ongoing consultation on vertebrate pest control baiting programs working cooperatively with local landholders.
- Training and education awareness for all construction staff and operational staff on key threatened species, both flora and fauna, relevant to the region and project.
- Mapping and identification of individual tree hollows and stick nests and developing measures to minimise impacts to these features.
- Pre-clearing protocols, including pre-clearing inspections, establishment of exclusion zones and on-ground identification of specific habitat features to be retained and/ or relocated.
- Monitoring of soil and water controls to prevent indirect impacts associated with water pollution to all waterways.
- Clear performance targets and monitoring criteria.
- Corrective actions.
- Timing and responsibilities.

A recommended outline of the BMP is provided below with further details demonstrated within the mitigation measures listed in Table 83.

- Introduction
  - Background
  - Management scope and objectives
- Planning requirements
- Construction and operational activities
- Habitat management
  - Flora and fauna values
  - Soils
  - Weeds and pests (i.e. key emerging weeds and priority weeds)
  - Baseline data
- Environmental mitigation measure
- Site specifics
  - Inductions
  - Erosion /sediment control
  - Retained vegetation and rehabilitation works
- Adaptive management
  - Performance criteria, triggers, and responses
- Compliance management
- Review and Improvement

The BMP will also provide detail on survey requirements prior to micro-siting of infrastructure components within the development corridor and provide criteria that must be met to ensure there are no increase to biodiversity impacts as a result of micro-siting during detailed design.

9.1.2. Bird and Bat Adaptive Management Plan (BBAMP) Framework

Framework and objectives

The overall objectives of the BBAMP are to provide an effective monitoring program and strategy to manage and mitigate operational issues relating to bird and bat impacts for the wind farm, to monitor and assess for impacts considered uncertain at the time of approval, and prescribe additional compensatory measures for residual prescribed impacts, if required. Additionally, the framework aims to provide certainty to the consent authority and stakeholders prior to approval that measures for minimising biodiversity impacts during operation have been clearly defined that address potential prescribed impacts that cannot be quantified prior to approval.

Guided by the collision risk assessment and turbine risk assessment, and additional baseline data to be collected from within the subject land, a detailed BBAMP will be developed prior to operation of the wind farm, in conjunction with relevant stakeholders, to confirm adaptive management measures around the potential for collision mortality, barrier effects and behavioural displacement of select resident, nomadic and migratory bird and bat species. A draft BBAMP will be submitted during RTS, and once more detailed designs and turbine locations are known.

The Proponent will commit to mitigation measures that must be underpinned by a rigorous monitoring program involving at least three years of carcass searches, including those undertaken by conservation detection dogs when available, and a robust Trigger Action Response Plan (TARP). Therefore, a detailed BBAMP will be finalised in consultation with DPHI and NSW DCCEEW prior to commissioning of any turbines, however a framework of the key elements of the BBAMP is provided below, with some known specifics detailed within the mitigation measures listed in Section 9.

Baseline information

The BBAMP will include the existing baseline data on threatened bird and bat species as well as any non-threatened species considered to be at risk of collision impacts ('at-risk' species) from the project. One of the key objectives for the collection of detailed baseline data is to gather adequate replicable information on the existing bird and bat species abundance and activity (site utilisation) prior to commencement of operation of the wind farm. This baseline data was collected across two years and eight seasons, and utilised to form risk assessments and CRM presented in this BDAR. This includes the setup of impact zones and control zones that will continue to be monitored pre commissioning of turbines, during construction and during operation for an agreed period of time. The data collected is utilised to detect changes in the species use of the site (including changes in activity patterns such as avoidance) post-commissioning and during operation of the wind farm, and allow for stringent mitigation measures to be implemented as, and when, they are required.

Investigations of the site utilisation patterns of bird and bat species within the subject land have been established as a Before-After-Control-Impact (BACI) assessment design. It is important that bird and bat surveys continue once the wind farm becomes operational and that the survey methods used prior to construction are replicated such that results from before and after operation are appropriately comparable. As such the bird and bat utilisation survey points established, and monitored to date, will continue to be used through the implementation phase of the BBAMP.

Following commissioning of turbines, ongoing monitoring would mirror the baseline surveys, across all seasons, for three to five years following commissioning of the wind farm, dependent upon individual turbine risk and adaptive management.

Trigger-level and unacceptable impacts for further investigation and responsive adaptive management

In order to effectively measure impacts to any at-risk populations or species during the operation phase of the development, and to actively re-assess the suitability of turbine curtailment strategies the development of alerts, trigger levels and adaptive mitigation response to a potential event is required.

Triggers for responsive management actions will apply where the number of collisions per annum represents a low, but uncertain potential to result in a negative effect on the local population of a species. This is a precautionary objective, as it will be implemented at levels substantially below numbers of collision mortality events that are considered likely to represent a significant impact on the viability of the overall population of any species.

The following definitions (Table 84) are considered a trigger-level alert and if realised would warrant an increased focus on areas of concern if they were to occur.

Table 84 General investigation and monitoring triggers for Bird and Bat strike – Tier 1 alert

Tier	Type	Trigger	Mitigation
Tier 1 alert	Threatened species	• Where any carcass; feather spot; or injured individual (likely caused as a result of turbine collision) is found under or close to (within 200m, or 2x blade length) a wind turbine during any single mortality search or incidentally by wind farm personnel.	Tier 1 mitigation instigated
	Non threatened 'at-risk' species	• Where three or more carcasses; feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (within 200m, or 2x blade length) a wind turbine during any single mortality search or incidentally by wind farm personnel.	
	Other protected species	• Where ten or more carcasses; feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (within 200m, or 2x blade length) a wind turbine during any single mortality search or incidentally by wind farm personnel.	

The following definitions (Table 85) are considered an unacceptable impact and require detailed investigation and stringent temporary or permanent mitigation should they occur.

Table 85 Unacceptable impacts – Tier 2 and Tier 3

Tier	Type	Trigger	Mitigation

Tier 2 impact	Non threatened 'at-risk' species	• Where population* numbers are known;
		  ○ Any impact that is likely to reduce the total species' population by more than 1% over a two year period; or
		• Where population numbers are not known;
		  ○ Five or more carcasses of one non-threatened at risk species identified in the tables in BDAR Section 6.2.3 are found under or close to (within 200m, or 2x blade length) a
			Tier 2 and 3 mitigation instigated

Tier	Type	Trigger	Mitigation
		wind turbine within a two month cycle** or during incidental searches. • Where three or more Tier 1 alerts are triggered in a six month period.	
Tier 3 impact	Threatened species	• Where population* numbers are known; ○ Any impact that is likely to reduce the total species' population by more than 1% over a five year period; or • Where population numbers are not known; ○ Any impact where three or more carcasses, feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (within 200m, or 2x blade length) a wind turbine within a two month cycle** or during incidental searches. • Where four or more Tier 1 alerts are triggered in a six month period.	

*'Population' relevant to the operation of the wind farm will be determined (where possible) in consultation with BCS via a detailed monitoring plan, and based on baseline and ongoing utilisation survey data and dependent on a species by species basis.

**A two month cycle is the search of all turbines split across a two month period i.e. 100 turbines in one month, the remaining 100 the following month.

A detailed decision framework will be included for triggers and mitigation (in conjunction with the below mitigation framework) associated with both the threatened and non-threatened at-risk species during the development of the BBAMP, and will be finalised prior to commissioning of turbines.

Monitor and report on the effectiveness of impacts and trigger levels

Purpose-trained dogs have been shown to be highly efficient at detecting carcasses (Mathews *et al.* 2013) and have been used for this purpose at a number of wind farms in in Australia. Using purpose-trained dogs obviates the need for formal transects to be established in the search zones as dogs use scent to detect carcasses and are permitted to roam to do so. Every dog will be fitted with a GPS tracking device while undertaking searches. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing routes taken by dogs will be made available to NSW DCCEEW on request. The use of trained dogs is the preferred method for searches and will be used, provided appropriately trained dogs and handlers are available. Dog handler(s) must have demonstrated capacity to identify bird and bat species of NSW. As far as practicable, a target of at least 50% of the required annual carcass searches will be undertaken by purpose-trained dogs.

However, if the use of dogs is not practicable or are unavailable for the project the alternative is to engage suitably trained ecologists or environmental officers. Observers will search by walking transects through the potential fall zone, in this case, an estimated 200 meter radius, and a repeated 100 meter pulse search. Searches will be undertaken by persons with demonstrated capacity to identify bird and bat species of NSW and relevant to the subject land. Transects will be spaced 6 meters apart, or as near to 6 meters as is practical, and observers will thus search the ground for 3 meters either side of each transect. Each observer will carry a hand-held GPS unit and record transects they walk. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing transects walked and will be made available to NSW DCCEEW on request.

It is proposed carcass searches be undertaken in accordance with the schedule in Table 86, pending adaptive management, triggers and introduction or amendments to mitigation measures.

Table 86 Monitoring requirements for carcass searches

Turbines	Monitoring schedule
All	• Monthly for the first six months following commissioning of turbines, however, must include the first spring/summer season following commissioning of turbines, and therefore may be extended in duration, including follow up pulse searches*.

Low and Moderate risk	• Over a two month cycle**, from six months up to three years following commissioning of relevant turbines, monthly searches in a randomised order including:
	  ○ 200m search area around relevant turbines, with a follow up 100m pulse search from October to March (6 in total).
	  ○ 200m search area around relevant turbines, with no pulse searches required from April to September (6 in total).
	• Three years after commissioning of relevant turbines, a review of sampling frequency will be undertaken to inform adaptive management.

High risk and Very High risk	• Over a two month cycle**, from six months to a minimum of five years following commissioning of relevant turbines, monthly searches in a randomised order including: ○ 200m search area around relevant turbines, with 100m pulse searches throughout. • From five years following commissioning of relevant turbines, sampling frequency thereafter will be informed by a series of scavenger surveys and adaptive management.

*A 'pulse search' is a secondary search undertaken from three to seven days following the primary search to detect additional mortality of bats and birds.

**A two month cycle is the search of all turbines split across a two month period i.e. 100 turbines in one month, the remaining 100 the following month.

It is considered that ensuring all turbines are regularly monitored, rather than focusing on a subset of turbines, will better suit adaptive management objectives of the BBAMP, including ensuring correct ongoing risk ratings for each operational turbine.

It is likely (but uncertain at present) that carcasses of bats and small birds will be scavenged quickly within the subject land. Carcass persistence trials will be undertaken during the course of the operational monitoring, and prior to its commencement, particularly to inform analyses required to extrapolate from numbers of carcasses detected to estimate total number of collisions. In order for the search regime to accommodate the likelihood of rapid scavenging, a relatively short period between initial searches is important.

Remote cameras will be used to record persistence of carcasses placed on-site within representative turbine locations and differing habitats. A total of 10 carcasses of birds and 10 carcasses of bats will be distributed under 50 turbines (25%) across the wind farm. Carcasses for the trials will be sourced from bird and bat carcasses found at the site or from other local sources, such as roadkills. It is vital that species used are representative of the bird and bat fauna within the subject land. However, if the collection of carcasses is lower than the requirement for scavenger trial, carcasses will be supplemented with proxies in accordance with the provided approval of NPWS. Trials to determine persistence time of carcasses are required to derive correction factors necessary to estimate total fatalities from the results of the carcass searches. Two persistence trials will be undertaken in each year of the monitoring regime (minimum of three years), one in each of spring and summer/autumn.

Further details on carcass searches/monitoring, persistence trials, incidental finds and data analysis are included in the detailed BBAMP.

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Carcass searches/monitoring and carcass persistence trials will also be completed in conjunction with searcher efficiency trials, of which two will be conducted per year for the first three to five years of monitoring. Searchers do not routinely find all carcasses, so it is necessary to ascertain the efficiency of searches in order to determine and apply appropriate correction factors for carcasses missed to inform estimation of total collision mortality for species of concern.

Operational mitigation measures

It is not feasible to foresee what potential factors might lead to an unexpectedly high level of collisions by any species, and therefore appropriate mitigation measures can be prepared only if a cause, or causes, of ecologically significant impacts on the relevant species is known. Additionally, flexibility in mitigation shall be designed to encourage the implementation of innovative and new technologies over the operational life of the wind farm where appropriate.

If a cause is not readily apparent, then investigation of the reason(s) for the impact must be undertaken prior to proposal of a mitigation strategy. Advice from NSW DCCEEW will be sought with regard to design and implementation of any such investigations and of an ultimate mitigation strategy, if required. NSW DCCEEW will be notified within two working days of determination by the wind farm operator or the contracted qualified ecologist that a trigger level or unacceptable impact for any species of concern is detected.

The BBAMP will detail considerations of mitigation measures to reduce the number of Tier 1, Tier 2 and Tier 3 impacts. Broadly, these will include general mitigation measures and specific trigger related mitigation, including but not limited to, those demonstrated in Table 87 below.

Table 87 Consideration of likely required mitigation measures

Type	Mitigation considerations and response

General	• All high risk or greater turbines will be feathered to prevent free-wheeling prior to predetermined cut-in speeds (i.e. prior to energy generation), adjusting their angle so they do not minimise force that would cause the rotor to spin.
	• Ongoing reassessment of species risk levels and thus relevant trigger-levels.
	• Periodic review of the turbine curtailment strategy and monitoring program every two years.
	• Incorporate any operation mitigation measures developed during the preparation and implementation of the BMP relating to active nests / nest trees.
	• Minimising availability of raptor perches on infrastructure within close proximity to turbines and overhead powerlines.
	• Installation of marker balls, flags or rotating markers on transmission lines to prevent collisions and determine perching.
	• Prompt animal carcass removal within 200 m of a turbine (within 24 hrs of discovery) to deter raptor scavenging opportunities and reviewed annually.
	• Participation in local (site based) and co-ordinated (LLS and NPWS) feral animal control programs, i.e., rabbits, wild dogs and foxes, and in line with carcass removal protocols.
	• Investigation of potential deterrents or evolving technologies, such as:
	  ○ Ultrasonic technologies, such as the SMART (Song Meter with Analysis and Remote Transfer) system by Wildlife Acoustics (see further detail below).
	  ○ Consideration of radar (or optical sensor) or live camera technologies for automatic, reactive and temporary curtailment of turbines, such as IdentiFlight avian detection system at high risk turbines (see further detail below).
	  ○ Avoiding or limiting the use of artificial lighting (synchronising flashing red light if required) on turbines and other infrastructure within close proximity to turbines.

Type	Mitigation considerations and response
	○ Consider novel deterrent techniques related to blade visibility (i.e., painting one blade a different colour). ○ Use of 'acoustic lighthouse' to deter avian activity by broadcasting, for example, audible frequencies of 4 – 6 kHz in front of turbine towers to encourage avoidance behaviour (as detailed in Boycott et al 2021). • Annual reporting to include triggers relating to the re-assessment of the mitigation strategies to be implemented over the following year of operation where tier 1 and/or tier 2 and 3 triggers have occurred. ○ Additional triggers will be developed that consider the actual/extrapolated impacts to bird and bat species calculated across the preceding year, and include associated mitigation measures and potential additional offsets for the following year of operation.
Tier 1 Alert mitigation and response	Initiate rapid assessment framework for tier 1 alerts within the BBAMP to identify the most effective mitigation measures to be implemented, including but not limited to: • Increased monitoring of a relevant turbine(s) for a seven day period following a tier 1 alert to determine a one off event, or a potential ongoing event. • Increased frequency of carcass removal, or increased use of other methods of deterrence. • In the case of at risk or threatened species nesting within 200m of an operational turbine blade tip, the nesting event will be allowed to occur, with increased monitoring, potential for temporary curtailment in line with tier 2 and tier 3 recommendations until removal of the nest following the breeding event can be undertaken. Any mitigation is to be consistent with project approval conditions. • The assessment is to determine possible causes of alert and identify if additional mitigation is required.
Tier 2 and 3 mitigation and response	Initiate rapid assessment framework for tier 2 and tier 3 triggers within the BBAMP to identify the most effective mitigation measures to be implemented. • Consider temporarily ceasing operation of a turbine(s) relevant to a trigger event during the rapid investigation. • Increased daily carcass searches for 14 days following discovery of a tier 2 or tier 3 trigger, to be undertaken within the subsequent four weeks of the trigger event by suitable trained ecologist, environmental advisor and/or detector dog services. • Consideration of detergents such as of 'acoustic lighthouses' (or similar mobile technology) for a minimum seven day period for automatic, reactive and temporary curtailment of turbines relating to a Tier 2 or 3 alert. • The assessment is to determine possible causes of the impact and identify the additional mitigation measures required to be implemented to minimise recurrence of the impact (as far as is practicable). Pending an investigation into tier 2 and tier 3 impacts being detected, the following may be required in consultation with the Proponent, suitably qualified ecologists, wind farm subject matter experts and NSW DCCEEW; • Implementation, increase, or re-location of collision risk reduction technologies such as SMART curtailment (microbats) or Identiflight or other avian detection systems (large birds). • Implementation of low-wind speed or nocturnal curtailments to reduce the potential for microbat collision during periods of highest activity. • Consideration of increased cut-in speeds for microbats impacts. • Temporary turbine shut down during periods of low visibility (i.e. fog), if suspected as the cause of collision(s). • Short-term seasonal shutdowns (e.g. based on migratory periods, ephemeral wetland flood events, or nesting events). For example in the case of at risk species or threatened species

Type	Mitigation considerations and response
	nesting within 200m of a turbine, the nesting event will be allowed to occur, with increased monitoring and/or temporary curtailment). • Short-term seasonal shutdowns following a tier 2 or tier 3 alert where there is a delay in getting the necessary personnel to site to undertake increased turbine monitoring. • Immediate reassessment of current curtailment strategy being implemented and if required adjustment (or inclusion if not being implemented for the specific turbine) to reduce the potential for reoccurrence of the unacceptable impact. This reassessment may be required on a temporary or permanent basis.

The need for adjustments to the mitigation strategy will be determined through regular monitoring on the efficacy of the current strategy (as prescribed in the BBAMP). Adjustments may include additional curtailment measures if an unacceptable number of strikes are found to occur, however the option to reduce the level of curtailment will also be prescribed, if sufficient evidence can be provided that it is safe to do so. Such evidence may include few, to no, recorded bird/bat strikes at a given turbine, combined with a comparison to the results of a trial period of reduced curtailment. As such, turbines currently assessed as low risk of impact may become curtailed in the future, or those turbines currently considered to present a moderate risk of impacts may be removed from the curtailment strategy, or have curtailment strategies increased. All such changes would be guided by the monitoring and adaptive management processes outlined in the BBAMP.

Detailed monitoring on the efficacy of the mitigation strategies, including proactive mitigation and responsive management triggers, has been committed to by the Proponent, as is detailed herein. This includes a schedule of proposed carcass searches utilising trained sniffer dogs (when available) focusing on an intensive search period over the initial six months of operation (must include the first spring/summer season) whilst animals habituate to the presence of the turbines. This is then followed by regular ongoing searches of all turbines for a period of three to five years, and then ongoing based on the results of the searches. Triggers have been developed and committed to, which based on the results of the carcass searches, will ensure that mitigation strategies (scaled based on the severity of the trigger) are promptly implemented and will arrest the occurrence of any unacceptable events (i.e. strikes). Mitigation strategies include the ongoing opportunities for alternative actions to turbine curtailment such as audible and ultrasonic noise broadcasting to create avoidance behaviour, or the use of radar to induce turbine shutdowns, with such technologies expected to develop greatly over the life of the project.

SMART curtailment

'Blanket curtailment' approaches although often successful in reducing bat fatalities, also result in a reduced energy generation capacity and often coincide with periods of high electrical demand thus rendering them potentially unsustainable in the long-term for many wind generation operations.

In an attempt to reduce bat fatalities while optimizing energy production, more tailored strategies can be developed to increase the time during which turbines can continue operation and power production relative to blanket operational mitigation approaches. 'Smart curtailment' approaches are being developed that use and combine information about real-time bat activity and environmental information, such as weather conditions, in order to guide curtailment decisions based on real-time risks to bats. Smart curtailment provides wind energy facilities with a pathway for reducing bat fatalities whilst also reducing curtailment time when compared to blanket curtailment techniques thereby maximising energy production whilst minimising impacts to bats.

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Studies trialling the approach overseas have achieved significant reductions in bat mortality without the need for blanket curtailment of turbines at lower wind speeds (Hayes et al. 2019). However, there are no comparable studies available for Australian wind farms. Furthermore, overseas studies have often been used in conjunction with automated bat call identification software, which is not currently available for Australian bat species. Automated identification allows bat calls to be identified to species level in real-time and in a consistent, repeatable and time-efficient way.

Recent technological advances have seen the release of smart curtailment systems that are considered applicable to the project. For example, the SMART (Song Meter with Analysis and Remote Transfer) system by Wildlife Acoustics, allows ultrasonic detectors to be mounted to the nacelles of turbines and files containing probable bat call information to be transmitted in real-time via modems and the cellular network to a database system where the information can then be analysed. The SMART system allows for user defined alarms which match bat call parameters that can be directly input into curtailment decision-making processes in real-time. Technology such as the SMART system provides real potential for a tailored curtailment approach for the project that would provide operational flexibility in allowing turbines to continue producing energy when they might otherwise be curtailed based only on wind speed information.

When the smart curtailment acoustic monitoring system is engaged, real-time monitoring of microbat activity would allow turbines to be curtailed when bat activity reaches a pre-determined threshold. The SMART curtailment acoustic monitoring system can also be switched off when wind speeds reach thresholds above which bat activity (and therefore collision risk) are considered to be negligible. Under these circumstances, electricity generation would proceed without intervention until wind speeds fall below the pre-determined threshold. This approach has been the subject of a study by Hayes et al (2019) that found implementing a similar acoustic monitoring and remote curtailment system when wind speeds were below 7.9 m/s, without the use of blanket low wind speed curtailments, reduced bat fatalities by 85 %.

Technologies such as the SMART system will be included in the BBAMP as possible mitigation strategies available to the operational project if an unacceptable level of impacts to bats was found to be occurring.

Automated avian detection systems

Technology related to smart curtailment systems for birds are also advancing at a rapid rate. Automated avian detection systems allow for detection of bird species and the triggering of curtailment of select turbines. The IdentiFlight avian detection system (IDF) was designed in the USA specifically to reduce Golden Eagle mortalities on wind farms, with testing suggesting that use of the system has achieved an 85 percent reduction in eagle fatalities at a wind farm site in Wyoming, USA (McClure et al. 2022).

The IDF system combines high-precision optical technology with artificial intelligence to detect raptors and other protected bird species within a 1 kilometre range. The IDF System tracks the movement of objects within its range, and quickly determines whether any objects are birds, and can learn to recognise key species of interest such as eagles. If a bird of interest is identified, the system begins to track the target, recording its position, predictive trajectory, and course probability relative to turbines in real time. Curtailment conditions are pre-determined, and if the target is predicted to cross into the rotor swept area of a turbine, the IDF Base Station issues a signal to the wind farm SCADA (supervisory control and data acquisition) system, which sends control signals to curtail relevant turbines to avert any collision. The system provides the visual and quantitative data needed to reduce or avoid collisions, but does not detect or document the collisions *per se*. This requires a carcass monitoring program, which is detailed above.

Unlike radar and other technological approaches to automated curtailment for birds, what distinguishes the IDF system is its ability to recognise different species and make curtailment decisions based on target species.

Assessment of the effectiveness of the IDF system in Australia, at the Cattle Hill Wind Farm in Tasmania (Goldwind 2022), concluded that IDF significantly reduced eagle collisions at the site. Furthermore, the data collected from the IDF system has provided detailed monitoring information on avifauna activity, and valuable insights into the understanding of eagle behaviours. The volume and quality of information captured by IDF is considered far more comprehensive than what is possible using traditional bird survey methods conducted by human observers.

For the IDF system to work accurately, it requires a large volume of bird images to be collected and classified to build a convolutional neural network that allows the system to recognise target species accurately, and minimise false triggers. It is therefore not suitable as a reactive management approach, but a means of pre-emptively reducing any potential mortality events. If installed early in the construction phase of the project, by the time wind farm operations commence IDF is likely to have captured enough data to be able to recognize target species such as Wedge-tailed Eagle with a high level of confidence, and may also be able to group other bird species that have similar morphological characteristics based on their wingspan and dimensional data. The IDF curtailment prescription relevant to the site could also be adjusted as additional knowledge of eagle populations utilising the site is gained through the IDF system.

The commissioning stage is also likely to be the highest collision risk period for eagles, being the first time they will encounter the operational turbines, therefore having the IDF system (or its more advanced equivalent) tested and validated as fully operational by the time operations commence is almost certainly going to reduce future mortalities.

The effectiveness of the system is likely to vary between sites and performance will be dependent on site topography, vegetation, wind farm layout and the number of IDF towers able to be accommodated within the wind farm footprint. A detailed implementation plan would need to be developed to ensure that the system could work effectively for the project.

IDF is far from the only new and emerging technology available to operational wind farms to reduce potential bird and bat collisions. A recent peer-reviewed paper published by Orsted (an offshore wind energy developer) and DHI (a water software development and engineering firm) provides a catalogue and assessment of available monitoring technologies for flying birds and bats at offshore wind farms in operation, with a focus on managing the risk of collision (Skov et al. 2023). Whilst the focus of the paper relates to offshore wind farms, the technologies reviewed have application potential onshore, and for the project. The assessment includes a comparison of the multiple applications for the following technologies:

- Radar (2D and 3D).
- Digital camera.
- Accelerometer.
- Acoustic equipment.
- Large-scale survey platform and large-scale telemetry.

		Implementation			Density		Species				Avoidance			Collision	
Type	Equipment	Retrofit	Installation Complexity	Cost of equipment	Flux outside OWF[1]	Flux inside OWF[1]	Distribution and behaviour	Species id	Flight speed	Flight height	Macro avoidance	Meso avoidance	Micro avoidance	Collision rate	Shutdown
Radar	3D Radar[2]	●	▼	▼	▲▲	▲▲	▲	▼	▲▲	▲▲	▲▲	▲▲	▼	▼	▲
	2D Radar[2]	●	▼	●	▲▲	▲▲	▲	▼	▲▲	-	▲▲	▲▲	▼	▼	▲
	Radar coupled to camera[2]	●	▼	▼	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲	▲▲
	Radar with fixed antenna[2]	●	●	●	●	●	▼	▲	●	-	▲	▲	▼	▼	●
Camera	Fixed camera[2]	▲	▲	▲	-	-	▼	▲	▼	-	▼	▼	▲▲	▲▲	●
	Dome with multiple fixed cameras	●	●	▼	-	-	▲▲	▲▲	▼	-	▼	▼	▲▲	▲▲	●
	Moving camera	▲	▲	●	-	-	▲▲	▲▲	▼	-	▼	▼	▲▲	▲▲	●
Other	Accelerometer as single sensor	▼	▼	▼	-	-	-	-	-	-	-	-	-	●	-
	Accelerometer coupled to camera	▼	▼	▼	-	-	-	-	-	-	-	-	-	▲	-
	Microphone[2]	▲	▲	▲▲	-	-	-	▲▲	-	-	-	-	-	-	●
Survey Platform	Ship-based surveys	-	-	▼	●	●	▲	▲▲	-	▲▲	▲▲	●	▼	▼	▼
	Aerial visual surveys	-	-	▼	▼	▼	●	▲▲	-	▲▲	▲▲	●	▼	▼	▼
	Aerial digital surveys	-	-	▼	▼	▼	●	▲▲	-	▲▲	▲▲	●	▼	▼	▼
	UAV/drone surveys	-	-	▼	▼	▼	●	▲▲	-	▲▲	▲▲	●	▼	▼	▼
Telemetry	Radio transmitters	▼	▼	●	▼	▼	▲▲	▲▲	▲▲	▲▲	▲▲	●	▼	▼	▼
	Satellite transmitters	▼	▼	●	▼	▼	▲▲	▲▲	▲▲	▲▲	▲▲	●	▼	▼	▼
	Archival tags	▼	▼	●	▼	▼	▲▲	▲▲	▲▲	▲▲	▲▲	▼	▼	▼	▼
	Acoustic telemetry	▼	▼	●	▼	▼	▲▲	▲▲	▲▲	-	●	▼	▼	▼	▼
	Very good	▲▲													
	Good	▲													
	Average	●													
	Bad	▼													
	Not Available	-													

Plate 1 **Scoring system applied in the assessment of monitoring technologies (Skov et al. 2023)**

Plate 1 provides an overview of the results of the comparison and provides insight into the suitability of the various technologies available depending on the desired application and mitigation requirements. The paper goes on to recommend the combination of technologies that best meet the aims of the mitigation. For example, if the mitigation objective was to shut down a turbine to prevent collision with a certain highly at-risk species, Skov et al (2023) recommend the following (Plate 2).

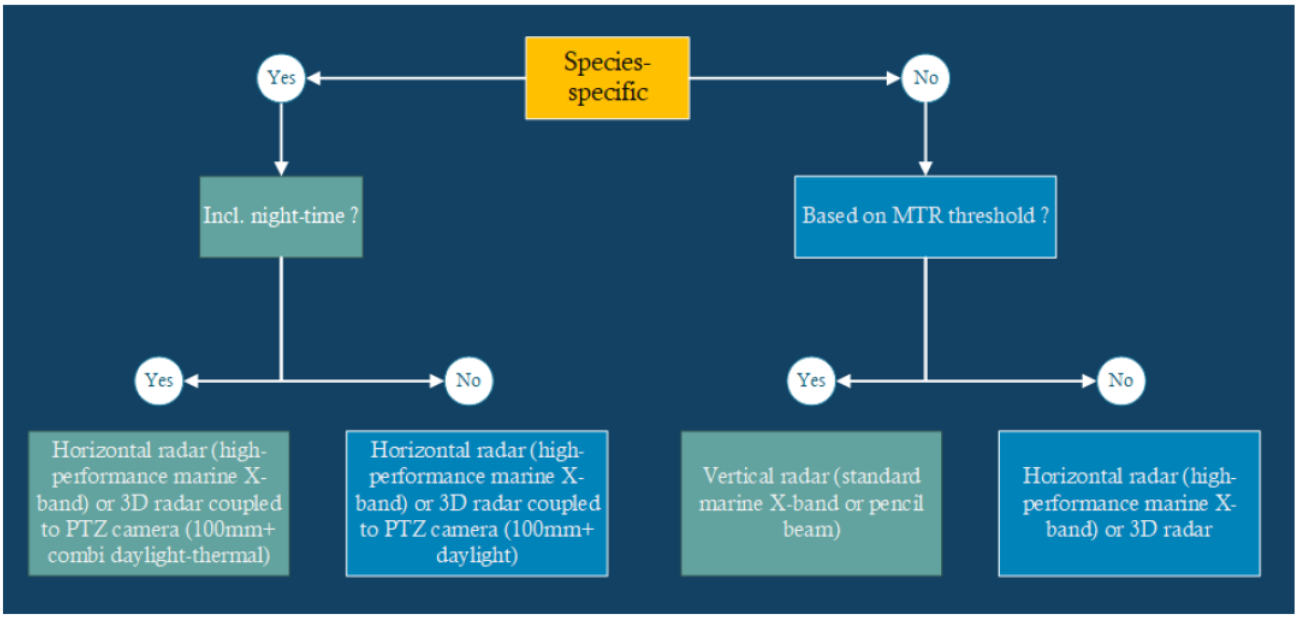


Plate 2 **Recommended solution for turbine shutdowns (MTR is migration traffic rate, and relates to birds flying per hour, per kilometre).**

The applicability and use of automated detection systems for the project requires further critical assessment, which will be undertaken during the finalisation of the BBAMP. However, assuming the site is suitable for installation of such technologies, automated detection systems may be a valuable method to avoid potential collisions for at-risk species. The effectiveness of any installed automated system would be monitored using carcass search methods as detailed above.

Further effective mitigation strategies that will be considered further as part of the BBAMP include pest animal control to reduce the occurrence of foxes, cats and dogs, likely to scavenge microbat carcasses, potentially skewing the results of searches, establishment of lighting systems that reduce insect (prey) attraction, and annual reporting requiring accounting for all events over the preceding 12 months and reinvestigation of the effectiveness of the current mitigation strategy. In the event of trigger level investigations being required, the Proponent has committed to increased carcass searches to determine the actual severity of the event, potential temporary turbine shutdowns (while the investigation is underway), re-assessment of existing low-wind speed curtailment strategy, and ultimately greater curtailment of turbines if unacceptable events are found to be re-occurring.

The proponent is prepared to work with authorities to share data and continue to contribute to the growing body of literature around bird and bat collisions at operational wind farms. Operational monitoring and adaptive management will ensure that any unacceptable events that may occur are captured and mitigated, thus providing an ongoing feedback loop to further reduce the potential for the project to result in substantial operational impacts to bird and bat species and populations.

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Seasonal curtailment

A key strategy to minimise the potential for at-risk waterbird and other nomadic species, such as Australasian Bittern, to collide with operational turbine blades is the implementation of increased monitoring during rare flood events.

Flooding events, such as that observed within 2022, may occur every 5 - 7 years, and it is possible that habitat provided by larger ephemeral creeklines and waterbodies may increase in area such that suitable habitat for at-risk waterbirds occurs in close proximity to operational turbines. Across the lifespan of the project currently, it is anticipated that these events could occur up to three times. During these events, it is proposed to;

- Increase monitoring of turbines within 500m of ephemeral waterbodies and creek lines during flooding events.
- Turbines may be curtailed to reduce the risk of turbine collision when suitable habitat occurs within 500m of a blade tip of a turbine during the flooding event.
- End of curtailment would be determined via field survey confirmation that birdlife and habitat value had reduced significantly enough back to pre-flood conditions for operation of the turbines to not increase collision risk for at risk species.

Finalisation of the BBAMP will include details of catchment-scale flood event monitoring requirements that would trigger additional monitoring of habitats in proximity to the project.

Residual prescribed impacts and compensatory measures

Following implementation of required mitigation, additional offset requirements for prescribed impacts may be required to offset residual impacts in accordance with the BAM. This may be achieved via the retiring of credits or payment to the Biodiversity Conservation Fund. The amount of credits required to be offset would be calculated by the number of actual and modelled impacts, accounting for scavenger impacts, to individual species in a given year, multiplied by the biodiversity risk weighting (BRW) for the relevant species. This method is commensurate with Equation 3 (Section 10.1.3) of the BAM for calculating species credit requirements for flora species assessed by a count of the number of individuals, which is aligned with the calculation of offsets required for impacts to individual bird and bat strikes. This method also captures the relevance of a current threatened listing for a species, and is in accordance with the expectations of BAM implementation for prescribed impacts (Section 8.6 of the BAM).

Where an unacceptable impact to a non-threatened 'at risk' species is encountered or estimated, following mitigation, then a like for like risk weighting may be applied from a similar threatened species i.e. – Wedge-tailed Eagle to Little Eagle, following consultation with NSW DCCEEW. Any credit generation required to offset residual prescribed impacts would be calculated during the annual reporting, which will also demonstrate that credits required for the preceding 12 months have been retired under the BOS.

Monitoring and adaptive management triggers for barrier effect impacts

Whilst the focus of the above section is on mitigation of the impacts associated with collision risk, it is acknowledged that there remains some potential for impacts associated with barrier effects for threatened and/or at-risk species. During operational monitoring, if there is a noted discernible statistical reduction or anomaly in abundance of an at-risk or threatened species, additional investigations into possible causes would occur. If it is determined that the operational wind farm was a key factor, additional assessments against key relevant Test of Significance criteria or Significant Impact Criteria would be used to quantify or

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measure the level of impact. If these assessments determined that an event resulting from barrier effects warranted additional mitigation, compensatory measures or species specific offsetting, these would be employed. This detail and decision framework is to be provided within the finalised BBAMP.

9.1.3. Mitigation cost estimates for significant impacts and management plans

Costs of mitigation as result of significant impacts from the project will be included in the BMP once final designs are known and post approval.

10. Impact summary

10.1. Direct and indirect impact to biodiversity values

The project is expected to impact upon the following biodiversity values:

- 10 native PCTs mapped as 17 separate vegetation zones, and 29 scattered paddock trees.
- Two BC Act listed TECs – Weeping Myall woodland and Sandhill Pine Woodland.
- Two EPBC Act listed TEC – Weeping Myall woodland and Natural grasslands of the Murray Valley Plains
- Assumed habitat for threatened flora and forest owl species credit species.
- Small impacts to habitat for recorded threatened *Swainsona* species, *Swainsona murrayana* and *Swainsona sericea*.
- Small linear impacts and minor fragmentation of important mapped areas for Plains wanderer, in conjunction with impacts to potential future habitat within dynamic grassland communities.
- Known forage and assumed breeding habitat for two fauna species credit species – Superb Parrot and Southern Bell Frog.
- Known and predicted habitat for a range of fauna ecosystem credit species.
- 35 species of bird and bat considered at risk of operational impact mainly associated with turbine strike.

As detailed in the above section of this BDAR, the proponent has undertaken significant efforts to avoid and minimise impacts to all biodiversity values present within the subject land, and the residual impacts to the above listed biodiversity values will continue to be minimised, mitigated and offset through the duration of the project.

No direct or indirect impacts are expected to occur as a result of the project to the Oolambeyan National Park or the South West Woodland Nature Reserve.

10.2. Serious and irreversible impacts

In accordance with Clause 6.7 of the BC Regulation an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

(a) Principle 1: It will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.
(b) Principle 2: It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.
(c) Principle 3: It is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.

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(d) Principal 4: The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

Four species considered to meet the above principles that may be impacted by the project are:

- Plains Wanderer *Pedionomus torquatus.*
- Austral Pillwort *Pilularia novae-hollandiae.*
- Claypan Daisy *Brachyscome muelleroides.*
- Bindweed *Convolvulus tedmoorei.*

Detailed SAII assessment is provided in Appendix 5. A summary of the results of the SAII is provide below in Table 88.

Table 88 SAII Summary

SAII entity	Summary of assessment
Austral Pillwort *Pilularia novae-hollandiae*	Surveys for *Pilularia novae-hollandiae* were interrupted by flooding events in Spring 2022 and subject to further survey in November 2023. No individuals were recorded to date in optimal areas of microhabitats. Further survey will be undertaken in November 2024 in targeted areas of habitat within the development corridor. Small areas of assumed presence are currently included within this BDAR of 8.78 ha in total. The majority of assumed presence occurs as a result of Stage 2. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the development corridor considered potential habitat including within seasonally damp situations such as shallow depressions and on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland. This has resulted in multiple revisions of the development corridor and footprint as demonstrated in Section 7. This species prefers seasonally moist grey gilgaied soils on the floodplains within PCTS such as PCT 13, PCT 15, PCT 17, PCT 45 and PCT 46, which occur within the development corridor, as well as areas of PCT 26, where it occurs with slight variations in microrelief on more gilgaied grey clay soils. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 8.2, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Claypan Daisy *Brachyscome muelleroides*	*Brachyscome muelleroides* has been surveyed for throughout the development footprint in September and November 2022 and September and November 2023 and has not been recorded. Limited spatial gaps in survey effort do occur in areas based on more recent design refinements, as well as flooding impacts, and will be subject to further survey in September and November 2024. However, overall, the amount of survey undertaken is representative to the size and requirements of each vegetation zone where habitat for this species is present. In terms of avoidance, detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the development corridor considered potential habitat including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers seasonally moist grey gilgaied soils on the floodplains within PCTs such

SAII entity	Summary of assessment
	as PCT 45 and PCT 46, which occur within the development corridor. Majority of impacts to these PCTs result from Stage 2 of the project. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 8.2, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Bindweed *Convolvulus tedmoorei*	*Convolvulus tedmoorei* has been surveyed for throughout the development footprint despite being impacted by flooding in spring 2022, within surveys conducted in September 2022 and September 2023 and has not been recorded. Further survey will be undertaken in November 2024 in targeted areas of habitat within the development corridor. Small areas of assumed presence are currently included within this BDAR of 3.13 ha in total. In terms of avoidance, detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas of grey clay soils as far as practicable. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers grey clay soils on the floodplains of the Darling and Murrumbidgee Rivers within PCTs such as PCT 17, PCT 24, PCT 26, PCT 45 and PCT 46, which all within the development corridor. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 8.2, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Plains Wanderer *Pedionomus torquatus*	Throughout the development of the project layout, design decisions have been implemented to avoid impacts to Plains Wanderer habitat from a very early stage. This includes the avoidance of areas of Important Mapped Habitat as far as practicable, and restricting development to only 4.02 ha of important mapped area. In total, there is 645 ha of important mapped area in the subject land, and 11.8 hectares within the development corridor. In total, the development footprint equates to 0.62% and the development corridor equates to 1.8% of the total area of mapped important habitat within the subject land. Some of these impacts (0.99 ha) relate to road upgrades and transmission line infrastructure proposed along Goolgumbla Road, an existing public road, or upgrades to existing farm access tracks that intersect with mapped important habitat. Due to the dynamic nature of the grasslands critical to this species, areas within the subject land may be suitable for this species in the future, however, the most optimal areas have been avoided within the development footprint as far as practicable. Supplementary surveys undertaken in April 2023 did not detect this species, however, based on extent of occurrence, the area of occupancy and carrying capacity, the overall subject land could potentially support 4 pairs of birds. Additional surveys for Plains Wanderer focused on identifying grasslands outside of NSW DCCEEW Mapped Important Areas that nonetheless contained similar structural characteristics to these areas. At the time of surveys (April 2023), limited areas of the grasslands observed were considered optimal within the development corridor, including the nearby Mapped Important Areas, where minimal areas contained optimal habitat structure. This is considered an effect of the dynamic nature of Riverine grasslands responding to above average rainfall conditions and flood events in the Spring 2022, create above average grass cover coverage generally through the broader locality. Indirect impacts associated with disruption or abiotic process, the loss of functionally important species, and/or exacerbation of fragmentation and isolation are considered unlikely to be substantial as a result of the project.

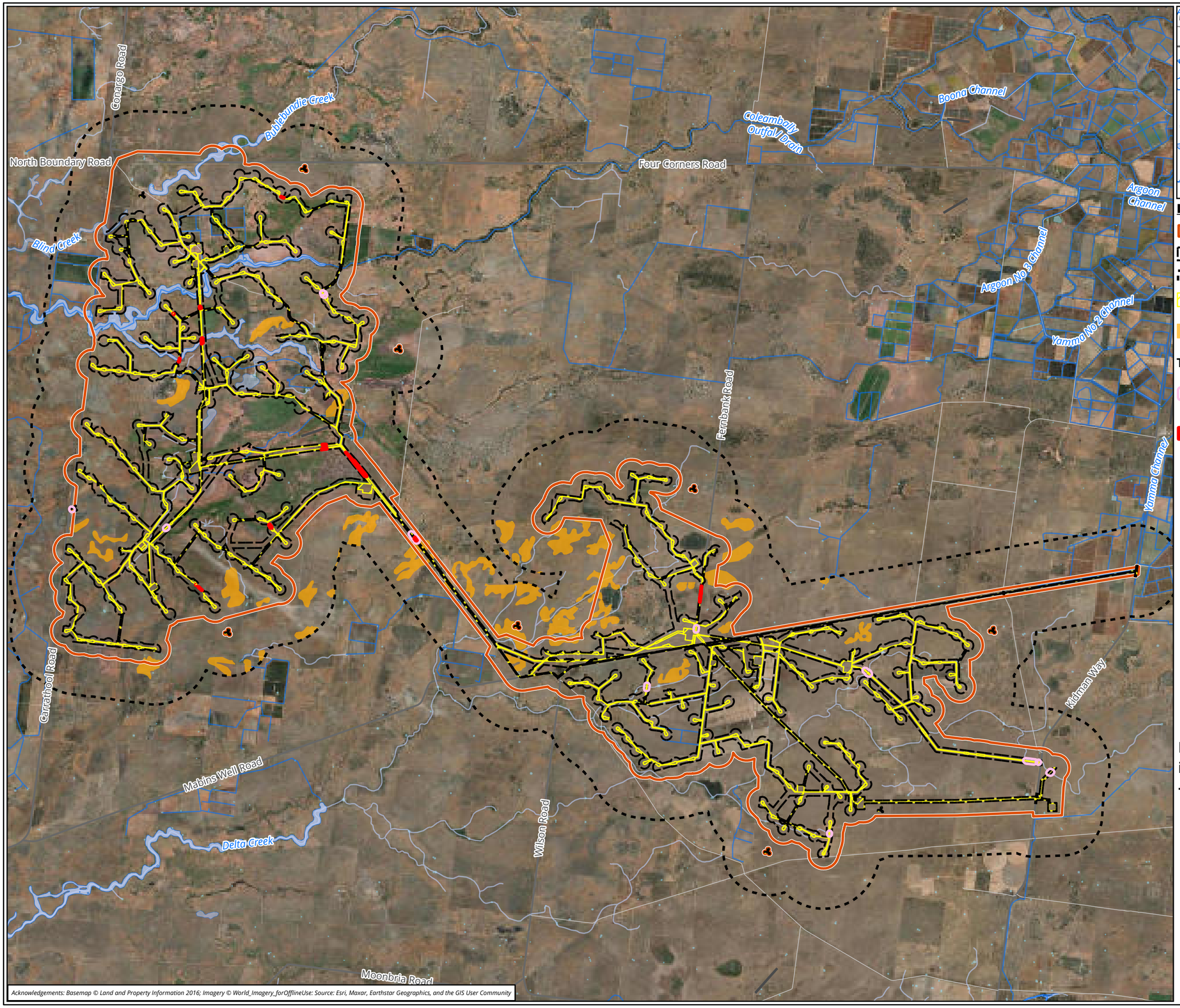


Figure 21 Serious and irreversible impacts (SAII) - Overview

Matter: 37263, Date: 03 May 2024,
GIS: JB, Checked by: MP, Last edited by: lharley
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37263_Dinawan_BDAR_Wind_F18-24.aprx
Layout: 37263_Wind_F21_SAII

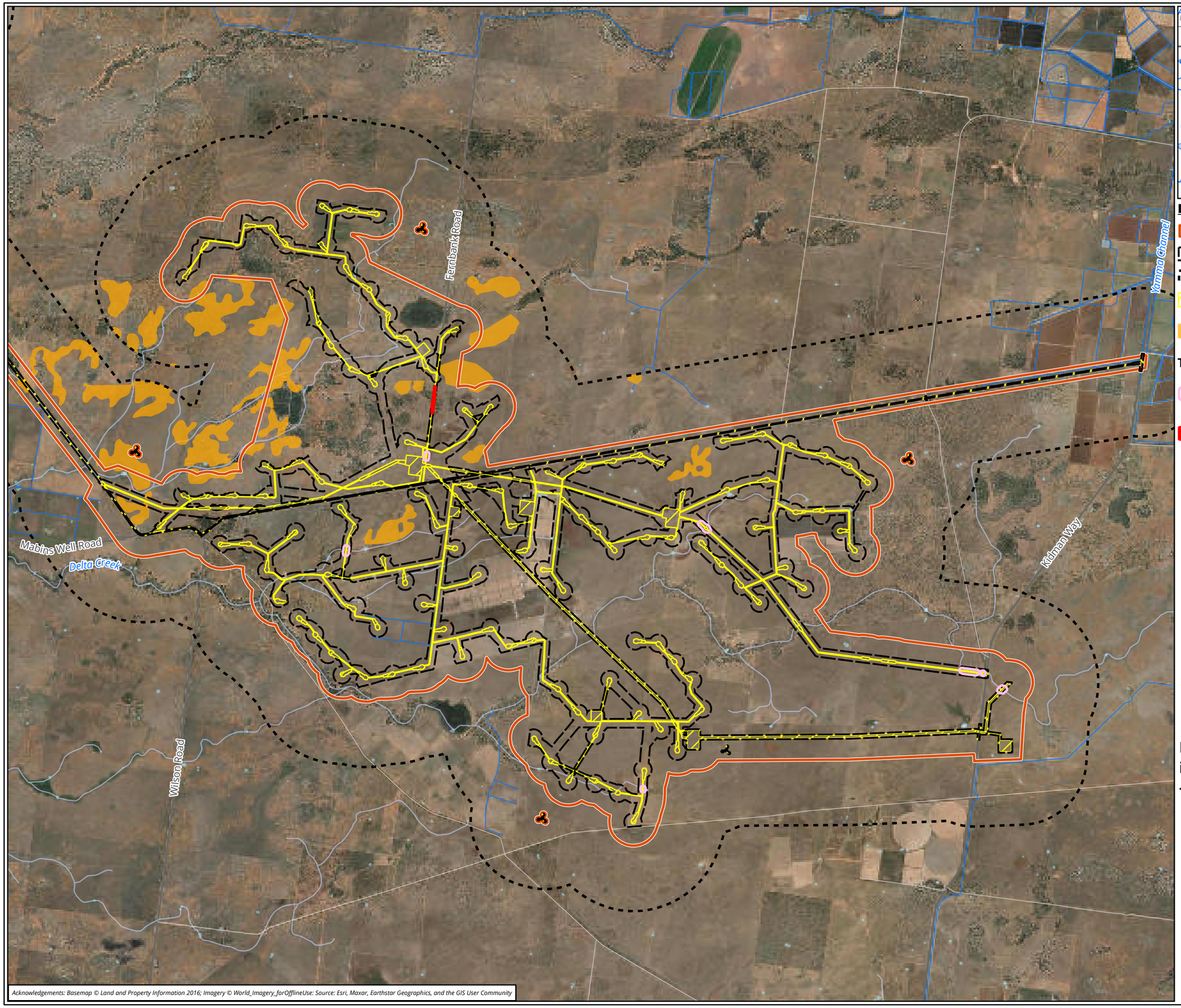
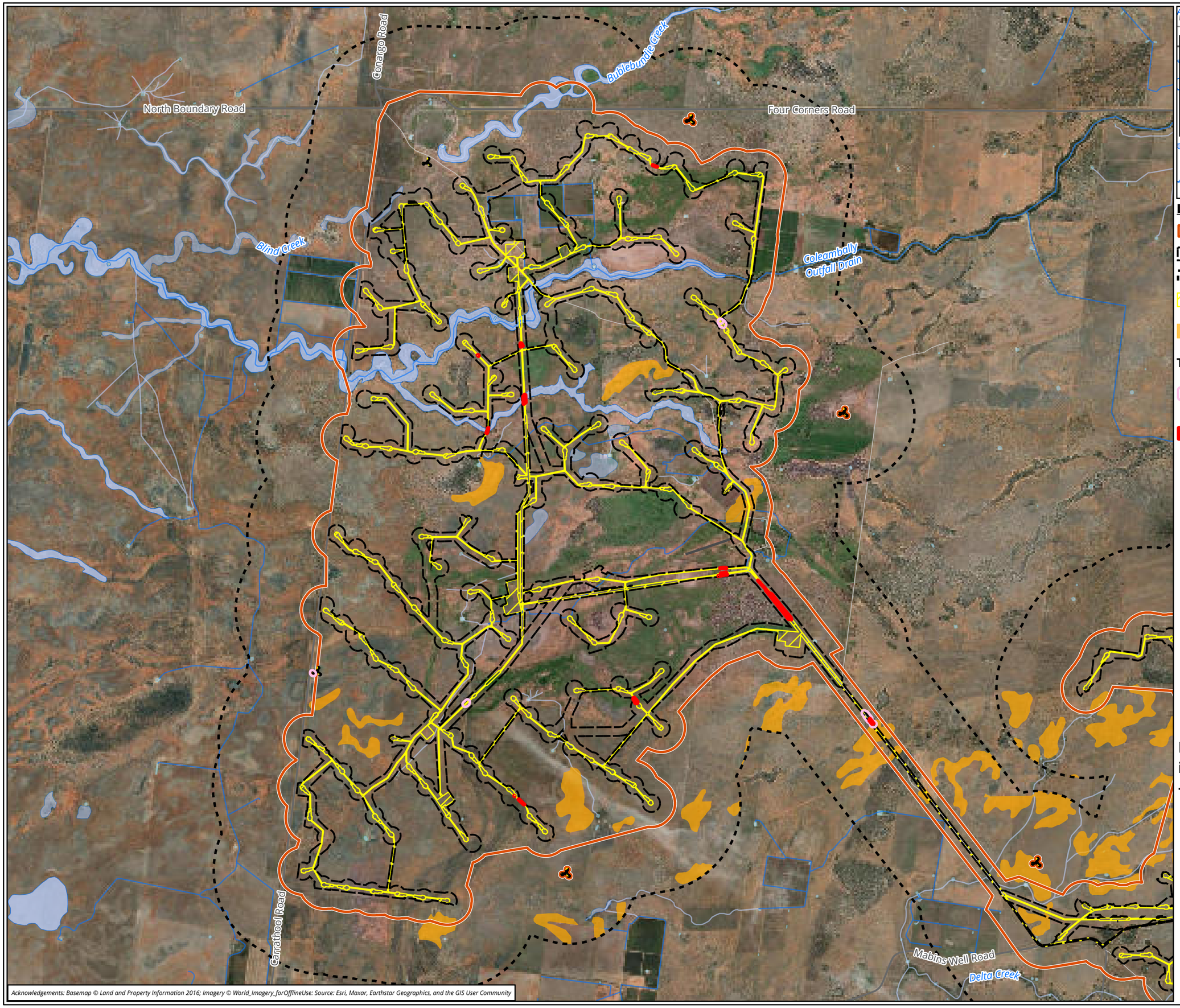


Figure 21 Serious and irreversible impacts (SAII) - Stage 1

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GIS: JB, Checked by: MP, Last edited by: lharley
Location: P:\37200s\37263\Mapping\37263_Dinawan_BDAR_Wind_F18-24.aprx
Layout: 37263_Wind_F21_SAII



Legend

- Subject land
- Development corridor
- Assessment area
- Development footprint
- Plains-wanderer important habitat

Threatened flora species polygon

- Bindweed - *Convolvulus tedmoorei*
- Austral Pillwort - *Pilularia novae-hollandiae*

Figure 21 Serious and irreversible impacts (SAII) - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

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Matter: 37263, Date: 03 May 2024,
GIS: JB, Checked by: MP, Last edited by: lharley
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24.aprx
Layout: 37263_Wind_F21_SAII

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © World_Imagery_forOfflineUse: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

10.3. Identification of impacts requiring offset, not requiring offset and areas not requiring assessment

The following section provides information on the project's impacts requiring offset, not requiring offset and areas not requiring assessment. Each category is displayed on Figure 22.

10.3.1. Impact requiring offset

Impacts to native vegetation (ecosystem credits)

As outlined in Section 9.2.1 of the BAM, the assessor must determine an offset for all impacts of proposals on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:

- ≥15, where the PCT is representative of an EEC or a CEEC.
- ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community.
- ≥20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

The offset requirement for the project was calculated using the BAM Calculator. Table 89 provides a summary of the ecosystem credit offsets required for impacts from the project.

Table 89 Offsets required (ecosystem credits) – Total development footprint

Vegetation zone	Impact (ha)	VI score	TEC	HBTs	Credit requirement
PCT 10_moderate	0.33	29.2	No	Yes	4
PCT 13_moderate	4.83	63.9	No	Yes	135
PCT 13_thinned	9.14	72.4	No	Yes	289
PCT 15_moderate	6.20	71.5	No	Yes	194
PCT 15_thinned	1.61	63.3	No	Yes	45
PCT 17_mod_good	1.84	70.8	No	No	57
PCT 17_moderate	1.09	42.1	No	No	20
PCT 24_moderate	0.23	29.0	No	No	3
PCT 26_DNG	395.93	19.6	No	No	3,873
PCT 26_intact	133.14	64.2	Weeping Myall Woodland	No	4,272
PCT 26_sparse	416.60	39.5	Weeping Myall Woodland	No	8,234
PCT 28_low	54.00	42.6	Sandhill Pine woodland	Yes	1,149
PCT 28_moderate	0.98	76.4	Sandhill Pine woodland	Yes	37
PCT 45_mod_good	8.83	92.1	Natural grasslands of Murray Valley Plains (EPBC Only)	No	508

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Vegetation zone	Impact (ha)	VI score	TEC	HBTs	Credit requirement
PCT 46_moderate	105.59	84.3	Natural grasslands of Murray Valley Plains (EPBC Only)	No	5,564
PCT 160_mod_good	4.07	81.8	No	No	125
PCT 160_moderate	0.84	39.5	No	No	12
					24,521

Impacts to threatened species and their habitat

As outlined in Section 9.2.2 of the BAM, an offset is also required for the impacts of the project on the habitat of species credit species. Table 90 provides a summary of the species credit offsets required for impacts from the project.

Table 90 Offsets required (species credits)

Species	Impact	Vegetation zone	Area (ha)	Biodiversity risk weighting	Credit requirement
Swainsona murrayana	Direct Assumed	PCT 15 moderate PCT 15 thinned PCT 26 DNG PCT 26 sparse PCT 28 moderate PCT 46 moderate	2.7 8.79	2	344
Swainsona sericea	Direct Assumed	PCT 15 moderate PCT 15 thinned PCT 26 DNG PCT 26 sparse PCT 28 moderate PCT 46 moderate	2.7 8.79	2	344
Austrostipa wakoolica	Assumed	PCT 28 moderate	0.98	2	37
Brachyscome papillosa	Assumed	PCT 13 thinned PCT 15 thinned PCT 24 moderate	9.1 1.6 0.23	2	383
Convolvulus tedmoorei	Assumed	PCT 17 mod_good PCT 17 moderate PCT 24 moderate	1.8 1.1 0.23	3	135
Eucalyptus leucoxylon subsp. pruinosa	Assumed	PCT 13 thinned PCT 15 thinned	3 individuals 1 individual	2	8

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Species	Impact	Vegetation zone	Area (ha)	Biodiversity risk weighting	Credit requirement
Lepidium monoplocoides	Assumed	PCT 13 thinned PCT 15 thinned PCT 24 moderate	9.1 1.6 0.23	2	383
Leptorhynchos orientalis	Assumed	PCT 24 moderate	0.23	2	3
Pilularia novae-hollandiae	Assumed	PCT 15 moderate PCT 15 thinned PCT 28 moderate	6.2 1.6 0.98	3	464
Barking Owl	Assumed	800m buffer of associated PCT containing large hollows PCT 10 moderate PCT 13 moderate PCT 13 thinned PCT 13 moderate PCT 15 thinned PCT 28 low PCT 28 moderate	28.31	2	910
Masked Owl	Assumed	800m buffer of associated PCT containing large hollows PCT 10 moderate PCT 13 moderate PCT 13 thinned PCT 13 moderate PCT 15 thinned PCT 28 low PCT 28 moderate	28.31	2	910
Plains Wanderer	Direct	Important mapped area	4.02	3	199
Superb Parrot	Direct/ Prescribed	100m buffer of associated PCTs that contain suitable hollows PCT 10 moderate PCT 13 moderate PCT 13 thinned PCT 13 moderate PCT 15 thinned PCT 26 DNG PCT 26 sparse PCT 26 intact PCT 28 low	40.01	2	1,146

Species	Impact	Vegetation zone	Area (ha)	Biodiversity risk weighting	Credit requirement
		PCT 28 moderate			
Southern Bell Frog	Direct/ Prescribed	200m buffer of habitat and associated PCTs in accordance with relevant guidelines. PCT 10 moderate PCT 13 moderate PCT 13 thinned PCT 13 moderate PCT 15 thinned PCT 26 DNG PCT 26 sparse PCT 26 intact PCT 28 low PCT 28 moderate	95.06	2	2,066

Species polygons for the above species credit species impacted by the project are illustrated in Figure 22 below.

Impacts to scattered trees

Offsets are required for the clearing of Class 2 and Class 3 paddock trees.

Table 91 Offsets required (scattered trees)

PCT	Class	Contains hollows	No. of trees	Credit required
PCT 13 Black Box - Lignum woodland wetland	2	No	1	1
	3	Yes	6	6
PCT 26 Weeping Myall open woodland	2	No	19	10
PCT 28 White Cypress Pine open woodland	2	No	3	2
TOTAL				19

10.3.2. Impacts not requiring offset

As outlined in Section 9.2.1 of the BAM, offsets are not required for impacts to vegetation zones that have a vegetation integrity score of ≥17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community.

Indirect impacts do not require offsetting and are subject to detailed mitigation and management to improve and maintain vegetation within criteria set in the BMP and BBAMP.

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10.3.3. Impacts not requiring assessment

As outlined in Section 9.3 of the BAM, areas within the subject land that do not contain native vegetation do not need to be assessed for ecosystem credits. Areas of land mapped as Category 1 Exempt land under the LLS Act also do not require assessment under the BAM.

Areas of land that do not contain native vegetation must still be assessed for threatened species habitat and prescribed biodiversity impacts in accordance with the BAM.

The project will impact upon approximately 129.57 hectares of land that does not contain native vegetation, that occurs on Category 1 – Exempt land.

10.3.4. Staged offsetting

The development corridor and development footprint has been broken up into two stages to facilitate the staged retirement of the project's biodiversity credit liability. Spark Renewables will confirm the offset staging plan with DPHI prior to the commencement of construction. This is discussed further in Section 11.

Table 92 Offsets required (ecosystem credits) – Stage 1

Vegetation zone	Impact (ha)	Credit requirement
Ecosystem credits		
PCT 10_moderate	-	-
PCT 13_moderate	-	-
PCT 13_thinned	3.36	106
PCT 15_moderate	0.35	11
PCT 15_thinned	-	-
PCT 17_mod_good	1.71	53
PCT 17_moderate	0.03	1
PCT 24_moderate	0.23	3
PCT 26_DNG	170.65	1,669
PCT 26_intact	70.84	2,273
PCT 26_sparse	230.80	4,562
PCT 28_low	0.50	11
PCT 28_moderate	-	-
PCT 45_mod_good	4.00	230
PCT 46_moderate	11.18	589
PCT 160_mod_good	-	-
PCT 160_moderate	-	-
Total	504.22	9,508
Species credits		
Brachyscome papillosa	3.63 assumed	125

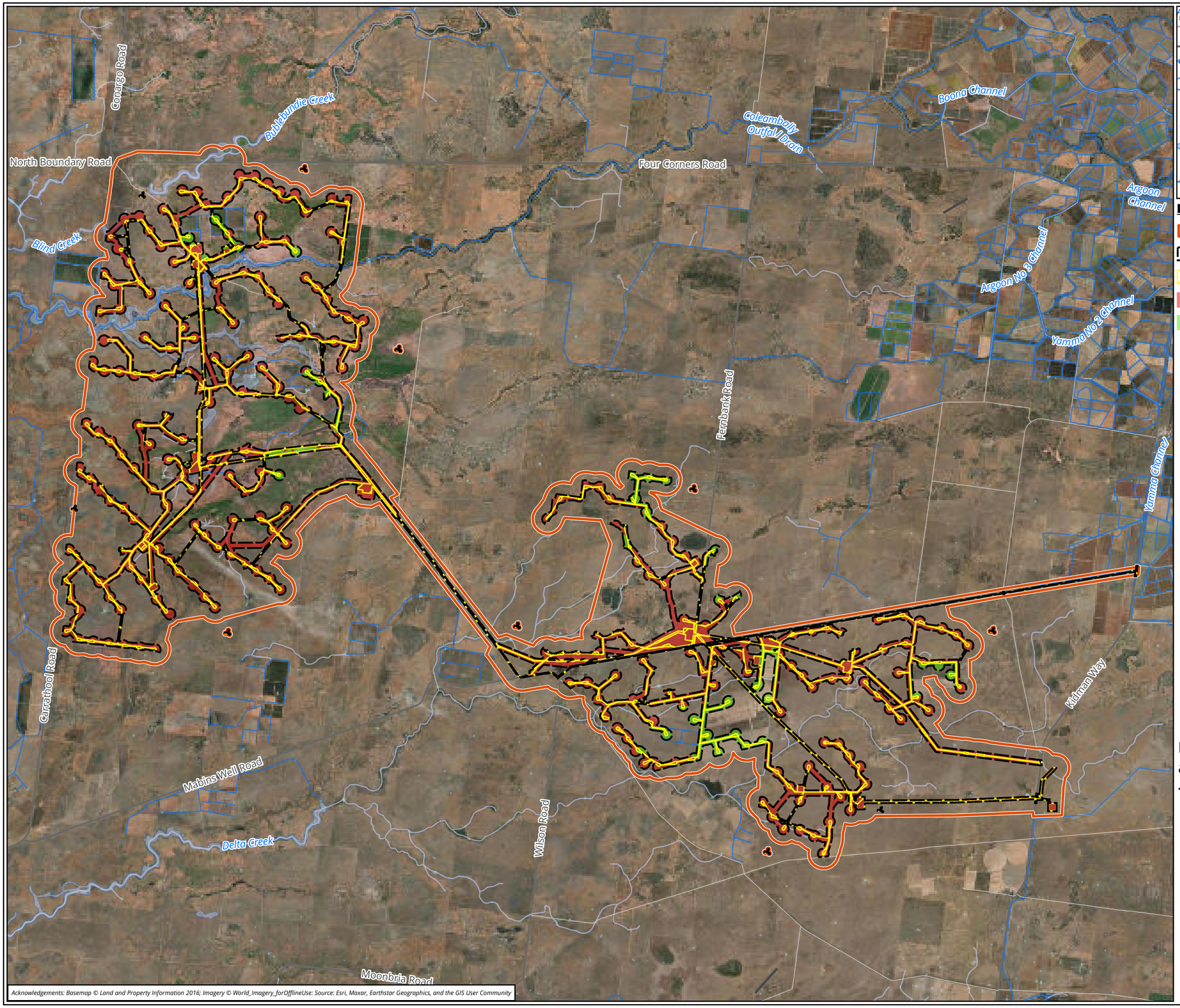
Vegetation zone	Impact (ha)	Credit requirement
Convolvulus tedmoorei	1.96 assumed	97
Eucalyptus leucoxylon subsp. pruinosa	1 individual assumed	2
Lepidium monoplocoides	3.63 assumed	125
Leptorhynchos orientalis	0.23 assumed	3
Pilularia novae-hollandiae	0.35 assumed	19
Swainsona murrayana	0.35 assumed	13
Swainsona sericea	0.35 assumed	13
Barking Owl	4.25 assumed	146
Masked Owl	4.25 assumed	146
Plains-wanderer	0.3 important mapped area	19
Southern Bell Frog	38.22	635
Superb Parrot	6.48	168

Table 93 Offsets required (ecosystem credits) – Stage 2

Vegetation zone	Impact (ha)	Credit requirement
Ecosystem credits		
PCT 10_moderate	0.33	4
PCT 13_moderate	4.83	135
PCT 13_thinned	5.78	183
PCT 15_moderate	5.85	183
PCT 15_thinned	1.61	45
PCT 17_mod_good	0.14	4
PCT 17_moderate	1.05	19
PCT 24_moderate	-	-
PCT 26_DNG	225.28	2,204
PCT 26_intact	62.31	1,999
PCT 26_sparse	185.81	3,672
PCT 28_low	53.5	1,139
PCT 28_moderate	0.98	37
PCT 45_mod_good	4.83	278
PCT 46_moderate	94.42	4,976
PCT 160_mod_good	4.07	125
PCT 160_moderate	0.84	12
Total	651.61	15,015

Vegetation zone	Impact (ha)	Credit requirement
Species credits		
Austrostipa wakoolica	0.98 assumed	37
Brachyscome papillosa	7.30 assumed	257
Convolvulus tedmoorei	1.17 assumed	40
Eucalyptus leucoxylon subsp. pruinosa	3 individuals	6
Lepidium monoplocoides	7.30 assumed	257
Pilularia novae-hollandiae	8.44 assumed	445
Swainsona murrayana	2.7 (confirmed), 8.44 (assumed	312
Swainsona sericea	2.7 (confirmed), 8.44 (assumed	312
Barking Owl	24.67 assumed	778
Masked Owl	24.67 assumed	778
Plains-wanderer	3.72 important mapped area	180
Southern Bell Frog	56.84	1,430
Superb Parrot	33.57	982

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Legend

- Subject land
- Development corridor
- Development footprint
- Impacts requiring offset
- Impacts not requiring offset

Figure 22 Impacts requiring and not requiring offsets - Overview

0 1 2 3 4 5

Kilometers
Scale: 1:130,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

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Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F22_Offset

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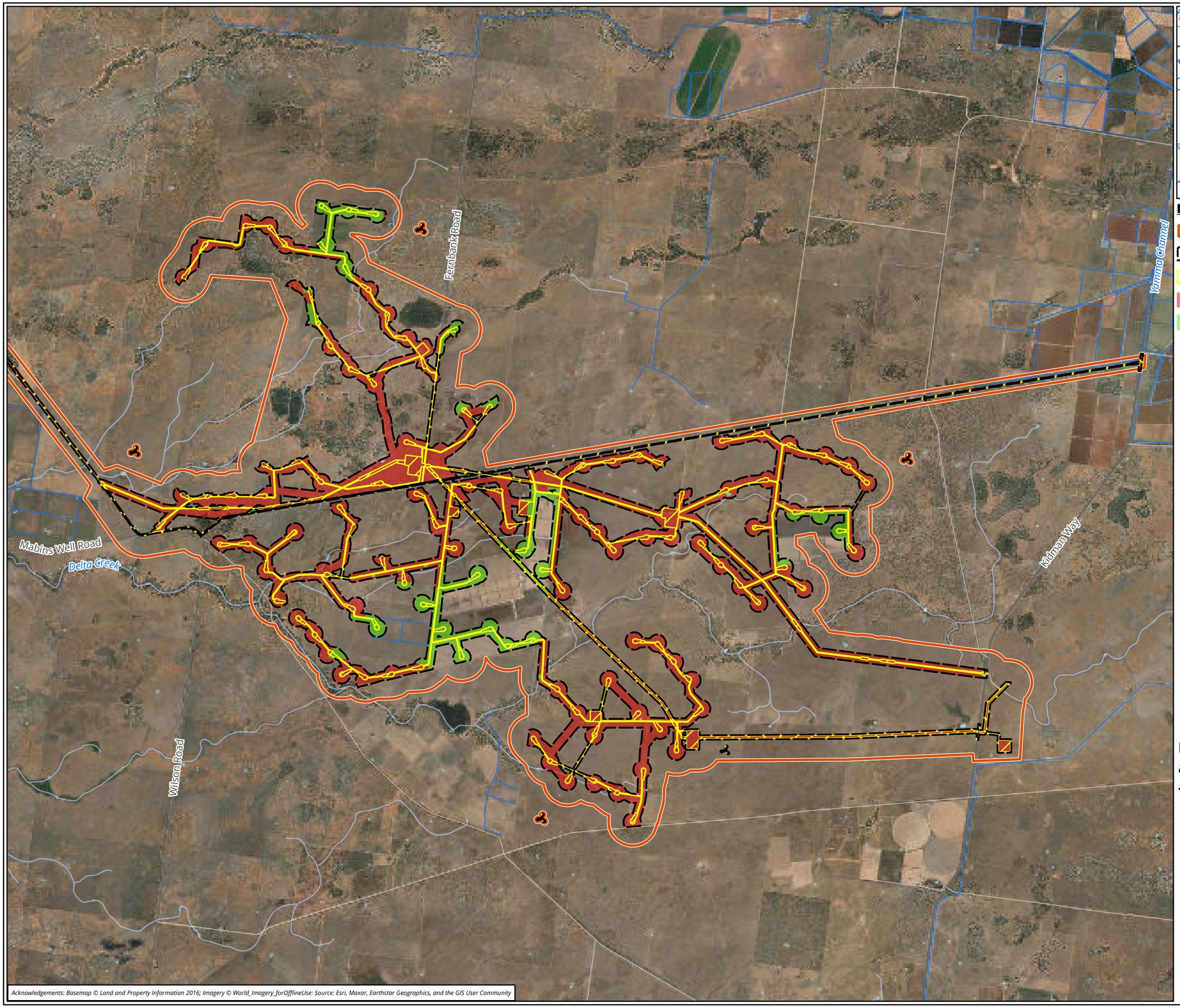
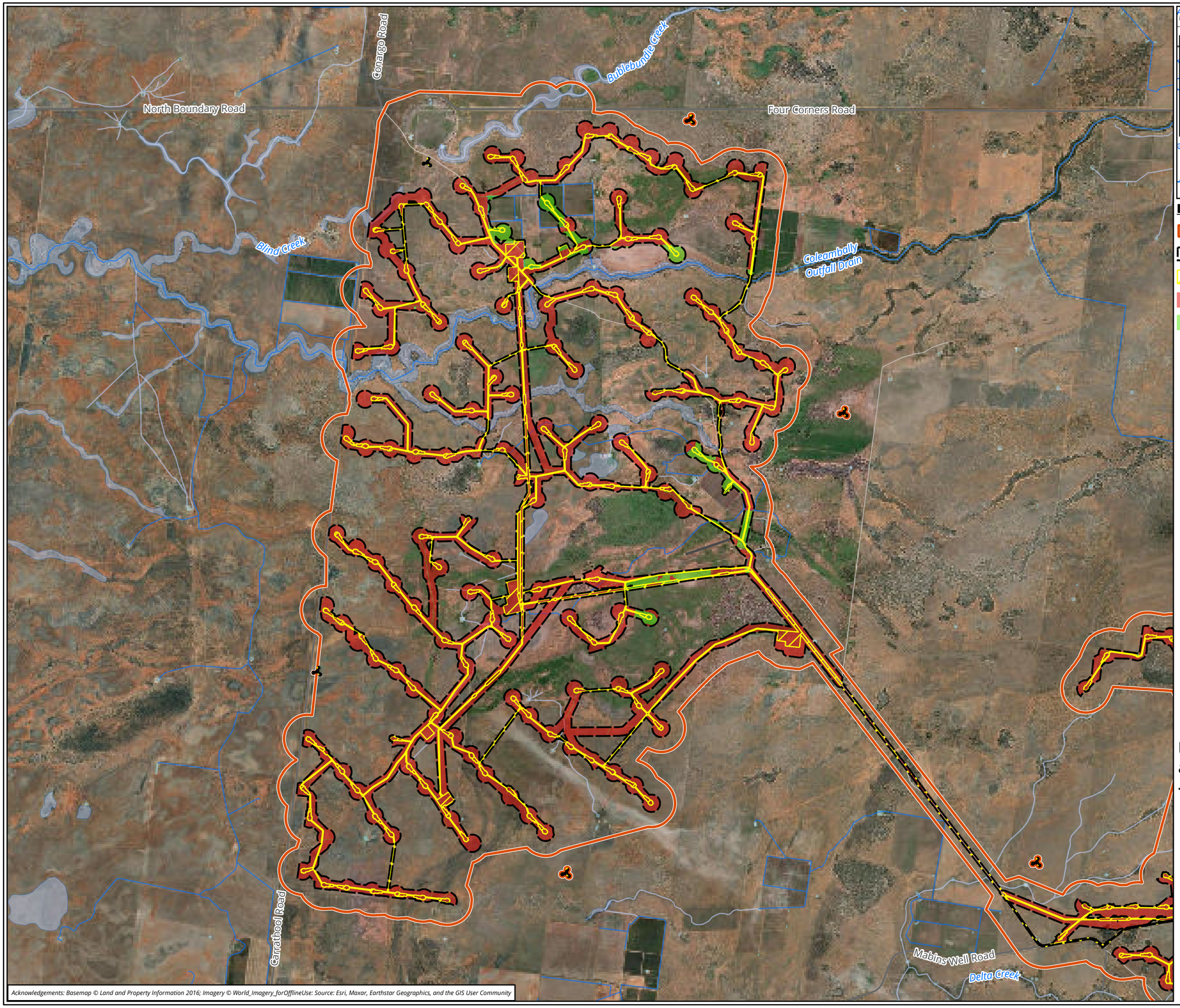


Figure 22 Impacts requiring and not requiring offsets - Stage 1

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F22_Offset



Legend

- Subject land
- Development corridor
- Development footprint
- Impacts requiring offset
- Impacts not requiring offset

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Figure 22 Impacts requiring and not requiring offsets - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

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Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F22_Offset

11. Biodiversity offset strategy

11.1. Overview

In order to secure the biodiversity offset liability expected to be required for the project's residual unavoidable impacts, Spark Renewables has commenced investigations into the establishment of local Biodiversity Stewardship Sites.

Five properties have been subject to desktop and on-ground assessment to determine their suitability for establishment of Biodiversity Stewardship Sites, and to generate offset credits suitable for the project's requirements, these properties are as follows:

- Four Corners – Approx. 4200 ha area to the north-west of the wind farm subject land.
- Goolgumbla – Approx. 2100 ha area to the north of the wind farm subject land.
- Red Swamp – Approx. 1100 ha area to the north of the solar farm subject land.
- Stuart – Approx. 3400 ha area to the south of the wind farm subject land.
- Turkey Plains – Approx. 950 ha area near the centre of the wind farm subject land.

Additionally, a sixth site is currently under early stage feasibility which is also located to the north of McLennons Bore Road and within local proximity to the subject land. Assessment is also being undertaken on areas excised and avoided within the Dinawan Solar Farm subject land, which contains highest quality habitats that have been avoided by that project.

11.2. Offsetting obligations and options

As outlined above in Table 89 through to Table 93, the project is expected to require offsets for residual unavoidable impacts and subsequent credit liabilities. The tables above demonstrate the total liabilities based on the development footprint as a whole, as well as total liabilities for Stage 1 (east) and Stage 2 (west).

Additionally, the Dinawan Wind Farm is under assessment in conjunction with the Dinawan Solar Farm, with credit liabilities generated for both. In order to adequately demonstrate the availability of credits in the currently assessed and potential stewardship sites, a total credit for both developments (including the revised development footprint for Dinawan Solar Farm), and credits potentially available is shown in Table 96. Additionally, a further summary, Table 97, is provided to demonstrate the residual credits and credits available at potential stewardship sites based on Stage 1 only for both Dinawan Wind Farm and Stage 1 and Stage 2 for the Dinawan Solar Farm.

To secure the above offset liability Spark Renewables has three broad options, which include:

- Payment to the Biodiversity Conservation Fund (the Fund) managed by the Biodiversity Conservation Trust (BCT).
- Purchase of credits from the open market.
- Establishment of a Biodiversity Stewardship Site(s) to generate credits for offsetting the project specifically.

Each of these options has some potential benefits and drawbacks, which are briefly outlined below.

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Option 1: Payment to the Biodiversity Offset Fund managed by the BCT

Satisfying an offset obligation by paying to the Biodiversity Offset Fund (the Fund) has the major benefit of being an expedited and unambiguous way for a proponent to meet their obligations. However, it does include increased costs associated with the 'Risk premium', and an administrative cost per credit added on top of the costs to source/generate the credits, calculated by the BCT. As such, Payment to the Fund is considered likely to be the most expensive option available to a proponent, however it requires the least amount time and effort in offset security, which can both be substantial (e.g., compared to establishing a Stewardship Site).

Option 2: Purchase credits from the open market

Biodiversity credits exist in an open market-based system whereby an owner of a Biodiversity Stewardship Site, who has generated a range of biodiversity credits, lists their credits in an online database for proponents with a credit obligation to interrogate and enter into price negotiations with relevant credit holders. As an open market, the price of credits is set by supply and demand factors as well as requirements for credits generated at a Biodiversity Stewardship Site to be sold for at least the minimum portion each credit contributes to the management costs of that site (Part A cost, further detailed below). Initial credit sales must all go to funding the management actions required to be undertaken at the Biodiversity Stewardship Site (the costing of which is termed the 'Total Fund Deposit' [TFD]), however once the TFD has been fully satisfied, any future credit sales are generally direct profit to the credit owner.

Potential benefits from procuring credits from the open market include a potential increase in offsetting options when applying the 'Like-for-Like' rules included in the BAM, and then further again with the 'Like for Like Variation Rules', as well as the ability to negotiate with sellers on price, potentially with multiple credit holders. Drawbacks include an ongoing general paucity of credits available on the market (which is particularly relevant to projects with large credit obligations), sellers setting a high price and being unwilling to negotiate, timeframes associated with negotiations, timeframes associated with procurement of a range of credit types (where required), timeframes to process sales, and additional credit 'transfer' and 'retirement' fees.

Option 3: Establish a Biodiversity Stewardship Site

Establishment of a Biodiversity Stewardship Site (or multiple sites) with the intention of generating credits to satisfy the project's offset obligation is considered likely to be the most suitable option available to Spark Renewables for the project. This is due to the expected quantum of offsets that will be required for the project, and the associated cost of securing those offsets through either the open credit market or via payment to the Fund. The suitability of this option is however dependent on securing land that is both suitable for the establishment of a Biodiversity Stewardship Site and supports PCTs/habitats considered Like-for-Like with those impacted by the project.

The major benefit of establishing a Biodiversity Stewardship Site to offset the project's impacts is the expected substantial reduction in the cost of offset security. The price of biodiversity credits on the open market (and those secured by the BCT via the Fund) is made up of two parts:

- Part A (compulsory) – the cost associated with implementing the required management actions at the Biodiversity Stewardship Site where the credits are generated (equivalent to the TFD); and
- Part B (optional) – the cost to the landholder associated with the establishment of the offset site (i.e., cost recovery, and lost opportunity costs), and most significantly, the landholder's profit margin.

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Under the situation where a proponent establishes a Biodiversity Stewardship Site to offset the impacts of their project, the Part B (optional) portion of the offset credits would generally be greatly reduced by excluding the profit margin, and any other non-essential cost recovery items. The price of the credits would therefore only comprise the Part A (compulsory) cost, or in other words the minimum dollar value required to generate the credits through on site protection and management of habitat. This exclusion (or reduction) of the Part B cost, generally results in substantial cost savings when compared to the price of credits on the open market, and/or the price paid to the Fund.

Drawbacks associated with the establishment of Biodiversity Stewardship Sites are associated with the large areas of land required to generate sufficient offset credits (generally between five to eight times the area of native vegetation impacted at the development site), sterilisation of the land for virtually all future uses other than in-perpetuity biodiversity conservation (some managed low-impact grazing may be allowable), and the ongoing requirement to manage the site to ensure the management actions, outlined in the Biodiversity Stewardship Site Management Plan, are implemented to the required standard.

One further drawback is the time required to establish a Biodiversity Stewardship Site and generate the credits required to offset a project's liability, and hence it is beneficial that Spark Renewables has commenced investigations into suitable sites, during the current EIS phase of the project.

11.3. Local offset feasibility

Assessments undertaken to date of offset suitability over the five above listed properties (the subject properties) are detailed below.

Background research

Desktop review of background information was undertaken to provide ecological context to the subject properties and items to consider during further assessment, including:

- BioNet Atlas of NSW Wildlife for BC Act listed threatened entities.
- Protected Matters Search Tool for EPBC Act matters of national environmental significance.
- Vegetation mapping including:
  - Riverina State Vegetation Type Mapping (SVTM) (DPIE 2016).
  - Biosis PCT mapping undertaken across the broader development site to date.
- Establishment of a Stewardship Site case for the project in the BAM Calculator and assessment of predicted threatened species.
- Research into factors influencing the boundaries of the potential Biodiversity Stewardship Sites such as areas to be excluded via review of Land and Property Information easements spatial layers, MinView searches, current cadastral databases, land zoning, and research into any existing offset obligations.

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Field investigation

Field investigations of the subject properties were completed by two experienced Biosis ecologists, over five days (24-26 July and 01-02 August 2023)

- Rapid ground-validation of mapped vegetation to preliminary PCTs and broad scale mapping of ecological condition states.
- Determination of high-level expected management issues/actions required to be undertaken to generate the biodiversity credits if a Biodiversity Stewardship Site is established. Including assessment of any management issues considered substantial enough to preclude areas from being entered in a Biodiversity Stewardship Site.
- Collection of floristic plot data (BAM plots) used for calculation of credit generation potential.
- Assessment of areas of potential habitat for threatened species that could generate 'species credits', and/or confirmation of existing species records.

Credit calculations and suitability assessment

Following completion of the field investigations, analysis of the data collected was undertaken to:

- Map and calculate the areas of vegetation zones.
- Calculate the estimated number of biodiversity credits generated by the subject properties through entry of vegetation zone areas and relevant BAM plot data into the online BAM Credit Calculator.
  - Where required, BAM plot data collected across the subject properties was supplemented with data collected during the preparation of this BDAR.
- Complete a suitability assessment, based on Offset Trading Group (OTG), to determine which areas of the subject properties would be best suited to generate credits that could be used to offset the impacts of the projects.

Results

Background research

Desktop review of background information found a range of suitable PCTs as being mapped across the subject properties and existing records of target species credit species, which have the potential to generate offset credits for the project. These items were ground validated with further detail provide below.

Desktop assessment into factors influencing the areas of each of the subject properties which can be entered into a Biodiversity Stewardship Site, such as the presence of utilities and assets and associated easements, mining leases, Crown Lands and other considerations such as existing conservation obligations, also found a range of items present across the subject properties. Such items generally require exclusion from a Biodiversity Stewardship Site, and as such coinciding areas of mapped vegetation and habitats cannot generate offset credits.

Table 94 provides the details of the factors influencing the potential boundaries of future Biodiversity Stewardship Sites at each of the subject properties, and provides an estimated percentage reduction in total area available for biodiversity credit generation (compared to the full extent of mapped vegetation and habitats on each site).

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Table 94 Results of desktop research into factors influencing the Biodiversity Stewardship Site areas and boundaries

Biodiversity Stewardship site	Approx. area	Utilities from Dial Before You Dig searches	Mining leases	Crown lands	Other considerations	Percentage reduction in credit generation
Four corners	4203 ha	• Essential Energy easement present within the site along southern boundary adjacent to North Boundary Road.	• None present.	• A number of Crown land road easements occur in a grid pattern through the site.	• Nil	• 5% reduction for utility asset maintenance corridors and Crown roads buffers.
Goolgumbla	2131 ha	• Essential Energy underground earth/wires, poles and (assumed) overhead powerlines along Pooginook Road along site's western boundary, crossing through north-western lots away from the roadway. • Telstra cabling along Pooginook Road, unlikely to occur within or influence the site.	• None present.	• A Crown land road easement occurs through the centre of the site running in an east/west direction.	• Nil	• 5% reduction for utility asset maintenance corridors and Crown roads buffers.
Red Swamp	1119 ha	• Transgrid communication cable in/adjacent to Kidman way, unlikely to occur within or influence the site. • Essential Energy underground earth/wires, poles and (assumed) overhead powerlines along Cadell Road along site's western boundary and Kidman Way along the site's south-eastern boundary. • Telstra cabling along Mclennons Bore Road, unlikely to occur within or influence the site. • Telstra cabling along Kidman Way appears to occur within the site.	• None present.	• Crown lands road easements occur along the northern, western and southern boundaries of the site and encroach slightly into the site.	• Nil	• 5% reduction for utility asset maintenance corridors and Crown roads buffers.

Biodiversity Stewardship site	Approx. area	Utilities from Dial Before You Dig searches	Mining leases	Crown lands	Other considerations	Percentage reduction in credit generation
Stuart	3365 ha	• Essential Energy underground earth/wires, poles and (assumed) overhead powerlines occur through the central portion of the site from Mabins Well Road in the southern portion of the site, and Carrathool Road along the site's western boundary. • Telstra cabling / infrastructure along Mabins Well Road and Carrathool Road may occur within the site. • Telstra cabling / infrastructure occurs within the central portion of site in Lots 22 and 28 DP756311, and Crown Land road easements.	• None present.	• A number of Crown land roads easements occur within the northern and southern portions of the site.	• A number of areas of Category 2 – Sensitive Regulated Land occur within the property assumed to represent historic and/or current conservation agreements or set-asides etc. these areas have been excluded from the potential BSA areas.	• 5% reduction for utility asset maintenance corridors and Crown roads buffers. • 633 ha370 excluded for assumed conservation areas.
Turkey Plains	967 ha	• Essential Energy poles and (assumed) overhead powerlines occur through the north-western potion of the site	• None present.	• Crown land road easements occur in the north and south of the site running in an east/west direction.	• Nil	• 5% reduction for utility asset maintenance corridors and Crown roads buffers.

Field investigation, Credit calculations and suitability assessment

Field investigations confirmed the presence of nine different PCTs across the five subject properties, details of which are provided in Table 95 below. Ecological condition was found to range from good to low and derived native grasslands.

Table 95 PCTs confirmed present within the subject properties

PCT	Offset Trading Group (OTG)	Four Corners	Goolgumbla	Red Swamp	Stuart	Turkey Plains
10 River Red Gum – Black Box woodland wetland	Inland Riverine Forests <50% cleared				X	
13 Black Box – Lignum woodland wetland	Inland Floodplain Woodlands ≥50% to 70% cleared	X	X	X		X
15 Black Box open woodland wetland with chenopod understorey	Inland Floodplain Woodlands ≥50% to <70% cleared			X		
16 Black Box grassy open woodland wetland	Inland Floodplain Woodlands ≥50% to <70% cleared		X	X		X
17 Lignum shrubland wetland	Inland Floodplain Shrublands ≥50% to <70% cleared	X	X	X	X	
26 Weeping Myall open woodland	Weeping Myall Woodland TEC	X	X	X	X	X
28 White Cypress Pine open woodland	Sandhill Pine Woodland TEC		X		X	
44 Forb-rich Speargrass – Windmill Grass – White Top grassland	Riverine Plain Grasslands ≥70% to <90% cleared					X
164 Cotton Bush open shrubland	Riverine Chenopod Shrublands <50% cleared				X	

Threatened species habitat was assessed and habitat was recorded for species expected to require offsets as a result of the project, with Silky Swainson-pea recorded on the Turkey Plains property, as well as Southern Bell Frog on the Goolgumbla property. Paired and juvenile Superb Parrots were also observed. Further assessment and targeted surveys would be required to determine the presence of the target threatened species across the subject properties.

Management actions that would be required to be undertaken following the establishment of a Biodiversity Stewardship Site across the subject properties were found to include fairly standard requirements such as; weed control, fence removal for fauna passage, fence installation/maintenance for stock exclusion, access track closures and maintenance, removal of dumped farm refuse and scrap building material, etc. None were found to be of significant concern in terms of preventing a BSA from being established over (portions of) the sites.

The offset credits that could potentially be generated at each property were assessed using BAM plot data collected across the subject properties, supplemented with relevant data collected from the BDAR. Table 96 provides the areas of each PCT and OTG recorded across the subject properties along with an estimate of the potential credits that could be generated (considering the exclusions detailed in Table 94). It should be noted that offset credit generation potential is considered an estimate only and further detailed assessment and collection of additional plot data is required to confirm the numbers presented herein. However, the data in Table 96 provides a good indication of the amount of offsets each property would be able to provide, which match those expected to be required by the project.

Table 96 Summary of OTGs and PCTs mapped and potential credit generation across the subject properties (including consideration of solar and wind credit requirements)

Type	Stage / Property	Inland Riverine Forests <50% (PCT 10)	Inland Floodplain Woodlands ≥50% to 70% (PCT 13, 15, 16)	Inland Floodplain Shrublands <50% (PCT 24, 160)	Inland Floodplain Shrublands ≥50% to <70% (PCT 17)	Riverine Plain Woodlands ≥90% (PCT 26 DNG)	Weeping Myall Woodland TEC (PCT 26 non-DNG)	Sandhill Pine Woodland TEC (PCT 28)	Natural Grasslands CEEC (PCT 44, 45, 46)	Riverine Chenopod Shrublands <50% (PCT 164)	Stage / Property total
BSA	Four Corners	0	86	0	43	15022	138	0	0	0	15289
BSA	Goolgumbla	0	2507	0	264	4304	1805	307	0	0	9188
BSA	Red Swamp	0	1077	0	66	1160	3149	0	146	0	5598
BSA	Stuart	119	0	0	373	6825	1766	564	0	259	9907
BSA	Turkey Plains	0	244	0	0	1520	1498	0	29	0	3289
BSA	**Totals**	**119**	**3914**	**0**	**747**	**28830**	**8356**	**871**	**174**	**259**	**43272**
Solar	Stage 1	0	0	0	0	243	47	0	0	0	290
Solar	Stage 2	0	0	0	27*[1]	7566	147	0	94	0	7838
Solar	Stage 3	0	0	0	0	1205	4269	0	0	0	5474
Solar	Stage 4	0	0	0	0	2	5498	0	2	0	5502
Solar	Stage 5	0	0	0	9	20	5309	0	0	0	5338
Solar	Stage 6	0	5	0	1	2740	53	0	0	0	2799
Solar	**Total**	**0**	**9**	**0**	**37**	**11776**	**15323**	**0**	**96**	**0**	**27241**
Wind	1 (East)	0	117	3	54	1669	6835	11	819	0	9508
Wind	2 (West)	4	546	137	23	2204	5671	1175*[2]	5253*[2]	0	15013
Wind	**Total**	**4**	**663**	**140**	**77**	**3873**	**12506**	**1186**	**6072**	**0**	**24521**
Total +/-	-	**115**	**3242**	**0*[3]**	**493*[3]**	**13,181**	**-19,473**	**-315**	**-5994**	**259**	-

*1 - PCT 17 1x credit short compared to total project requirement, likely due to rounding error, added it to Stage 1 requirements

*2 - Sandhill Pine TEC 1x extra credit required, Natural Grasslands TEC 1x extra credit required, compared to project requirement, likely due to rounding error, removed from Stage 2

*3 - Inland Floodplain Shrublands <50% cleared can be offset by Inland Floodplain Shrublands ≥50% to 70% cleared

Table 97 Summary of OTGs and PCTs mapped and potential credit generation across the subject properties – Stage 1 only

Type	Stage / Property	Inland Riverine Forests <50% cleared (PCT 10)	Inland Floodplain Woodlands ≥50% to 70% cleared (PCT 13, 15, 16)	Inland Floodplain Shrublands <50% cleared (PCT 24, 160)	Inland Floodplain Shrublands ≥50% to <70% cleared (PCT 17)	Riverine Plain Woodlands ≥90% cleared (PCT 26 DNG)	Weeping Myall Woodland TEC (PCT 26 non-DNG)	Sandhill Pine Woodland TEC (PCT 28)	Natural Grasslands CEEC (PCT 44, 45, 46)	Riverine Chenopod Shrublands <50% cleared (PCT 164)	Stage / Property total
BSA	Four Cnrs	0	86	0	43	15022	138	0	0	0	15289
BSA	Red Swamp	0	1077	0	66	1160	3149	0	146	0	5598
BSA	Stuart	119	0	0	373	6825	1766	564	0	259	9907
BSA	Turkey Plains	0	244	0	0	1520	1498	0	29	0	3289
BSA	**Totals**	**119**	**3914**	**0**	**747**	**28830**	**8356**	**871**	**174**	**259**	**34084**
Solar	Stage 1	0	0	0	0	243	47	0	0	0	290
Solar	Stage 2	0	0	0	27*1	7566	147	0	94	0	7838
Solar	**Total**	**0**	**4**	**0**	**27**	**7809**	**194**	**0**	**94**	**0**	**8128**
Wind	1 (East)	0	117	3	54	1669	6835	11	819	0	9508
Wind	**Total**	**0**	**117**	**3**	**54**	**1669**	**6835**	**11**	**819**	**0**	**9508**
Total +/-	-	**119**	**1286**	**0*2**	**399*2**	**15,048**	**-478**	**553**	**-739**	**259**	-

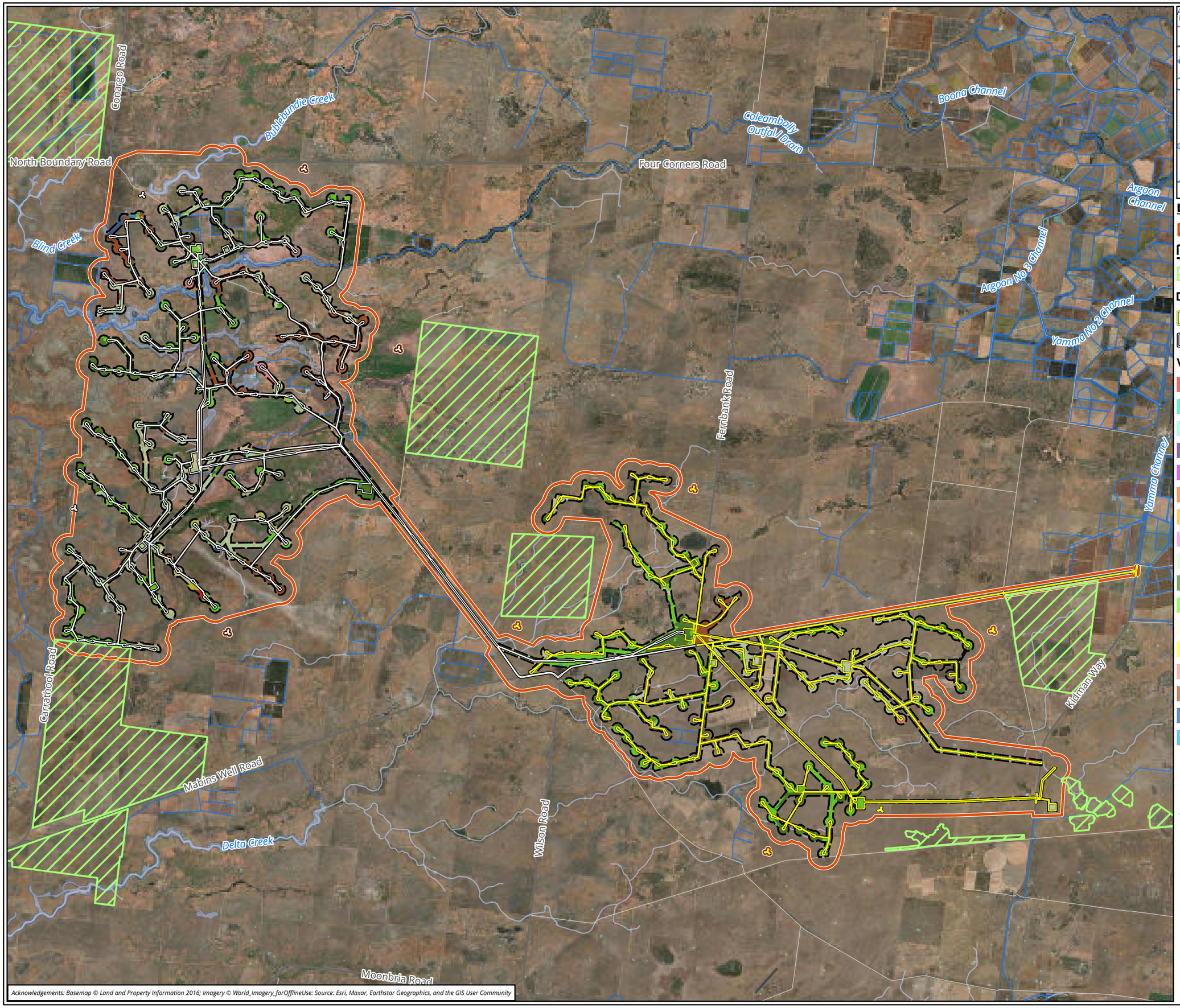
*1 - PCT 17 1x credit short compared to total project requirement, likely due to rounding error, added it to Stage 1 requirements

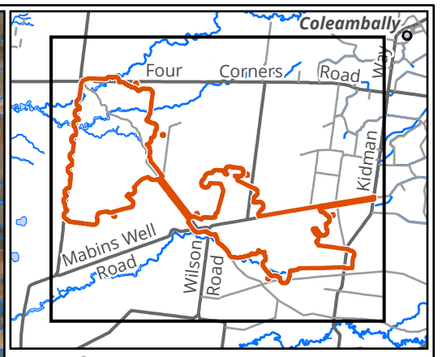
*2 - Inland Floodplain Shrublands <50% cleared can be offset by Inland Floodplain Shrublands ≥50% to 70% cleared

11.4. Offset staging plan

As outlined in Section 1.1.2, the project has been broken up into two stages to facilitate the development and staged retirement of the project's biodiversity credit liability. Prior to works commencing in each area, the biodiversity offset associated with that area will be secured. This is demonstrated in Table 92 and Table 93.

Spark Renewables will confirm the offset staging plan with DPHI prior to the commencement of construction.





Legend

- Subject land
- Development corridor
- Indicative stewardship sites

Development footprint

- Stage 1
- Stage 2

Vegetation zone

- VZ1 - 10_Moderate
- VZ2 - 13_Moderate
- VZ3 - 13_Thinned
- VZ4 - 15_Moderate
- VZ5 - 15_Thinned
- VZ6 - 17_Mod_Good
- VZ7 - 17_Moderate
- VZ8 - 24_Moderate
- VZ9 - 26_DNG
- VZ10 - 26_Intact
- VZ11 - 26_Sparse_Canopy
- VZ12 - 28_Low
- VZ13 - 28_Moderate
- VZ14 - 45_Mod_Good
- VZ15 - 46_Moderate
- VZ16 - 160_Mod_Good
- VZ17 - 160_Moderate

Figure 23 Staging and stewardship site boundaries - Overview

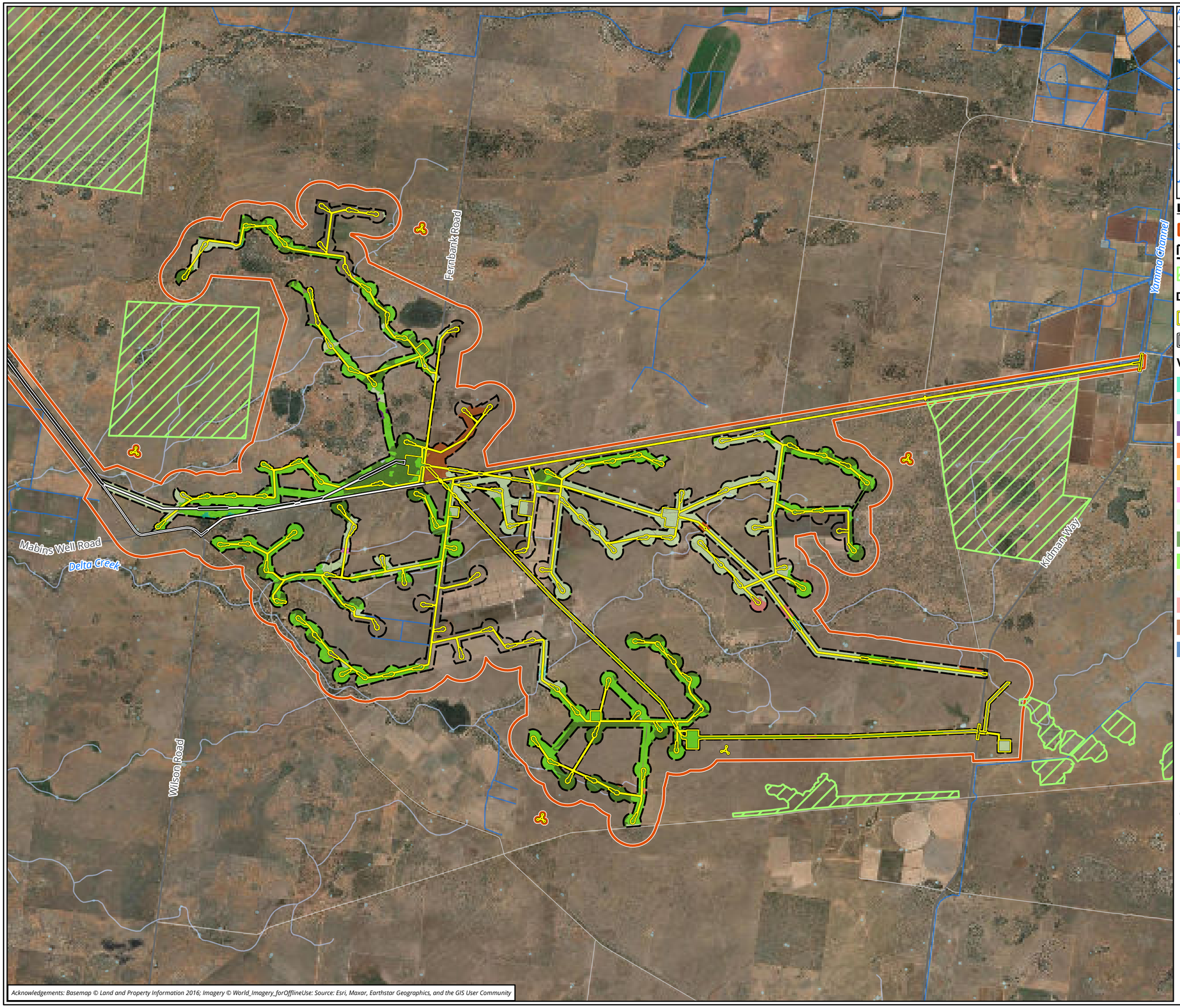
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Kilometers
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Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F23_Staging



Legend

- Subject land
- Development corridor
- Stewardship site boundaries

Development footprint

- Stage 1
- Stage 2

Vegetation zone

- VZ2 - 13_Moderate
- VZ3 - 13_Thinned
- VZ4 - 15_Moderate
- VZ6 - 17_Mod_Good
- VZ7 - 17_Moderate
- VZ8 - 24_Moderate
- VZ9 - 26_DNG
- VZ10 - 26_Intact
- VZ11 - 26_Sparse_Canopy
- VZ12 - 28_Low
- VZ14 - 45_Mod_Good
- VZ15 - 46_Moderate
- VZ16 - 160_Mod_Good

Figure 23 Staging and stewardship site boundaries - Stage 1

0 1 2 3

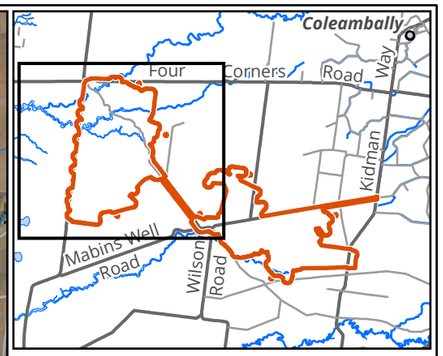
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Layout: 37263_Wind_F23_Staging





Legend

- Subject land
- Development corridor
- Stewardship site boundaries

Development footprint

- Stage 1
- Stage 2

Vegetation zone

- VZ1 - 10_Moderate
- VZ2 - 13_Moderate
- VZ3 - 13_Thinned
- VZ4 - 15_Moderate
- VZ5 - 15_Thinned
- VZ6 - 17_Mod_Good
- VZ7 - 17_Moderate
- VZ9 - 26_DNG
- VZ10 - 26_Intact
- VZ11 - 26_Sparse_Canopy
- VZ12 - 28_Low
- VZ13 - 28_Moderate
- VZ14 - 45_Mod_Good
- VZ15 - 46_Moderate
- VZ16 - 160_Mod_Good
- VZ17 - 160_Moderate

Figure 23 Staging and stewardship site boundaries - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F23_Staging

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © World_Imagery_forOfflineUse: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

12. Assessment against EPBC Act and FM Act

12.1. Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (MNES) protected under the Act. Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the Commonwealth Minister for the Environment and Water for assessment.

On the 12 July 2023, a delegate of the Federal Minister for the Environment and Water, determined the Dinawan Wind Farm was a controlled action under section 75 of the EPBC Act with the following controlling provisions:

- Listed threatened species and communities.

Supplementary SEARs were issued following the controlled action declaration.

12.1.1. Project assessment against the EPBC Act

The project is being assessed under the bilateral agreement addressing the matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulation 2000 (EPBC Regulation). As such, an assessment of the likelihood of occurrence of nationally listed biota occurring in the impact area and determination of significant impact likely to result from the project has been undertaken (Appendix 2). An assessment of significant impacts under the EPBC Act in accordance with the Significant Impact Guidelines (CoA 2013) was undertaken for threatened MNES biota (Appendix 6). Assessments of significant impacts on threatened species and ecological communities presented here are limited to biota recorded or identified as having a medium or higher likelihood of occurrence in the impact area and that may be impacted by construction and/or operation of the project, as well as those referenced in Supplementary SEARs.

The controlled action decision specifies listed threatened species and ecological communities as controlling provisions. Impacts associated with World Heritage properties and National Heritage places are outside the scope of this assessment, and Ramsar wetlands are not considered as they are not assessed to be controlling provisions. MNES within the subject land are detailed within Table 98 below.

All MNES protected under the triggered controlling provisions are potentially relevant. The supplementary SEARs issued 22 August 2023 by Cth DCCEEW consider that there is likely to be a significant impact on the following species or communities:

- Plains Wanderer – Critically Endangered.
- Natural Grasslands of the Murray Valley Plains – Critically Endangered
- Weeping Myall Woodlands – Endangered.

Additional to this, the following species are identified as potentially being at risk of impact:

- Winged Peppercress *Lepidium monoplocoides* - Endangered
- Sand-hill Spider Orchid *Caladenia arenaria* – Endangered
- Turnip Copperburr *Sclerolaena napiformis* – Endangered

- Spear Grass *Austrostipa wakoolica* – Endangered
- Claypan Daisy *Brachyscome muelleroides* – Vulnerable
- Chariot Wheels *Maireana cheelii* – Vulnerable
- Slender Darling Pea *Swainsona murrayana* – Vulnerable
- Red Darling Pea *Swainsona plagiotropis* – Vulnerable
- Major Mitchell's Cockatoo (eastern) *Lophochroa leadbeateri leadbeateri* – Endangered
- Australasian Bittern *Botaurus poiciloptilus* – Endangered
- Australian Painted Snipe *Rostratula australis* – Endangered
- Superb Parrot *Polytelis swainsonii* – Vulnerable
- Southern Whiteface *Aphelocephala leucopsis* – Vulnerable
- Painted Honeyeater *Grantiella picta* – Vulnerable
- Diamond Firetail *Stagonopleura guttata* – Vulnerable
- Blue-winged Parrot *Neophema chrysostoma* – Vulnerable
- Corben's Long-eared Bat *Nyctophilus corbeni* – Vulnerable
- Southern Bell Frog *Litoria raniformis* – Vulnerable.

A list of biodiversity related MNES considered likely to be, or be at some risk of being, significantly impacted by the project is provided in Table 98, with detailed assessments included as Appendix 6. This assessment determined the MNES outlined below as having the potential for significant impact from the project:

- Plains Wanderer – Critically Endangered.
    - Significant impact likely.
- Superb Parrot – Vulnerable.
    - Significant impact possible.
- Natural Grasslands of the Murray Valley Plains – Critically Endangered
    - Significant impact likely.
- Weeping Myall Woodlands – Endangered.
    - Significant impact likely.

Assessments have been undertaken in accordance with the Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (CoA 2013) within Appendix 6. All relevant EPBC Act listed species and ecological communities, and listed migratory species considered herein are listed in Table 98 and Table 99, along with a summary of the evidence used to conclude whether a significant impact is likely or unlikely to occur as a result of the project.

12.1.2. MNES within the subject land

A summary of all MNES recorded, or considered to have the potential to occur, within the development footprint and development corridor is provided in Table 98.

Table 98 MNES within the subject land

Matter of NES	Project specifics	Potential for significant impact
Threatened species	The Controlled Action decision identified the proposed action (i.e. the project) as likely to have a significant impact on the following species: • **Plains Wanderer** The Controlled Action decision identified the following species as being at risk of impact: • **Winged Peppercress** • Sand-hill Spider Orchid • **Turnip Copperburr** • **Spear Grass** • **Claypan Daisy** • **Chariot Wheels** • **Slender Darling Pea** • **Red Darling Pea** • **Major Mitchell's Cockatoo** • **Australasian Bittern** • **Australian Painted Snipe** • **Superb Parrot** • **Southern Whiteface** • **Painted Honeyeater** • **Diamond Firetail** • Blue-winged Parrot • **Corben's Long-eared Bat** • White-throated Needletail Although not mentioned within the controlled action decision, **Southern Bell Frog** has also been included. 17 EPBC listed threatened species above are considered to have a known, potential or uncertain impact as a result of the project. Those entities are highlighted in **bold** above. All other potential threatened species are considered to have a low likelihood of occurrence due to limited or absent suitable habitats in the subject land.	The following species were determined to be potentially at risk of significant impact, and require assessment under the EPBC Act. • Plains Wanderer • Winged Peppercress • Turnip Copperburr • Chariot Wheels • Spear Grass • Claypan Daisy • Mossgiel Daisy • Slender Darling Pea • Red Darling Pea • Major Mitchell's Cockatoo • Australasian Bittern • Australian Painted Snipe • Superb Parrot • Southern Whiteface • Painted Honeyeater • Diamond Firetail • Southern Bell Frog • Corben's Long-eared Impacts to White-throated Needle tail and Blue-winged Parrot have been considered to be low or negligible, due to westerly distribution limits or vagrancy respectively. Impacts to Sand-hill Spider Orchid is considered negligible due to lack of suitable microhabitats and geographical limitations.
Threatened ecological communities	Direct and indirect impacts are considered to occur to two listed TECs: • Weeping Myall Woodland • Natural Grasslands of the Murray Valley Plains No other EPBC listed TECs occur within the subject land.	Of all entities assessed, the following are considered to have a significant impact resulting from the project: • Weeping Myall Woodland • Natural Grasslands of the Murray Valley Plains

Matter of NES	Project specifics	Potential for significant impact
Migratory species	The Controlled Action decision did not identify the proposed action as likely to have a significant impact on migratory species. Background searches identified the following migratory species as having potential to occur in the subject land: • *Actitis hypoleucos* • *Apus pacificus* • *Calidris acuminata* • *Calidris ferruginea* • *Calidris melanotos* • *Charadrius veredus* • *Gallinago hardwickii* • *Gelochelidon nilotica* • *Haliaeetus leucogaster* • *Hirundapus caudacutus* • *Hydroprogne caspia* • *Limosa limosa* • *Merops ornatus* • *Motacilla flava* • *Numenius madagascariensis* • *Legadis falcinellus* • *Tringa nebularia*	There is limited suitable habitat within the subject land for migratory shorebird species, particularly those that are largely associated with tidal mudflats or coastal beaches and estuaries. Migratory species that may occur in inland areas such as Latham's Snipe and Glossy Ibis, may occasionally utilise any natural drainage systems, depressional wetlands or farm dams in the subject land during suitable conditions. Impacts to these areas are likely to be minimal, with the project design largely avoiding any impacts to wetland habitats. Fork-tailed Swift were observed during BUS, and an assessment of this species has been undertaken. Despite collision risk associated with the wind farm, all other migratory species are considered to be not significantly impacted.
World or National Heritage Places	No world heritage places or national heritage places were identified as occurring within the subject land or within 10 km of the subject land.	There are no national or world heritage places within or near the subject land. The project is unlikely to result in any direct or indirect impacts to national or world heritage.
Wetlands of international importance (Ramsar sites)	There are no Ramsar wetland areas within or near the subject land. The subject land is 200-300 kilometres upstream from the nearest Ramsar site at Hattah-Kulkyne Lakes (Ramsar site 16), 400-500 kilometres upstream from the Riverland (Ramsar site 29) and Banrock Station wetland complex (Ramsar site 63), and 500-600 kilometres upstream from the Coorong, and lakes Alexandrina and Albert wetland (Ramsar site 25).	The project is not expected to incur any significant impacts, or modifications to the natural drainage systems including watercourses and lake areas within the subject land or surrounding landscape.

Table 99 Detailed summary of MNES with potential for impact within the subject land

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (Appendix 6)
Development footprint					
Weeping Myall woodlands	Likely to be significant impacted	Recorded within development footprint.	Yes	Most dominant vegetation community with the broader locality and development footprint, in three various conditions zones. Although a large amount of intact Weeping Myall has been prioritised for avoidance, due to the removal of approximately 150.46 ha of Weeping Myall TEC that is known or likely to meet the criteria under the EPBC Act, in conjunction with cumulative impacts within the region, there is potential for significant impacts on the TEC.	Potential for significant impact on criteria 1 of SIC – Reduce the extent of an ecological community
Natural Grasslands of the Murray Valley Plains	Likely to be significant impacted	Recorded within development footprint.	Yes	Impacts to known areas of this community have been avoided where possible and restricted to smaller isolated patches or fringing areas of larger more connected patches. Total impacts associated with this TEC are approximately 114 ha, of which 15.18 ha (13%) is attributed to Stage 1 and 99.24 ha (87%) is attributed to Stage 2 impacts. Potential areas of vegetation that will have patches commensurate with this TEC within the subject land equate to approximately 5,699 ha. It is estimated in the Riverina that approximately 61,000 ha remain in the region. Based on an impact are of 114 ha, the project has potential to remove approximately 2% and 0.2% of the predicted extent of this TEC within the subject land and broader region respectively. Although areas of this TEC have been avoided, and restricted to more linear impacts in nature, given the overall amount of impact and potential for cumulative impacts, it is likely that significant impacts would occur to this TEC.	Significant impact likely. Attributed predominantly to Stage 2 impacts only
Plains-Wanderer	Likely to be significant impacted	Known to occur. Important mapped habitat within subject land	Yes	The Plains Wanderer is known to occur throughout the broader locality historically, with the Riverina considered a strong hold for the species. Due to the dynamic nature of the grassland habitats and condition states therein, a key focus during project design was the avoidance of likely suitable habitat at a landscape scale. Specifically, due to the cryptic nature of this species and critically endangered listing, avoidance of suitable habitat and mapped important areas were incorporated early into project designs. This included avoiding and minimising impacts to areas of lower tussocky grasslands such as PCT 46, as well as areas of important mapped habitat and associated buffers. Approximately 4.02 ha of important mapped area will be impacted and offset, however 0.99 ha of this occurs across an existing formed public road. Approximately 11.8 ha of important mapped area occurs within the development corridor, and 645 ha within the subject land. Additionally, areas or PCT 46 (114 ha total, 15.18 ha in Stage 1 and 99.24 ha in Stage 2) will be impacted that may provide habitat in future due to the dynamic nature of grassland communities in the Riverina. Direct impacts equate to approximately 0.91% of potentially suitable habitat within the subject land. Site surveys were undertaken in November 2022 (impacted by flooding) as well as March 2023 and April 2023. Surveys were conducted via nocturnal transects as well as acoustic detection. No evidence of this species within suitable habitat within the subject land were recorded.	Significant impact possible due to criteria 2 of SIC – Attributed predominantly to Stage 2 impacts only. Reduce the area of occupancy of the species
Brachyscome muelleroides	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Brachyscome muelleroides* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded despite flooding impeding some access however sufficient survey for the species was completed . In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible (including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland). This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers seasonally moist grey gilgaied soils on the floodplains with PCTs such as PCT 45 and PCT 46, which occur within the subject land. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Brachyscome papillosa	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Brachyscome papillosa* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are	Significant impact unlikely

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MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (Appendix 6)
				outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	
Lepidium monoplocoides	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Lepidium monoplocoides* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. Further survey will be undertaken in September 2024 and November 2024. To date, no records have been detected. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures	Significant impact unlikely
Sclerolaena napiformis	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Sclerolaena napiformis* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. It will also be subject to further survey in September 2024 and November 2024. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible (including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland). This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers grassland PCTs such as PCT 46, and derived areas of PCT 26 which occur within the subject land. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Austrostipa wakoolica	Low risk of significant impact	Surveyed. Assumed present	Unlikely	*Austrostipa wakoolica* has not been surveyed adequately to date, due to flooding and access constraints in November 2022 and 2023, with small areas still currently assumed present. It will be subject to further survey in November 2024. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This included known habitats such as lignum swamp in brown loam with box and mallee, creek banks in grey silty clay, mallee and lignum sandy loam flat, open cypress pine forest on low range in sandy soil and a low rock rise fenced-off from stock for about 18 months (DECCW, 2014). This species can be associated with PCT 17 and PCT 26 and has been assumed present in these zones. For PCT 26, this species has only been assumed in areas within this zone that are subject to more frequent periodic flooding for its habitat to maintain wet conditions. Avoidance has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Regardless of the outcomes of the additional surveys, potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact considered unlikely
Maireana cheelii	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Maireana cheelii* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. It will also be subject to further survey in November 2024. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Swainsona murrayana	Some risk of significant impact	Recorded within development footprint.	Yes	This species has been identified during surveys in September 2022 and September 2023. All records and suitable habitat were found to be in certain habitats of reduced grass cover, increase forb cover with species such as Bulbine lily. Large numbers of the species were recorded, estimated to up to 500 individuals and 42 ha of optimal habitat, however numerous designs revisions have occurred to avoid and minimise impacts to larger patches to ensure a viable local population can be maintained. Impacts will occur to isolated individual and small patches, totalling approximately 2.7 ha of known occurrence. Unlikely to be considered an important population. This represents approximately 6% of the local population recorded. Additionally this species is also	Significant impact considered unlikely

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MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (Appendix 6)
				impacted by the adjacent Dinawan Solar Farm, with a further 5 ha impacted. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	
Swainsona plagiotropis	Low risk of significant impact	Surveyed. Unlikely to be present	Unlikely	Targeted surveys for *Swainsona plagiotropis* have been carried out throughout the development footprint in September 2022 and September 2023 and this species has not been recorded. It was found to be flowering during surveys in September 2023 at a known reference population near Jerilderie. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Eastern Major Mitchell's Cockatoo	Low risk of significant impact	Surveyed. Unlikely to be present for breeding	Unlikely	Not recorded during detailed BUS across two years. Hollow bearing trees will be removed as part of the project, limited to 15. Turbine collision is possible, but overall risk is considered low. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. No known breeding site will be impacted. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Australasian Bittern	Some risk of significant impact	Transient only	Unlikely	There is no optimal habitat for the Australasian Bittern within the subject land, however this species is known to fly to and from breeding grounds in and around Leeton and Griffith in NSW, through to Victoria. It is unlikely that this species would occur within the subject land, other than rare transient use or during increased seasonal flooding events and only on a temporary basis. Potential flight heights for Australasian Bitterns can vary depending on several factors, including habitat type, weather conditions, and behavioural patterns. Generally, Bitterns are known to fly at relatively low altitudes, often skimming over wetland vegetation such as reeds and grasses. This low-level flight behaviour is believed to be an adaptation to their hunting strategy, as they primarily prey on small fish, frogs, and invertebrates found in shallow water within wetland habitats. Bitterns are likely to fly lower to minimise energy expenditure and maintain stability due to their bulky heavy set build. However, prolonged flights over open areas and open habitats may occur on occasion, and they may occasionally ascend to slightly higher altitudes, particularly during certain behaviours such as territorial displays, courtship flights, or nomadic movements. It is not well known, and although possible, it is considered an unlikely event that Bitterns would fly within the RSA of this project, that being within 80-280m above ground level. This species has a low risk of being effected by macro avoidance of large areas of turbines. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Australian Painted Snipe	Low risk of significant impact	Transient only	Unlikely	There is no optimal habitat for the Australian Painted Snipe within the subject land, however this species is known to fly to and from optimal areas nomadically based on environmental conditions, influenced by factors such as habitat availability, water levels, and food resources as well as for breeding events between September and March. Swamps, and flooded grasslands may provide suitable habitat on the rare occasion during rare flooding events. Australian Painted Snipes typically fly at relatively low elevations, especially during their migration and foraging activities. They are not considered high-altitude migratory birds like some species of waterbirds and/or raptors. Instead, they tend to fly close to the ground, skimming over wetlands and vegetation as they move between feeding and breeding sites. Whilst not well known, and research on movements is currently underway, it is unlikely that Australian Painted Snipe would fly within the RSA of this project, that being within 80-280m above ground level. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Superb Parrot	Some risk of significant impact	Recorded within development footprint.	Yes	Recorded foraging onsite. No direct observational evidence of breeding was recorded within the subject land, however numerous paired individuals and juveniles were observed. Potential hollows were found to be preferentially in use by common species such as Blue Bonnets and Galahs. A number of annual flights (between 1 and 3) for the Superb Parrot are at risk of collision with turbines as well as the potential, albeit low likelihood, of macro avoidance of habitat within the subject land. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high	Potential for significant impact based on reduced occupancy and collision risk. Recorded within RSA.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (Appendix 6)
				biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures. x	
Southern Whiteface	Low risk of significant impact	Recorded within development footprint.	Yes	Recorded foraging onsite frequently in all majority of habitats within the development corridor. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely Not at risk of collision
Painted Honeyeater	Low risk of significant impact	Recorded adjacent to development footprint	Yes	Recorded foraging adjacent to the previous development corridor in high condition Weeping Myall vegetation that has been avoided. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Direct impacts to 133 ha of intact Weeping Myall areas containing mature woody vegetation are predicted; however, 871 ha will be retained and an additional 5,771 ha within the subject land will also be retained. Movement through the landscape will not be impeded by the project. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely Not at risk of collision
Diamond Firetail	Low risk of significant impact	Recorded within development footprint.	Yes	Recorded foraging onsite. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures	Significant impact unlikely Not at risk of collision
Blue-winged Parrot	Low risk of significant impact	Surveyed. Unlikely to be present	Negligible	Not recorded during detailed BBUS surveys across two years. Considered vagrant in NSW, with breeding noted as typically occurring in Tasmania, coastal south-eastern Australia and southern Victoria.. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures	Significant impact unlikely Not at risk of collision
Southern Bell Frog	Some risk of significant impact	Recorded within development footprint.	Yes	This species was observed opportunistically and repeatedly during habitat surveys, as well as again in February and March 2023, and January 2024 during targeted habitat surveys. Records occurred following above average rainfall and flooding conditions that likely washed individuals from a stronghold area in the Coleambally irrigation areas to the north, via flooding events in Delta Creek and Coleambally outfall drain. For majority of the time, the only areas that provide more permanent, yet still suboptimal habitat, are within the irrigation channel and grasslands adjacent to. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Direct impacts will be limited, with most impacts associated to adjacent buffers and dispersal habitat. It was noted that where more permanent water was found and *Gambusia holbrooki* were present, Southern Bell Frog was not recorded or observed to be present. Where more permanent water was found, such as irrigation channels and farm dams, and where *Gambusia holbrooki* was not present, mature individuals, immature individuals and tadpoles were observed. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures as well generation of additional credits for indirect impacts to residual transient habitats as prescribed by the BAM.	Significant impact unlikely

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MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (Appendix 6)
Coben long-eared Bat	Low risk of significant impact	Recorded within development footprint.	Unlikely	Corben's long-eared bats can vary depending on factors such as time of night (more frequent movement between dusk and 10pm), weather conditions, and individual behaviour. These bats often fly at low levels, particularly when foraging for insects. They may fly just a few meters above the ground or forest canopy with good vegetative structure., where their prey is more abundant. Unlikely to fly within RSA. Flying at lower heights allows them to more effectively detect and capture flying insects using echolocation. Habitat for this species are intact riverine woodland communities and White Cypress Pine communities, where impacts have been minimised. The removal of 15 hollow bearing tress, in a locality with a high abundance of small and medium hollows, is not likely to affect this species. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
Fork Tailed Swift	Low risk of significant impact	Recorded within development footprint.	Yes	This species was recorded once, during BUS surveys in March 2024 only, despite two years of survey. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. Mostly occur over inland plains but sometimes above foothills or in coastal areas. Fork-tailed Swift undertake extensive migrations, traveling thousands of kms from their breeding grounds to their wintering areas. Their movements are influenced by factors such as food availability, weather patterns, and breeding cycles. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely
White-throated Needletail	Low risk of significant impact	Surveyed. Unlikely to be present	Low	Not recorded during detailed BUS surveys across two years. Foraging in Australia occurs until January – April, where birds begin migration back to breeding grounds in Asia and Siberia. The subject land is considered to be at its southern and westerly distribution This species is almost entirely aerial, foraging from 1m to 1000m above the ground, they occur over most habitat types, with a preference towards wooded areas,. Roosting occurs in in forest/woodland in dense canopy or hollow, with indications of aerial roosting also occurring.. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.	Significant impact unlikely

12.1.3. Survey effort for MNES entities

Habitat assessments to determine microhabitats for threatened species across the development corridor and subject land have been completed. Suitable foraging and breeding habitat was identified for a number of species within the development corridor and subject land. Targeted surveys included the following:

- Targeted flora surveys.
- Targeted nocturnal bird surveys.
- Diurnal bird surveys (Bird Utilisation Surveys):
- Two years survey effort covering summer/autumn/winter/spring.
- Microchiroptera bat survey (Bat Utilisation Survey).

Vegetation surveys comprising mapping of vegetation communities and collection of floristic plot data were also completed to determine the presence of TECs listed as MNES under the EPBC Act.

Section 4, provides details of survey method and effort, justification for survey methods employed, timing of surveys, experience of personnel undertaking the surveys and the result of the surveys.

The following MNES listed species were identified during the survey effort:

- Painted Honeyeater.
- Diamond Firetail.
- Southern Whiteface.
- Superb Parrot.
- Southern Bell Frog.
- Corben's Long-eared Bat (precautionary from call analysis based on species group identification).
- Fork-tailed Swift.
- *Swainsona murrayana*.

12.1.4. Avoidance of impacts to MNES

Avoidance and minimisation of impacts to biodiversity values have been undertaken throughout the development and design of the project from initial desktop-based constraints information, followed by design workshops and updates based on a number of rounds of collection of ground-validated data. Section 7 provides detailed information of efforts undertaken to minimise impacts to biodiversity values.

12.1.5. MNES potentially impacted by the project

The likelihood of occurrence of MNES within the development corridor and subsequent potential impacts were assessed through desktop and field-based assessments. Species were determined to be at risk of significant impact and were subject to assessment under the EPBC Act Significant Impact Guidelines (DoE 2013):

Likelihood of occurrence tables are addressed with BAM candidate species in Appendix 2. Significant Impact Criteria assessments for MNES are provided in Appendix 6. This assessment determined the species outlined

below as having the potential for significant impact from the project – where impacts are substantially linked to a particular project stage, this is noted:

- Plains Wanderer – Critically Endangered.
    - Significant impact (attributed to stage 2 only).
- Superb Parrot – Vulnerable.
    - Significant impact.
- Natural Grasslands of the Murray Valley Plains – Critically Endangered
    - Significant impact (attributed to stage 2 only).
- Weeping Myall Woodlands – Endangered.
    - Significant impact.

Species such as the Australasian Bittern that may traverse through the landscape during nomadic movement may be impacted by barrier effects and macro avoidance of large areas of turbines, however this impact is not considered to be significant or substantial.

12.1.6. Mitigation to MNES

Ongoing avoidance, minimisation and mitigation of impacts to biodiversity values will be undertaken through detailed design, construction and operation of the project. Table 83 in Section 9 provides detailed information on mitigation measures and commitment to ensure impacts to MNES continue to be minimised during future project stages.

12.1.7. Offsetting of residual impacts to MNES

Impacts to MNES as a result of the project have been determined to be significant for two listed threatened species, and two threatened ecological communities, in accordance with Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013) (refer Appendix 6). Offsetting in accordance with the EPBC Act Environmental Offsets Policy (CoA 2012) and the EPBC Act is not specifically required. Reducing impacts to these species and communities will be the focus of further detailed design.

Impacts to all MNES, including those assessed as unlikely to be significantly impacted by the project, will be offset in accordance with the NSW BOS through either direct establishment of Biodiversity Stewardship Sites to generate biodiversity credits to offset the project's impacts, through securing biodiversity credits from the open market, or from payment to the Biodiversity Conservation Fund. Further information of the project biodiversity offset strategy is provided in Section 11.

The project is committed to providing additional offsets, over and above those required by the NSW BOS and EPBC Act Environmental Offsets Policy to benefit significantly impacted communities and species through means such as providing additional funding for habitat management, predator exclusion and pest control. These are likely to be contained within stewardship sites currently under assessment for the project. The quantum of additional offset contributions, specific measures to be funded, and relevant mechanisms will be detailed in the project's final designs Biodiversity Offset Strategy, to be developed post-approval.

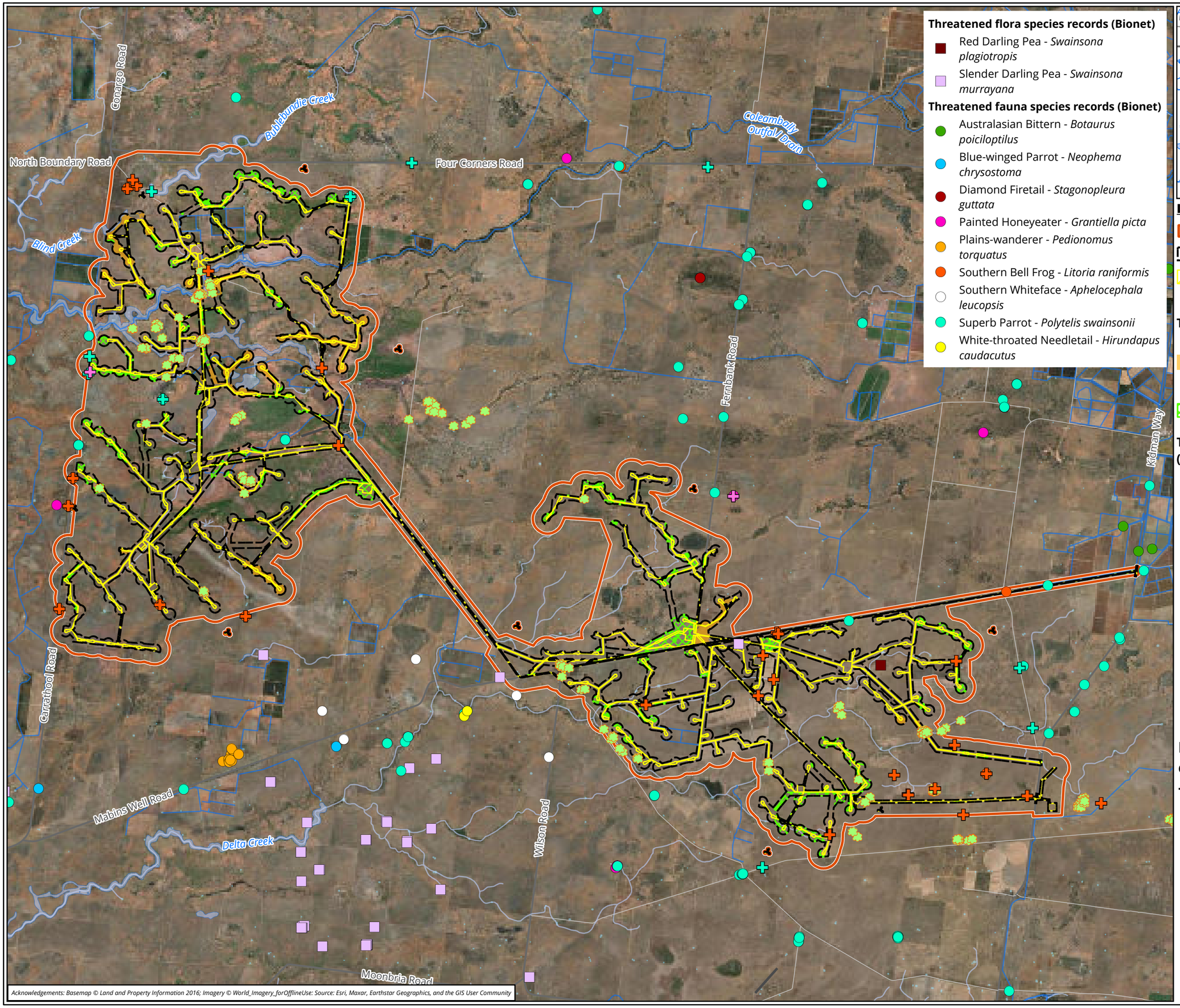
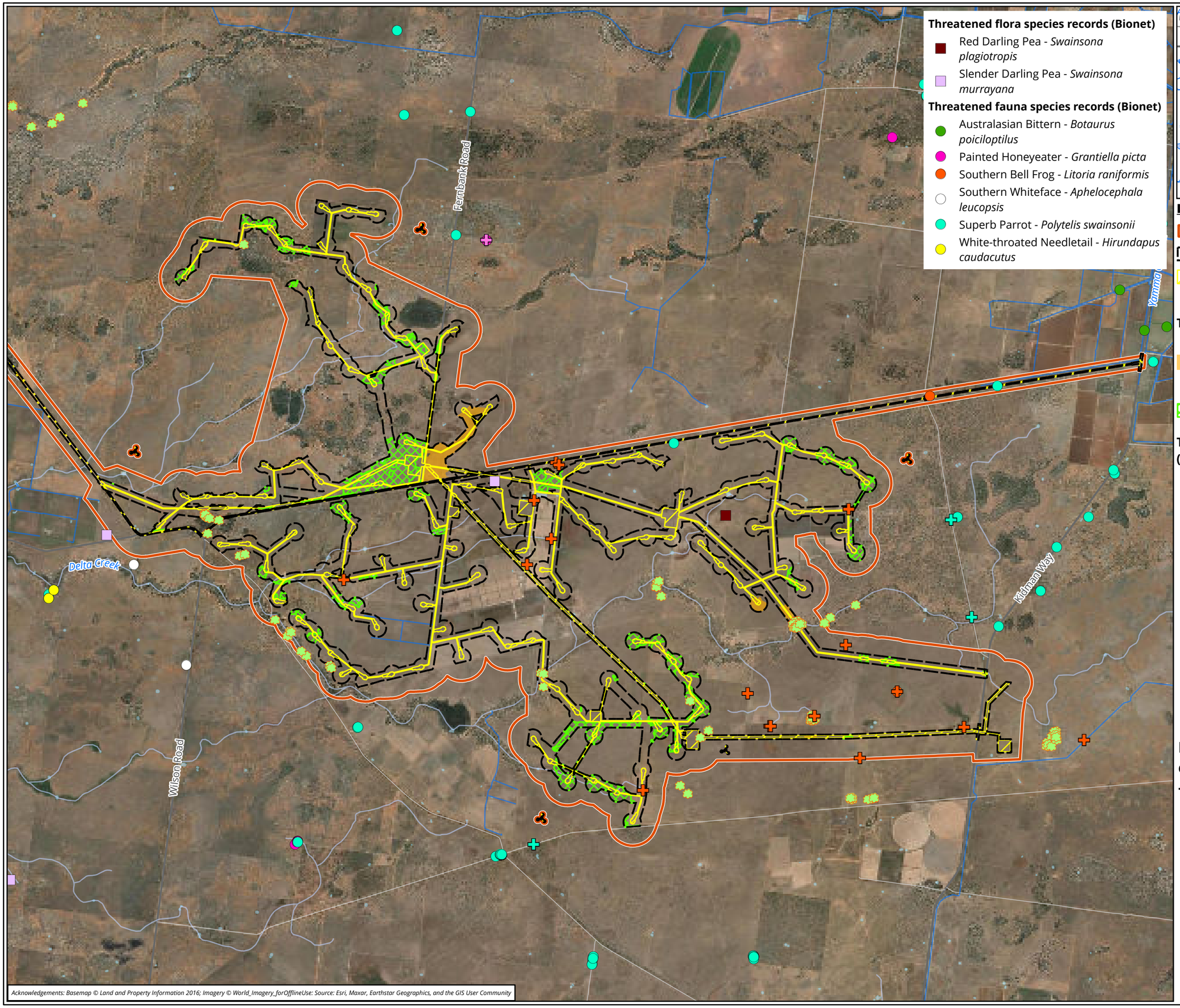


Figure 24 Matters of national environmental significance - Overview

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © World_Imagery_forOfflineUse: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

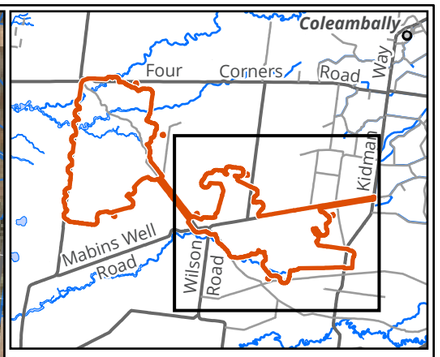


Threatened flora species records (Bionet)

- Red Darling Pea - *Swainsona plagiotropis*
- Slender Darling Pea - *Swainsona murrayana*

Threatened fauna species records (Bionet)

- Australasian Bittern - *Botaurus poiciloptilus*
- Painted Honeyeater - *Grantiella picta*
- Southern Bell Frog - *Litoria raniformis*
- Southern Whiteface - *Aphelocephala leucopsis*
- Superb Parrot - *Polytelis swainsonii*
- White-throated Needletail - *Hirundapus caudacutus*



Legend

- Subject land
- Development corridor
- Development footprint
- Hollow-bearing tree

Threatened ecological communities

- Natural Grasslands of the Murray Valley Plains (potential) (CEEC, EPBC Act)
- Weeping Myall Woodlands (EEC, EPBC Act)

Threatened fauna species records (Biosis)

- Painted Honeyeater - *Grantiella picta*
- Southern Bell Frog - *Litoria raniformis*
- Superb Parrot - *Polytelis swainsonii*

Figure 24 Matters of national environmental significance - Stage 1

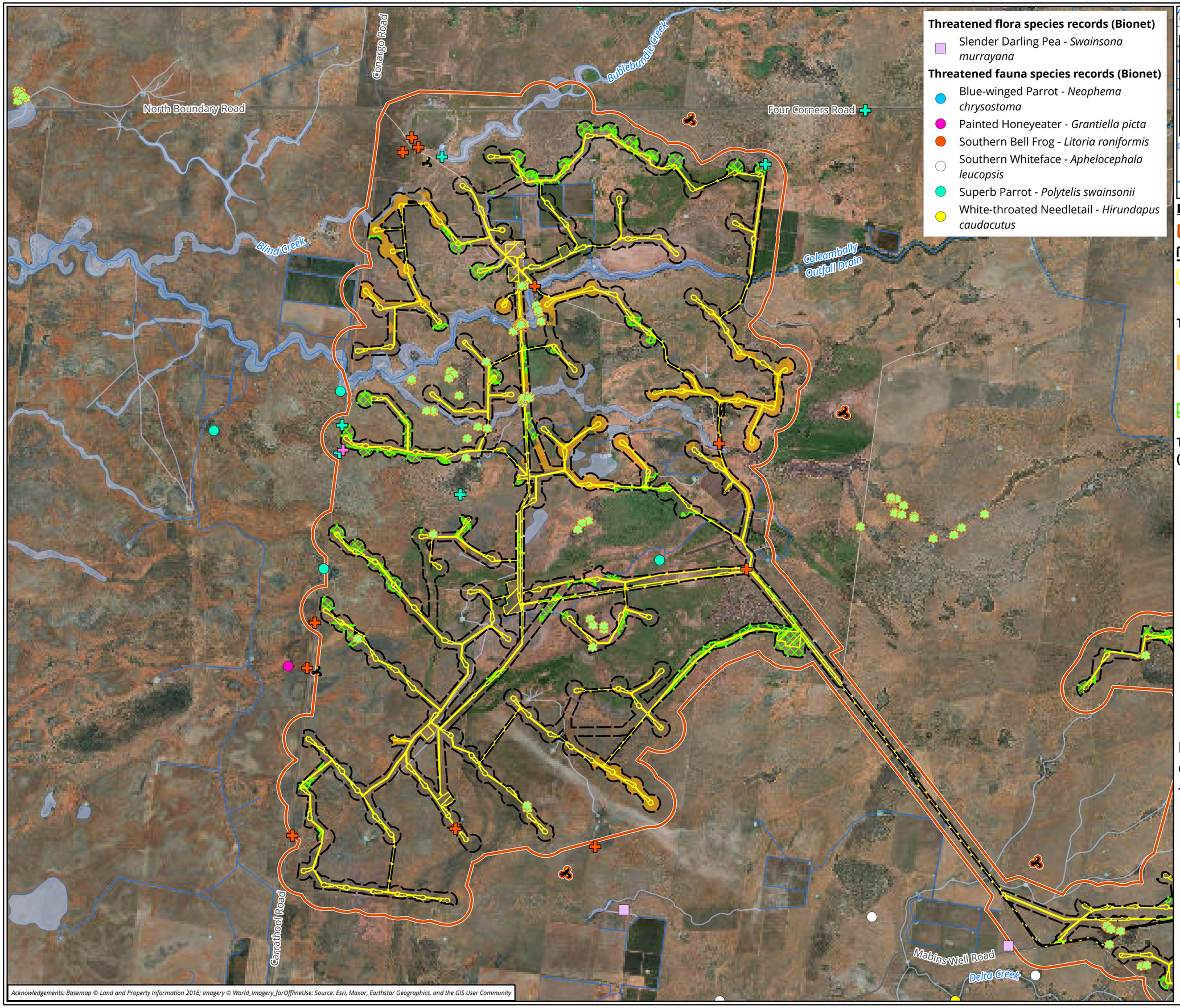
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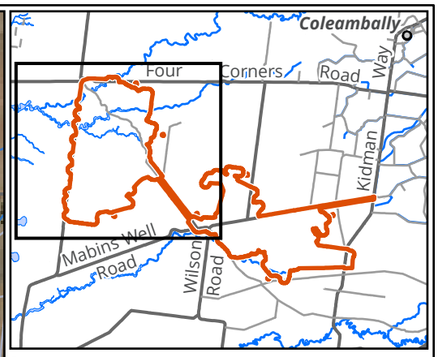
Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

N

biosis

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F24_MNES





Legend

- Subject land
- Development corridor
- Development footprint
- Hollow-bearing tree

Threatened ecological communities

- Natural Grasslands of the Murray Valley Plains (potential) (CEEC, EPBC Act)
- Weeping Myall Woodlands (EEC, EPBC Act)

Threatened fauna species records (Biosis)

- Painted Honeyeater - *Grantiella picta*
- Southern Bell Frog - *Litoria raniformis*
- Superb Parrot - *Polytelis swainsonii*

Figure 24 Matters of national environmental significance - Stage 2

0 1 2 3

Kilometers
Scale: 1:80,000 @ A3
Coordinate System:
GDA2020 MGA Zone 55

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biosis

Matter: 37263, Date: 12 April 2024,
GIS: JB, Checked by: MP, Last edited by: jbeckius
Location: P:\37200s\37263\Mapping\
37263_Dinawan_BDAR_Wind_F18-24_BACKUP.aprx
Layout: 37263_Wind_F24_MNES

12.2. Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through an Assessment of Significance process.

Predicted habitat for threatened aquatic species such as the Flathead Galaxias or Silver Perch is mapped on the DPI spatial data portal within the subject land and within sections of the Coleambally Outfall Drain. These species are also identified as part of Delta Creek, however this creek will not be directly impacted. The Coleambally Outfall Drain are identified as Poor Freshwater Fish Community habitat within the subject land and on the NSW DPI Freshwater Fish Community map (DPI 2023). The area of indicative habitat for this species within the subject land is located within a modified earthen channel, the Coleambally Outfall Drain, which is used to supply water for irrigation (NSW Agriculture 2003). Water pooling and minor flow were observed during surveys within the subject land, however water quality was observed to be in poor condition. The habitat within the Coleambally Outfall Drain consists of a two-three meter wide, highly modified earthen channel, and at best, one to two meter in depth. This channel may be used as transitional habitat between areas of suitable breeding and foraging areas, however it is considered highly unlikely to support breeding of these species during low or high flows. No records of threatened aquatic species have been recorded within 10 kilometres of the subject land on the BioNet Atlas of NSW, however two species were predicted by the Protected Matters Search Tool (PMST).

Numerous ephemeral watercourses associated are located within the subject land and dissected by the development corridor. No instream woody debris is proposed to be removed and therefore a permit under Part 7 of the FM Act is not required. NSW DPI is required to assess all projects that involve structures that span the full width of a waterway (including pipe crossings) or modifies the velocity or quantity of water. Crossing locations within the Coleambally Outfall Drain are located where existing structures occur currently. Consideration of appropriate riparian buffer distances for the purpose of key fish habitat conservation, as well as best practise guidance on minimising impacts to fish passage and general aquatic wildlife as a result of temporary and permanent waterway crossings will be undertaken. Mitigation measures will be implemented to ensure impacts within the subject land do not result in indirect impacts to waterways in the broader locality. As the waterways within the subject land do not support significant aquatic ecological communities, fish passage is unlikely to be impacted by the project.

12.3. Biosecurity Act 2015

The *Biosecurity Act 2015* provides for the identification, classification and control of priority weeds with the purpose of determining if a biosecurity risk is likely to occur. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within NSW or any part of the State. A pest plant has the potential to; harm or reduce biodiversity or out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.

Two priority weeds for the Murray LLS Region have been recorded in the subject land and are African Boxthorn *Lycium ferocissimum* and Bathurst Burr *Xanthium spinosum*. Both have a General Biosecurity Duty under the Act.

13. Biodiversity credit report

Offsetting through establishment of Biodiversity Stewardship Sites, the transfer and retirement of biodiversity credits, and/or paying into the BCT Offset Fund, is required for the project. Biodiversity credit reports provided on the following pages.

Biodiversity credit report 00034895/BAAS17051/24/00046668 relates to impacts to vegetation zones and species credit species habitats.

Biodiversity credit report 00034895/BAAS17051/24/00047205 relates to impacts to paddock tress undertaken in accordance with the BAM streamlined assessment module (see Appendix 6.1)

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034895/BAAS17051/24/00046668	Dinawan Wind Farm BDAR	14/03/2024
Assessor Name	Report Created	BAM Data version *
Mitchell Palmer	20/06/2024	67
Assessor Number	BAM Case Status	Date Finalised
BAAS17051	Locked	20/06/2024
Assessment Revision	Assessment Type	
0	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
2	13_Moderate	Not a TEC	63.9	63.9	4.8	PCT Cleared - 57%	High Sensitivity to Gain			1.75		135

3	13_Thinned	Not a TEC	72.4	72.4	9.1	PCT Cleared - 57%	High Sensitivity to Gain			1.75		289
											Subtotal	**424**
Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
4	15_Moderate	Not a TEC	71.5	71.5	6.2	PCT Cleared - 50%	High Sensitivity to Gain			1.75		194
5	15_Thinned	Not a TEC	63.3	63.3	1.6	PCT Cleared - 50%	High Sensitivity to Gain			1.75		45
											Subtotal	**239**
Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains												
8	24_Moderate	Not a TEC	29	29.0	0.23	PCT Cleared - 20%	High Sensitivity to Gain			1.50		3
											Subtotal	**3**

Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion												
15	46_Moderate	Natural Grasslands of the Murray Valley Plains	84.3	84.3	105.6	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		5564
											Subtotal	**5564**
Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
6	17_Mod_Good	Not a TEC	70.8	70.8	1.8	PCT Cleared - 63%	High Sensitivity to Gain			1.75		57
7	17_Moderate	Not a TEC	42.1	42.1	1.1	PCT Cleared - 63%	High Sensitivity to Gain			1.75		20
											Subtotal	**77**
Nitre Goosefoot shrubland wetland on clays of the inland floodplains												
16	160_Mod_Good	Not a TEC	81.8	81.8	4.1	PCT Cleared - 28%	High Sensitivity to Gain			1.50		125
17	160_Moderate	Not a TEC	39.5	39.5	0.84	PCT Cleared - 28%	High Sensitivity to Gain			1.50		12

											Subtotal	**137**
Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion												
14	45_Mod_Good	Natural Grasslands of the Murray Valley Plains	92.1	92.1	8.8	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		508
											Subtotal	**508**
River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
1	10_Moderate	Not a TEC	29.2	29.2	0.33	PCT Cleared - 43%	High Sensitivity to Gain			1.50		4
											Subtotal	**4**

Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion												
9	26_DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	19.6	19.6	395.9	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		3873
10	26_Intact01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	64.2	64.2	133.1	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		4272

11	26_Sparse01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	39.5	39.5	416.6	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		8234
											Subtotal	**16379**
White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone												
12	28_Low	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	42.6	42.6	54	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		1149

13	28_Moderate	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	76.4	76.4	0.98	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		37
											Subtotal	**1186**
											Total	**24521**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Austrostipa wakoolica / A spear-grass (Flora)									
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	37
								Subtotal	**37**

Brachyscome papillosa / Mossgiel Daisy (Flora)									
13_Thinned	72.4	72.4	9.1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	329
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	51
24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	3
								Subtotal	**383**
Convolvulus tedmoorei / Bindweed (Flora)									
17_Mod_Good	70.8	70.8	1.8	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	96
17_Moderate	42.1	42.1	1.1	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	34

24_Moderate	29.0	29.0	0.23	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	5
								Subtotal	**135**
Eucalyptus leucoxylon subsp. pruinosa / Yellow Gum (Flora)									
13_Thinned	N/A	N/A	3	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	6
15_Thinned	N/A	N/A	1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	2
								Subtotal	**8**
Lepidium monoplocoides / Winged Peppercress (Flora)									
13_Thinned	72.4	72.4	9.1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	329
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	51

24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	3
								Subtotal	**383**
Leptorhynchos orientalis / Lanky Buttons (Flora)									
24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Not Listed	False	3
								Subtotal	**3**
Litoria raniformis / Southern Bell Frog (Fauna)									
13_Moderate	63.9	63.9	0.81	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	26
13_Thinned	72.4	72.4	2.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	91

15_Thinned	63.3	63.3	1.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	39
17_Mod_Good	70.8	70.8	0.64	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	23
26_DNG	19.6	19.6	33.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	326
26_Intact01	64.2	64.2	8.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	268
26_Sparse01	39.5	39.5	32.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	637
28_Low	42.6	42.6	0.77	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	16

45_Mod_Good	92.1	92.1	0.31	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	14
46_Moderate	84.3	84.3	14.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	611
160_Mod_Good	81.8	81.8	0.37	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	15
								Subtotal	**2066**
Ninox connivens / Barking Owl (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	154
13_Thinned	72.4	72.4	9.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	329

15_Moderate	71.5	71.5	6.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	221
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	51
28_Low	42.6	42.6	5.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	113
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	37
								Subtotal	**910**
Pedionomus torquatus / Plains-wanderer (Fauna)									
13_Thinned	72.4	72.4	0.52	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	28

15_Moderate	71.5	71.5	0.05	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	3
17_Moderate	42.1	42.1	0.1	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	3
26_DNG	19.6	19.6	0.08	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	1
26_Sparse01	39.5	39.5	1.3	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	39
46_Moderate	84.3	84.3	2	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	125

								Subtotal	**199**
Pilularia novae-hollandiae / Austral Pillwort (Flora)									
15_Moderate	71.5	71.5	6.2	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	332
15_Thinned	63.3	63.3	1.6	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	76
28_Moderate	76.4	76.4	0.98	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	56
								Subtotal	**464**
Polytelis swainsonii / Superb Parrot (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	154

13_Thinned	72.4	72.4	9.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	329
15_Moderate	71.5	71.5	6.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	221
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	51
17_Moderate	42.1	42.1	0.55	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	12
26_DNG	19.6	19.6	6.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	63
26_Intact01	64.2	64.2	0.05	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2
26_Sparse01	39.5	39.5	6.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	131

28_Low	42.6	42.6	0.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2
28_Moderate	76.4	76.4	0.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	8
45_Mod_Good	92.1	92.1	0.68	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	31
46_Moderate	84.3	84.3	3.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	137
								Subtotal	**1146**
Swainsona murrayana / Slender Darling Pea (Flora)									
15_Moderate	71.5	71.5	6.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	221
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	51

26_DNG	19.6	19.6	2.1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	21
26_Intact01	64.2	64.2	0.08	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	3
26_Sparse01	39.5	39.5	0.51	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	10
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	37
46_Moderate	84.3	84.3	0.01	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1
								Subtotal	**344**
Swainsona sericea / Silky Swainson-pea (Flora)									
15_Moderate	71.5	71.5	6.2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	221

15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	51
26_DNG	19.6	19.6	2.1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	21
26_Intact01	64.2	64.2	0.08	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	3
26_Sparse01	39.5	39.5	0.51	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	10
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	37
46_Moderate	84.3	84.3	0.01	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	1
								Subtotal	**344**

Tyto novaehollandiae / Masked Owl (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	154
13_Thinned	72.4	72.4	9.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	329
15_Moderate	71.5	71.5	6.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	221
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	51
28_Low	42.6	42.6	5.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	113
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	37

								Subtotal	**910**

BAM Credit Summary Report

Proposal Details

Assessment Id
00034895/BAAS17051/24/00046668

Proposal Name
Dinawan Wind Farm BDAR- STAGE 1 EAST

BAM data last updated *
14/03/2024

Assessor Name
Mitchell Palmer

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Assessment Revision
3

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
1	13_Thinned	Not a TEC	72.4	72.4	3.4	PCT Cleared - 57%	High Sensitivity to Gain			1.75		106
											Subtotal	**106**
Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
2	15_Moderate	Not a TEC	71.5	71.5	0.35	PCT Cleared - 50%	High Sensitivity to Gain			1.75		11
											Subtotal	**11**
Canegrass swamp tall grassland wetland of drainage depressions, lakes and pans of the inland plains												
5	24_Moderate	Not a TEC	29	29.0	0.23	PCT Cleared - 20%	High Sensitivity to Gain			1.50		3
											Subtotal	**3**

Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion												
11	46_Moderate	Natural Grasslands of the Murray Valley Plains	84.3	84.3	11.2	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		589
											Subtotal	**589**
Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
3	17_Mod_Good	Not a TEC	70.8	70.8	1.7	PCT Cleared - 63%	High Sensitivity to Gain			1.75		53
4	17_Moderate	Not a TEC	42.1	42.1	0.03	PCT Cleared - 63%	High Sensitivity to Gain			1.75		1
											Subtotal	**54**

Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion												
10	45_Mod_Good	Natural Grasslands of the Murray Valley Plains	92.1	92.1	4	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		230
											Subtotal	**230**
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion												
6	26_DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	19.6	19.6	170.6	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		1669

7	26_Intact01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	64.2	64.2	70.8	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00	2273
8	26_Sparse01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	39.5	39.5	230.8	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00	4562
										Subtotal	**8504**

White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone												
9	28_Low	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	42.6	42.6	0.5	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		11
											Subtotal	**11**
											Total	**9508**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Brachyscome papillosa / Mossgiel Daisy (Flora)									
13_Thinned	72.4	72.4	3.4	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	122
24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	3
								Subtotal	**125**

Convolvulus tedmoorei / Bindweed (Flora)									
17_Mod_Good	70.8	70.8	1.7	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	91
17_Moderate	42.1	42.1	0.03	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	1
24_Moderate	29.0	29.0	0.23	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	5
								Subtotal	**97**
Eucalyptus leucoxylon subsp. pruinosa / Yellow Gum (Flora)									
13_Thinned	N/A	N/A	1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	2
								Subtotal	**2**
Lepidium monoplocoides / Winged Peppercress (Flora)									
13_Thinned	72.4	72.4	3.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	122

24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	3
								Subtotal	**125**
Leptorhynchos orientalis / Lanky Buttons (Flora)									
24_Moderate	29.0	29.0	0.23	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Not Listed	False	3
								Subtotal	**3**
Litoria raniformis / Southern Bell Frog (Fauna)									
13_Thinned	72.4	72.4	0.31	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	11
17_Mod_Good	70.8	70.8	0.61	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	22

26_DNG	19.6	19.6	17	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	166
26_Intact01	64.2	64.2	2.9	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	92
26_Sparse01	39.5	39.5	17.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	344
								Subtotal	**635**
Ninox connivens / Barking Owl (Fauna)									
13_Thinned	72.4	72.4	3.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	122
15_Moderate	71.5	71.5	0.35	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	13
28_Low	42.6	42.6	0.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	11

								Subtotal	**146**
Pedionomus torquatus / Plains-wanderer (Fauna)									
46_Moderate	84.3	84.3	0.3	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	19
								Subtotal	**19**
Pilularia novae-hollandiae / Austral Pillwort (Flora)									
15_Moderate	71.5	71.5	0.35	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	19
								Subtotal	**19**
Polytelis swainsonii / Superb Parrot (Fauna)									
13_Thinned	72.4	72.4	3.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	122
15_Moderate	71.5	71.5	0.35	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	13

26_DNG	19.6	19.6	2.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	24
26_Sparse01	39.5	39.5	0.24	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	5
45_Mod_Good	92.1	92.1	0.09	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	4
								Subtotal	**168**
Swainsona murrayana / Slender Darling Pea (Flora)									
15_Moderate	71.5	71.5	0.35	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	13
								Subtotal	**13**
Swainsona sericea / Silky Swainson-pea (Flora)									
15_Moderate	71.5	71.5	0.35	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	13
								Subtotal	**13**

Tyto novaehollandiae / Masked Owl (Fauna)									
13_Thinned	72.4	72.4	3.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	122
15_Moderate	71.5	71.5	0.35	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	13
28_Low	42.6	42.6	0.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	11
								Subtotal	**146**

BAM Credit Summary Report

Proposal Details

Assessment Id
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Proposal Name
Dinawan Wind Farm BDAR- Stage 2

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Mitchell Palmer

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Assessment Revision
2

Assessment Type
Major Projects

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Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
2	13_Moderate	Not a TEC	63.9	63.9	4.8	PCT Cleared - 57%	High Sensitivity to Gain			1.75		135

3	13_Thinned	Not a TEC	72.4	72.4	5.8	PCT Cleared - 57%	High Sensitivity to Gain			1.75		183
											Subtotal	**318**
Black Box open woodland wetland with chenopod understorey mainly on the outer floodplains in south-western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
4	15_Moderate	Not a TEC	71.5	71.5	5.8	PCT Cleared - 50%	High Sensitivity to Gain			1.75		183
5	15_Thinned	Not a TEC	63.3	63.3	1.6	PCT Cleared - 50%	High Sensitivity to Gain			1.75		45
											Subtotal	**228**
Curly Windmill Grass - speargrass - wallaby grass grassland on alluvial clay and loam on the Hay Plain, Riverina Bioregion												
14	46_Moderate	Natural Grasslands of the Murray Valley Plains	84.3	84.3	94.4	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		4976
											Subtotal	**4976**

Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
6	17_Mod_Good	Not a TEC	70.8	70.8	0.14	PCT Cleared - 63%	High Sensitivity to Gain			1.75		4
7	17_Moderate	Not a TEC	42.1	42.1	1	PCT Cleared - 63%	High Sensitivity to Gain			1.75		19
											Subtotal	**23**
Nitre Goosefoot shrubland wetland on clays of the inland floodplains												
15	160_Mod_Good	Not a TEC	81.8	81.8	4.1	PCT Cleared - 28%	High Sensitivity to Gain			1.50		125
16	160_Moderate	Not a TEC	39.5	39.5	0.84	PCT Cleared - 28%	High Sensitivity to Gain			1.50		12
											Subtotal	**137**
Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion												
13	45_Mod_Good	Natural Grasslands of the Murray Valley Plains	92.1	92.1	4.8	Environment Protection and Conservation Act listing status	High Sensitivity to Gain	Not Listed	Critically Endangered	2.50		278
											Subtotal	**278**

River Red Gum - Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)												
1	10_Moderate	Not a TEC	29.2	29.2	0.33	PCT Cleared - 43%	High Sensitivity to Gain			1.50		4
											Subtotal	**4**
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion												
8	26_DNG	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	19.6	19.6	225.3	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		2204

9	26_Intact01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	64.2	64.2	62.3	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		1999
10	26_Sparse01	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	39.5	39.5	185.8	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		3672
											Subtotal	**7875**

White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone												
11	28_Low	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	42.6	42.6	53.5	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		1139
12	28_Moderate	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	76.4	76.4	0.98	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		37
											Subtotal	**1176**
											Total	**15015**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Austrostipa wakoolica / A spear-grass (Flora)									
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	37
								Subtotal	**37**
Brachyscome papillosa / Mossgiel Daisy (Flora)									
13_Thinned	72.4	72.4	5.7	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	206
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	51
								Subtotal	**257**
Convolvulus tedmoorei / Bindweed (Flora)									
17_Mod_Good	70.8	70.8	0.14	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	7

17_Moderate	42.1	42.1	1	Population size	Ecology or response to management is poorly known	Endangered	Not Listed	True	33
								Subtotal	**40**
Eucalyptus leucoxylon subsp. pruinosa / Yellow Gum (Flora)									
13_Thinned	N/A	N/A	2	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	4
15_Thinned	N/A	N/A	1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	2
								Subtotal	**6**
Lepidium monoplocoides / Winged Peppercress (Flora)									
13_Thinned	72.4	72.4	5.7	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	206
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	51

								Subtotal	**257**
Litoria raniformis / Southern Bell Frog (Fauna)									
13_Moderate	63.9	63.9	0.81	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	26
13_Thinned	72.4	72.4	2.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	80
15_Thinned	63.3	63.3	1.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	39
17_Mod_Good	70.8	70.8	0.03	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	1
26_DNG	19.6	19.6	16.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	160

26_Intact01	64.2	64.2	5.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	176
26_Sparse01	39.5	39.5	14.8	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	293
28_Low	42.6	42.6	0.77	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	16
45_Mod_Good	92.1	92.1	0.31	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	14
46_Moderate	84.3	84.3	14.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	610
160_Mod_Good	81.8	81.8	0.37	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Vulnerable	False	15

								Subtotal	1430
Ninox connivens / Barking Owl (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	154
13_Thinned	72.4	72.4	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	209
15_Moderate	71.5	71.5	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	209
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	51
28_Low	42.6	42.6	5.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	113

28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	37
								Subtotal	**778**
Pedionomus torquatus / Plains-wanderer (Fauna)									
13_Thinned	72.4	72.4	0.52	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	28
15_Moderate	71.5	71.5	0.05	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	3
17_Moderate	42.1	42.1	0.1	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	3

26_DNG	19.6	19.6	0.08	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	1
26_Sparse01	39.5	39.5	1.3	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	39
46_Moderate	84.3	84.3	1.7	Environment Protection and Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Critically Endangered	True	106
								Subtotal	**180**
Pilularia novae-hollandiae / Austral Pillwort (Flora)									
15_Moderate	71.5	71.5	5.8	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	313

15_Thinned	63.3	63.3	1.6	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	76
28_Moderate	76.4	76.4	0.98	Geographic Distribution	Ecology or response to management is poorly known	Endangered	Not Listed	True	56
								Subtotal	**445**
Polytelis swainsonii / Superb Parrot (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	154
13_Thinned	72.4	72.4	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	209
15_Moderate	71.5	71.5	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	209

15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	51
17_Moderate	42.1	42.1	0.55	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	12
26_DNG	19.6	19.6	4.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	40
26_Intact01	64.2	64.2	0.05	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2
26_Sparse01	39.5	39.5	6.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	126
28_Low	42.6	42.6	0.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2
28_Moderate	76.4	76.4	0.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	8

45_Mod_Good	92.1	92.1	0.59	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	27
46_Moderate	84.3	84.3	3.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	137
								Subtotal	**982**
Swainsona murrayana / Slender Darling Pea (Flora)									
15_Moderate	71.5	71.5	5.3	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	189
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	51
26_DNG	19.6	19.6	2.1	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	21
26_Intact01	64.2	64.2	0.08	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	3

26_Sparse01	39.5	39.5	0.51	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	10
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	37
46_Moderate	84.3	84.3	0.01	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Vulnerable	False	1
								Subtotal	**312**
Swainsona sericea / Silky Swainson-pea (Flora)									
15_Moderate	71.5	71.5	5.3	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	189
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	51
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Vulnerable	Not Listed	False	37
								Subtotal	**277**

Tyto novaehollandiae / Masked Owl (Fauna)									
10_Moderate	29.2	29.2	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	5
13_Moderate	63.9	63.9	4.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	154
13_Thinned	72.4	72.4	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	209
15_Moderate	71.5	71.5	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	209
15_Thinned	63.3	63.3	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	51
28_Low	42.6	42.6	5.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	113
28_Moderate	76.4	76.4	0.98	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	37

								Subtotal	**778**

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00034895/BAAS17051/24/00047205	Dinawan wind - Scattered	14/03/2024
Assessor Name	Report Created	BAM Data version *
Mitchell Palmer	20/06/2024	67
Assessor Number	BAM Case Status	Date Finalised
BAAS17051	Finalised	20/06/2024
Assessment Revision	Assessment Type	BOS entry trigger
1	Scattered Trees	Major Project

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Scattered Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
13-Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)			
2	False	1.0	1
3	True	6.0	6
			7
26-Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion			
2	False	19.0	10
			10
28-White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone			
2	False	3.0	2
			2
			19

Species credits for threatened species

Nil

Scattered Tree Report

Proposal Details

Assessment Id
00034895/BAAS17051/24/00047205

Assessment name
Dinawan wind - Scattered

BAM data last updated *
14/03/2024

Assessor Name
Mitchell Palmer

Report Created
20/06/2024

BAM Data version *
67

Assessor Number
BAAS17051

BAM Case Status
Finalised

Date Finalised
20/06/2024

Assessment Revision
0

Assessment Type
Scattered Trees

BOS entry trigger
Major Project

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Scattered Trees

PCT code	PCT name	No. of trees	Species	DBHOB Category	Contain hollows	Class	Assessment required
13	Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	1	Eucalyptus largiflorens	>= 20cm and <50cm	False	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

Scattered Tree Report

13	Black Box - Lignum woodland wetland of the inner floodplains in the semi-arid (warm) climate zone (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	6	Eucalyptus largiflorens	>= 50cm	True	3	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species
26	Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	19	Acacia pendula	>= 20cm and <30cm	False	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species
28	White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	3	Callitris glaucophylla	>= 20cm and <30cm	False	2	Visual assessment for hollows, presence of important habitat features and habitat suitability for threatened species

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APPENDICES

Appendix 1. Survey methods

Appendix 1.1. Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1992, Harden 1993, Harden 2000, Harden 2002). All doubtful species names were verified with the online Australian Plant Name Index (Australian National Botanic Gardens & Australian National Herbarium 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Section 4 and Appendix 3.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Cth DCCEEW (DSEWPaC 2009). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

Appendix 1.2. Permits and licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by NSW DCCEEW (SL100758, expiry date 30 June 2024). The BAM Assessment and quality review of the BDAR was carried out by Accredited Assessor/s Mitchell Palmer (BAAS17051) and Callan Wharfe (BAAS18138).

Appendix 1.3. Limitations

As discussed throughout this BDAR in Section 3 and Section 4, field surveys were undertaken in accordance with the BAM (DPIE 2020a) as far as practicable for a project of this size. Ecological surveys provide a sampling of flora and fauna at a given time and season. Factors influencing detectability of species during survey include species dormancy, seasonal conditions, ephemeral status of waterbodies, and migration and breeding behaviours of some fauna. Above average rainfall events in 2022, and substantial flooding of low lying areas throughout the subject land hindered field surveys and access in September and October 2022 , however the largest impacts due to flooding occurred in November 2022. In many cases, these factors do not present a significant limitation to assessing the overall biodiversity values of a site. Second and third season surveys in spring 2023 and spring 2024 will complete the required surveys under the BAM for the project. Gaps in flora survey do occur and will be completed in spring 2024.

Surveys undertaken, combined with habitat assessments and desktop analysis are considered sufficient to reach the conclusions herein regarding this and all other species' likelihood of occurrence within the subject land.

Database searches, and associated conclusions on the likelihood of species to occur within the assessment area, are reliant upon external data sources and information managed by third parties.

Appendix 2. BAM Candidate species and EPBC assessment

Table A 1: Threatened flora species assessment

Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
Amphibromus fluitans **River Swamp Wallaby-grass**	VU	VU	No	Inhabits both natural and man-made water-bodies, including swamps, lagoons, billabongs and dams, most of which are permanent, and not ephemeral waterbodies	Low	No	Excluded – Geographical limitations	Low	The closest record of River Swamp-Wallaby Grass occurs over 80 kilometres away and is over 20 years old. Suitable habitat is broadly associated with PCT 10, 17, 24 and 160.
Austrostipa wakoolica **A spear-grass**	EN	EN	Yes	Densely tufted perennial grass restricted to the Murray River tributaries of central-western and south-western NSW. Grows on floodplains, on the edges of lignum swamp, creek banks and lignum sandy-loam flats in a variety of communities including Western Slopes Dry Sclerophyll Forests, Floodplain Transition Woodlands, Riverine Plain Woodlands and Western Peneplain Woodlands. Grows in a variety of soils including silty clays and sandy loams.	Medium	Yes	Included – Survey undertaken	Low	The subject land is within Spear Grass predicted distribution only. The closest record occurs over 40km from the subject land. Suitable habitat is broadly represented by Lignum swamp and depressions on floodplains within PCT 10, 17, 24, 26 and 28. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
Brachyscome muelleroides **Claypan Daisy**	VU	VU	Yes	Annual herb distributed throughout the Wagga Wagga, Narranderra, Tocumwal and Walbundrie areas. Found growing in damp areas, depressions, claypan margins, and lagoon margins in Riverine Plain Grasslands and Inland Floodplain Swamps. Grows in muds derived from heavy clay.	Medium	Yes	Included – Survey undertaken	Low	Claypan Daisy occurs over 40km from the subject land. Suitable habitat is broadly represented by grasslands comprising PCT 46 and 45. This species was not detected during targeted surveys.
Brachyscome papillosa **Mossgiel Daisy**	VU	VU	Yes	Multistemmed perennial herb endemic to NSW, primarily distributed throughout the Riverina bioregion with one site occurring in the South Western Slopes. Grows on Saltbush plains in a variety of communities including Aeolian Chenopod Shrublands, Inland Floodplain Shrublands, Riverine Plain Grasslands and Inland Saline Lakes. Grows in clay soils.	Medium	Yes	Included – Survey undertaken	Low	Mossgiel Daisy occurs over 25km from the subject land, with the most recent record from over 20 years ago. Suitable habitat is broadly represented by shrubland and grassland comprising PCTs 13, 15, 24, 45, 46 and 160. This species was not detected during targeted surveys. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Caladenia arenaria **Sand-hill Spider Orchid**	EN	EN	No	Small orchid, found in the Riverina between Urana and Narranderra. Grows in woodland and on sandhills	Low	No	Excluded – No suitable microhabitat	Negligible	Sand-hill Spider Orchid occurs over 30km east from the subject land Suitable habitat is broadly represented by shrubland and pine

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				associated with White Cypress Pine *Callitris glaucophylla* in Floodplain Transition Woodlands and Riverine Sandhill Woodlands. Grows in sand soils.					communities PCT 28, however not known known to occur east of Jerilderie as a geographical limitation
Convolvulus tedmoorei **Bindweed**		EN	Yes	Perennial herb restricted to four areas, two on the Murrumbidgee and Darling Rivers, one on the road to Wilcannia east of Broken Hill and one from Menindee Road near Scarsdale. Found on floodplains in a variety of communities including Riverine Chenopod Shrublands, Inland Floodplain Shrublands, Semi-arid Floodplain Grasslands and Inland Saline Lakes. Grows in grey clay soils.	Low	Yes	Included – Survey undertaken	Low	Bindweed occurs over 20km from the subject land, with the most recent record from over 50 years ago. Suitable habitat is broadly represented by shrubland and grassland comprising PCTs 15, 17, 24, 26, 45, 46 and 160. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Cullen parvum **Small Scurf-pea**		EN	No	Small shrub recorded from two locations, once in 1884 in Wagga Wagga and the other in 1967 in Jinderra near Albury. Found in grassland or understorey in areas that experience between –50 - 700mm of rainfall per year such as Inland Riverine Forests, Riverine Plain Grasslands, Floodplain Transition	Low	No	Excluded – No suitable microhabitat	Low	Small Scurf-pea occurs over 20km from the subject land, with the most recent record from over 50 years ago. Suitable habitat is broadly represented by shrubland and grassland.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				Woodlands and Western Slopes Grassy Woodlands.					
***Diuris* sp. (Oaklands, D.L. Jones 5380)** **Oaklands Diuris**		EN	No	Terrestrial orchid restricted to the Oaklands-Urana region of southern NSW. Grows amongst grasses and forbs in association with White Cypress Pine Callitris glaucophylla in Floodplain Transition Woodlands and Riverine Sandhill Woodlands. Grows in sandy loam soils.	Low	No	Excluded – No suitable microhabitat	Low	The habitat for Oaklands Diuris is not present within the subject land. The species is not associated with any PCT's present within the subject land.
Diuris tricolor **Pine Donkey Orchid**		VU	No	Terrestrial orchid with a sporadic distribution ranging from south of Narrandera stretching northwards through central western NSW towards the QLD border. Grows amongst grasses, sometimes in disturbed areas in a variety of communities including Pilliga Outwash Dry Sclerophyll Forests, Southern Tablelands Grassy Woodlands, North-west Alluvial Sand Woodlands and Floodplain Transition Woodlands. Grows on sand and red earth soils.	Low	No	Excluded – No suitable microhabitat	Low	Habitat for Diuris Tricolor is not present within the subject land. The species is not associated with any PCT's present within the subject land.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
Eucalyptus leucoxylon subsp. Pruinosa **Yellow Gum**		VU	Yes	Small to medium-sized tree restricted to several small areas between Barham and Euston. In New South Wales, it occurs at the bases of sandy rises and on loamy clay flats on the floodplains of the Murray River and its tributaries in the Riverina Bioregion	Low	Yes	Included – Survey undertaken	Low	No records of Yellow Gum occur within 25km of the subject land. This species has habitat broadly associated with PCT's 13 and 15, however was not detected during the field investigation or targeted surveys. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Lepidium aschersonii **Spiny Peppercress**	VU	VU	No	Erect perennial herb occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains). Found on ridges of gilgai clays dominated by Brigalow, Belah, Buloke and Grey Box. In the south has been recorded growing in Bull Mallee. Often the understorey is dominated by introduced plants. The species grows as a component of the ground flora, in grey loamy clays.	Low	No	Excluded – No suitable microhabitat	Low	No records of Spiny-Peppercress occur within 25 km of the subject land. Suitable habitat is represented in PCT 17 and 26 in northern NSW. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
Lepidium monoplocoides **Winged Peppercress**	EN	EN	Yes	Erect, annual herb with populations sparsely scattered throughout a widespread distribution spanning the semi-arid western plains. Historical records are numerous although recent records are confined to two collections from Broken Hill, in 1915 and 1950. Grows in areas receiving between 300 mm to 500 mm annual rainfall on periodically inundated and waterlogged habitats in a variety of communities including Inland Floodplain Shrublands, Floodplain Transition Woodlands, Inland Saline Lakes, Sand Plain Mallee Woodlands and Western Peneplain Woodlands. Grows on waterlogged grey-brown clays	Medium	Yes	Included – Survey undertaken	Low	Winged Peppercress has been recorded over 25km from the subject land. Suitable habitat is available within patches of PCTs 10, 13, 15, 17, 24, 26, 28, 45, 46 and 160.
Leptorhynchos orientalis **Lanky Buttons**		EN	Yes	Erect, annual forb confined to several Hay Plain and southern Riverina locations including Willanthry east of Hillston, Zara-Wanganella via Hay, McKinley Road south-west of Hillst'n, 'Moru"dah" west of Buckinbong State Forest and	High	Yes	Included – Survey undertaken	Medium	Lanky buttons has been recorded over 25km from the subject land. Suitable habitat is available within shrublands, grasslands and woodland communities represented by PCTs 24, 26, 46 and 45. No individuals were observed during targeted surveys. Small areas of

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				Cowl Cowl Station near Hillston. Grows in woodlands and sometimes on the margins of swamps in a variety of communities including Inland Floodplain Shrublands, Inland Floodplain Swamps, Riverine Plain Grasslands, Floodplain Transition Woodlands and Riverine Plain Woodlands. Grows on red clay to clay loam soils.					assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Maireana cheelii **Chariot Wheels**	VU	VU	Yes	Small perennial forb restricted to the southern Riverina region of NSW between Deniliquin and Hay. Grows in shallow depressions, on eroded or scalded surfaces or on the edge of windswept claypans in association with Bladder Saltbush Atriplex vesicaria in a variety of communities including Riverine Chenopod Shrublands, Riverine Plain Grasslands, Gibber Transition Shrublands, North-west Floodplain Woodlands, and Inland Saline Lakes. Grows on heavy grey clays, brown to red-brown clay-loams, or hard cracking red clay soils.	Medium	Yes	Included – Survey undertaken	Low	Chariot Wheels has been recorded approximately 20km from the subject land. Suitable habitat is broadly available within woodland and grassland PCT's 13, 15, 26 and 46. No individuals were observed during targeted surveys.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
Pilularia novae-hollandiae **Austral Pillwort**		EN	Yes	Semi-aquatic fern with the only extant populations located at Lake Cowal and Oolambeyan National Park. Historical distribution ranged from Sydney, Khancoban, The Riverina near Albury and Urana. Grows in seasonally dry depressions, drainage lines, margins of marshes, shallow swamps and waterways in a variety of communities including Inland Riverine Forests, Inland Floodplain Swamps, Southern Tableland Dry Sclerophyll Forests, Coastal Floodplain Wetlands, Coastal Swamp Forests, Coastal Freshwater Lagoons. Grows in mud amongst grasses and sedges.	Medium	Yes	Included – Survey undertaken	Low	Austral Pilwort has been recorded 18km from the subject land. Suitable habitat is available within depressions and gilgai's within shrubland, fringing woodland and grassland PCT's 10, 13, 15, 24, 26, 46 and 45. No individuals were observed during the targeted surveys to date. Small areas of assumed presence have been undertaken due to a shortfall and gaps in targeted surveys, but surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Sclerolaena napiformis **Turnip Copperburr**	EN	EN	Yes	Small subshrub known from a few populations in the southern Riverina between Jerilderie and Moama primarily in Travelling Stock Routes and Road Reserves and also in north-central Victoria. Found growing on level plains in remnant grassland habitats including those subject to	Medium	Yes	Included – Survey undertaken Not recorded during surveys	Low	Turnip Copperburr has been recorded 19km from the subject land. This species is primarily found on the Hay Plain, which occurs anecdotally west of Oolambeyan National park on the flat scalded plains towards Balranald. Broadly associated with PCTs 26 and 46. No individuals were observed during targeted surveys.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				grazing in Riverine Plain Grasslands and Riverine Plain Woodlands. Grows in clay loam soils.					
Swainsona murrayana **Slender Darling Pea**	VU	VU	Yes	Small sparsely downy forb distributed between Jerilderie and Deniliquin areas of the southern Riverine Plain as far north as Willandra National Park, near Broken Hill and between Dubbo and Mudgee. Found growing on level plains, floodplains and depressions in a variety of communities including Riverine Chenopod Shrublands, Semi-arid Floodplain Shrublands, Western Slopes Grasslands, Brigalow Clay Plain Woodlands, Riverine Plain Woodlands and Inland Saline Lakes. Grows in heavy clay based soils ranging from grey, red and brown cracking clays to red-brown earths and loams.	High	Yes	Included – Survey undertaken Recorded during surveys	High	Slender Darling Pea has been recorded within the subject land, with suitable habitat represented by shrubland, grassland and woodland PCTs 10, 13, 15, 17, 24, 26, 28, 46 and 45. Refinements to the development footprint have avoided significant populations of this species identified within the subject land.
Swainsona plagiotropis **Red Darling Pea**	VU	VU	Yes	Small prostrate forb sparsely distributed between Jerilderie and the Louth-Bourke area with a disjunct population occurring in the north-western plains from Buttabone Stud	Medium	Yes	Included – Survey undertaken	Low	This species is primarily found on the Hay Plain, which occurs anecdotally west of Oolambeyan National park on the flat scalded plains towards Balranald, but also known to occur within the Jerilderie Nature Reserve.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				Park ~35 kilometres west of Warren. Found growing on roadsides, rail reserves, stock routes, grasslands and in table drains in Riverine Plain Grasslands, Riverine Chenopod Shrublands, Semi-arid Floodplain Grasslands and Riverine Plain Woodlands. Grows in heavy red-brown clay-loam soils.					No individuals were observed during targeted surveys. Broad habitat is associated with PCTs 26, 45 and 46. Surveys to date have not shown any indication of presence within the development corridor. More surveys to be undertaken in Spring 2024.
Swainsona sericea **Silky Swainson-pea**		VU	Yes	Small prostrate or erect perennial herb with a distribution spanning from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains with an additional outlying population in the far north-west of NSW. Found growing in a variety of communities including Natural Temperate Grasslands, Snow Gum Eucalyptus pauciflora Woodlands on the Monaro, Box-Gum Woodland, New England Dry Sclerophyll Forests, North-west Slopes Dry Sclerophyll Woodlands, North-west Plain Shrublands, Western Slopes Grasslands, Floodplain Transition	High	Yes	Included – Survey undertaken Recorded during surveys	High	Silky Swainsona-pea has been recorded bordering the subject land in isolated patches. Suitable habitat is broadly available within woodland and grassland PCTs 10, 13, 15, 17, 24, 26, 28, 46 and 45. Refinements to the development footprint have avoided significant populations of this species identified within the subject land.

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Species	Status		BAM predicted SCS	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC							
				Woodlands and Subalpine Woodlands.					
Solanum karsense **Menindee Nightshade**	VU	VU	Yes	Forb restricted to the far south-western plains, extending up the Darling River to the Menindee and Wilcannia districts. Grows in occasionally flooded depressions with heavy soil, including level river floodplains of grey clay with Black Box and Old Man Saltbush, and open treeless plains with solonized brown soils. Habitats are generally lake beds or floodplains of heavy grey clays with a highly self-mulching surface. Also found on sandy floodplains and ridges and in calcareous soils, red sands, red-brown earths and loamy soils	Low	Yes	Excluded – Geographical limitations	Negligible	Menindee Nightshade does not occur within 25km of the subject land. This species is primarily found west of Maude, and therefore has been excluded from the assessment.

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Table A 2: Threatened fauna species assessment

Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
Birds											
Actitis hypoleucos **Common Sandpiper**			No	Migratory	PMST, BioNet	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999).	Low	No	BUS survey undertaken - vagrant	Negligible	No records of Common Sandpiper occur within 50km of the subject land. Suitable habitat may include grassland and riparian woodland, however, the subject land is unlikely to provide habitat frequented by the species, with only few populations known west of the Great Dividing Range. Low risk of collision due to vagrancy.
Anthochaera phrygia **Regent Honeyeater**	CR	CR	No		PMST, BioNet	Regent Honeyeaters are semi-nomadic, occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Nectar and fruit from mistletoes are also eaten.	Low	No	Excluded – no microhabitat or important mapped areas	Negligible	No records of Regent honeyeater occur within 50km of the subject land. The subject land is not mapped as an important area for the species and does not

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						This species usually nest in tall mature eucalypts and sheoaks.					contain suitable habitat, as it is not associated with any PCTs that occur within the subject land.
Aphelocephala leucopsis **Southern Whiteface**	Vu		No	No	PMST	Dry open forests and woodland and inland scrubs of mallee, mulga and saltbush are the preferred habitat of Southern Whiteface, especially areas with fallen timber or dead trees and stumps.	Known	No	Included – Survey undertaken	Low	Southern Whiteface has been recorded within and adjacent to the subject land Suitable habitat is available in woodland, scattered trees and open farmland associated with PCT's 13, 15, and 26. Preferred intact habitat has been avoided. Minor impacts to fringing vegetation.
Apus pacificus **Fork-tailed Swift**			No	Migratory	PMST, BioNet	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh.	Known	No	Included – BUS survey undertaken	Medium	Fork tailed swift has been recorded within the subject land. Suitable habitat may include open farmland and riparian woodland. Collisions are possible to due flight behaviour

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999).					
Ardeotis australis **Australian Bustard**		EN	Yes		BioNet	This species appears to be confined to areas where the upper vegetation canopy cover is less than 10% or under 2m high (NPWS 1996). Mainly occurs in open woodland, low shrubland, farmland and roost in tree or on a high vantage point on the ground (Blakers et al. 1984, NPWS 1996). This species does not build nest, eggs are laid on open bare ground beside grass or tussock (NPWS 1996).	Medium	Yes	Included – Survey undertaken	Low	Australian Bustard has been recorded approximately 17km from the subject land with the most recent record from over 15 years ago. Suitable habitat for the species is available within the subject land, represented by open farmland and shrubland and grassland communities consistent with PCT's 10, 15, 13, 17, 24, 26, 28, 45, 46 and 160
Botaurus poiciloptilus **Australasian Bittern**	EN	EN	No		PMST, BioNet	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation	Low	No	BUS survey undertaken	Low	Australian Bittern has not been recorded within the subject land. Suitable habitat is present, represented by Lignum woodland

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						including Typha spp. and Eleocharis spp.. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.					and wetland PCT 13 and 24. Known to move through the site during migration. Collision risk low, but consequence high.
Burhinus grallarius **Bush Stone-curlew**		EN	Yes		BioNet	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Occurs in lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present.	Low	Yes	Included – Survey undertaken	Low	Bush Stone-Curlew has been recorded approximately 19km from the subject land with the most recent record from over 10 years ago. Suitable habitat for the species is available within the subject land, represented by partially cleared farmland and thinned woodland communities consistent with PCT's 10, 13, 17, 24, 26, 28, 45, 46 and 160.
Calidris acuminata			No	Migratory	PMST, BioNet	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands,	Low	No	BUS survey undertaken	Negligible	Sharp-tailed Sandpiper has been recorded approximately 16km

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
Sharp-tailed Sandpiper						with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beachcast seaweed. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies 1996).					from the subject land. Suitable habitat within the subject land may include wetland communities and flooded paddocks.
Calidris ferruginea **Curlew Sandpiper**	CR	EN	No	Migratory	PMST, BioNet	Inhabits sheltered intertidal mudflats. Also non-tidal swamps,	Low	No	BUS survey undertaken	Low	Curlew Sandpiper has not been recorded within 50km of the subject land. No

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						lagoons and lakes near the coast. Infrequently recorded inland.					suitable habitat is available within the subject land, such as intertidal flats, and the species is not associated with any PCTs within the subject land.
Calidris melanotos **Pectoral Sandpiper**			No	Migratory	PMST, BioNet	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins & Davies 1996).	Low	No	BUS survey undertaken	Negligible	Pectoral Sandpiper has not been recorded within 50km of the subject land. Habitat within the subject land is not suitable, given the distance from the coast.
Calyptorhynchus Latham	VU	VU	No		PMST, BioNet	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to	Low	No	BUS survey undertaken	Low	Glossy Black-Cockatoo has been recorded approximately 40km

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Glossy Black-Cockatoo						prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.					from the subject land. Habitat within the subject land is unsuitable, as it does not contain forest communities with Allocasuarina species, and the species is not associated with any PCT's within the subject land.
Charadrius veredus **Oriental Plover**			No	Migratory	BioNet	Immediately after arriving in non-breeding grounds in northern Australia, Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland (Bigg 1981; Bransbury 1985; Crawford 1972; Murlis et al. 1988; Serventy & Whittell 1976; Storr 1977, 1980, 1984b). Thereafter they usually inhabit flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps At the onset of the Wet Season, some may move into lightly wooded	Low	No	BUS survey undertaken	Negligible	Oriental Plover has been recorded approximately 38km from the subject land, with the most recent record from over 15 years ago. Suitable habitat may include open farmland and grassland communities within the subject land.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
						grasslands (Storr 1977). Some remain in estuarine and littoral environments, and a few are occasionally recorded around terrestrial wetlands or flooded paddocks (Boekel 1980; Close 1982; McCrie 1984). Vagrants in southern Australia have been recorded in saltmarsh (Park 1983; Patterson 1983; Pedler 1982).					
Falco hypoleucos **Grey Falcon**	VU	VU	No		PMST, BioNet	Found over open country and wooded lands of tropical and temperate Australia. Mainly found on sandy and stony plains of inland drainage systems with lightly timbered acacia scrub.	Low	No	BUS survey undertaken	Low	Grey Falcon has been recorded approximately 13km from the subject land with the most recent record from over 10 years ago. Suitable habitat for the species is available within the subject land, represented by open farmland and acacia woodland communities and within PCT's 13, 15, 16, 17, 26, 46 and 45.
Gallinago hardwickii **Latham's Snipe**			No	Migratory	PMST, BioNet	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (Chapman 1969; Naarding 1981). They usually inhabit open,	Medium	No	BUS survey undertaken	Low	Latham's Snipe has been recorded approximately 13km from the subject land. Suitable habitat is

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (Frith et. al. 1977; Naarding 1983; Weston 2006, pers. comm.). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Frith et al. 1977; Naarding 1983).					represented by wetland communities within the subject land.
Gelochelidon nilotica **Gull-billed Tern**			No	Migratory	BioNet	Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. They are only rarely found over the ocean	Known	No	BUS survey undertaken	Negligible	Gull-billed Tern has been recorded approximately 35km from the subject land. Suitable habitat may be present within wetland communities and in grasslands during periods of inundation.
Grantiella picta **Painted Honeyeater**	VU	VU	No		PMST, BioNet	Found mainly in dry open woodlands and forests, where it is strongly associated with mistletoe. Often found on plains with scattered eucalypts and remnant trees on farmlands.	Known	No	BUS survey undertaken	High	Painted Honeyeater has previously been recorded within the subject land in 2019 and recorded within surveys for the wind farm. Suitable habitat is available in woodland, scattered trees and open farmland

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
											associated with PCT's 13, 15, and 26 with appropriate levels of mistletoe
Haliaeetus leucogaster **White-bellied Sea-Eagle**		VU	Yes		BioNet	A migratory species that is generally sedentary in Australia, although immature individuals and some adults are dispersive. Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees.	Low	Yes	BUS survey undertaken	Low	White-bellied Sea-Eagle has been recorded approximately 16km from the subject land. Terrestrial and shallow aquatic foraging habitat are available within PCTs10, 13, and 15. Aquatic foraging resources are likely favourable during wetter periods, where freshwater wetlands become inundated.
Hieraaetus morphnoides **Little Eagle**		VU	Yes		Bionet	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.	Medium	Yes	BUS survey undertaken	Medium	Little Eagle has previously been recorded within the subject land in 2020. Suitable habitat is available within open and sparsely vegetated and intact woodlands within PCTs 13, 15, 17, 26, 46 and 45.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
Hirundapus caudacutus **White-throated Needletail**	VU		No	Migratory	PMST, Bionet	Almost exclusively an aerial species, occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest.	Medium	No	BUS survey undertaken	Negligible	White-throated Needletail has not been recorded within the subject land. Generally, only comes to ground in adverse weather in western NSW. Subject land is fringing on the most westerly distribution.
Hydroprogne caspia **Caspian Tern**			No	Migratory		Generally found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred, however known to frequent inland areas and wetlands during periods of inundation.	Low	No	BUS survey undertaken	Low	Caspian Tern has been recorded approximately 34 km from the subject land over 15 years ago. No suitable habitat occurs within the subject land, given the distance from the coast.
Lathamus discolor **Swift Parrot**	CR	EN	No		PMST, Bionet	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus	Low	No	BUS survey undertaken Excluded – no important mapped habitat	Negligible	Swift Parrot has been recorded approximately 25km from the subject land. No suitable habitat occurs within the subject land, with a low floristic diversity of flowering trees and shrubs across the PCTs present. The subject

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.					land does not contain any important areas mapped for the species, and the species is not associated with any PCT's within the subject land.
Leipoa ocellata **Malleefowl**	VU	EN	No	Migratory	PMST, Bionet	The malleefowl occurs in tall, dense mallee with a mean annual rainfall of 300 to 450mm (NPWS 1996). This species prefers areas with a light sandy to sandy loam soil, a dense but discontinuous canopy cover, dense and variable herb layer and open ground for easy of movement (NPWS 1996).	Low	No	Excluded – No habitat	Negligible	Malleefowl has been recorded approximately 19km from the subject land with the most recent record from over 20 years ago. The species is not associated with any PCT's present within the subject land and no suitable habitat it present, given there is no tall, densely vegetation Mallee vegetation.
Limosa limosa		VU	No	Migratory	Bionet	In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is	Low	No	BUS survey undertaken	Low	Black-tailed Godwit has been recorded approximately 46km

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Black-tailed Godwit						commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks (Higgins & Davies 1996).					from the subject land over 20 years ago. The subject land is unlikely to provide suitable habitat for this species given the distance from coastal areas, and that very few records occur inland.
Lophochroa leadbeateri **Major Mitchell's Cockatoo**	EN	VU	Yes		Bionet	Found mainly in semi-arid and arid regions, in dry woodlands, particularly mallee - casuarina assemblages. They breed in the hollows of large trees, often near watercourse.	Medium	Yes	BUS survey undertaken	Low	Major Mitchells Cockatoo has been recorded approximately 13km from the subject land. Foraging and breeding habitat is represented by large hollows and woodland communities within PCT's 10, 13, 15, 17, 24, 26, 28, 45, and 46. At

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
											risk of collisions due to flocking nature.
Lophoictinia isura **Square-tailed Kite**		VU	Yes		Bionet	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata, or E. smithii. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	Low	Yes	BUS survey undertaken	Low	Square-tailed Kite has been recorded approximately 36km from the subject land over 10 years ago. Suitable habitat is represented by large Eucalypts, open farmland, woodland, shrubland and grassland communities within PCT's 13, 15, 26 and 45.
Merops ornatus **Rainbow Bee-eater**			No	Migratory	Bionet	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (Higgins 1999). It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water (Badman 1979; Boekel 1976; Fry 1984;	Known	No	BUS survey undertaken	Medium	Rainbow Bee-eater has previously been recorded within the subject land. Suitable habitat is represented by woodland and shrubland communities and areas of open farmland.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
						Roberts 1979; Storr 1984a, 1984b, 1985a). It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches (Higgins 1999).					
Motacilla flava **Yellow Wagtail**			No	Migratory	PMST, Bionet	Prefers damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs	Low	No	Excluded - vagrant	Negligible	Yellow Wagtail has not been recorded within 50km of the subject land.
Neophema chrysostoma **Blue-winged Parrot**	VU	VU	No		PMST	Favour grasslands and grassy woodlands. They are often found near wetlands both near the coast and in semi-arid zones.	Low	No	BUS survey undertaken Vagrant	Low	Woodland habitat is broadly available within PCTs 13, 15 and 26 however the subject land does Blue-winged Parrots are in Tasmania and Victoria, particularly in southern Victoria and the midlands and eastern areas of Tasmania. Sparser populations are found in western New South Wales. Considered a vagrant species in NSW

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Ninox connivens **Barking Owl**		VU	Yes		Bionet	Generally found in open forests, woodlands, swamp woodlands, farmlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats. Hunts small arboreal mammals or birds and terrestrial mammals when tree hollows are absent.	Medium	Yes	Hollow bearing tree survey undertaken	Low	Suitable habitat available in large hollows, open farmland, dense shrubland and woodland within PCTs 10, 13, 15 and 26
Numenius madagascariensis **Eastern Curlew**	CR		No	Migratory	PMST, Bionet	Occurs in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats often with beds of seagrass.	Low	No	Excluded - vagrant	Negligible	Eastern Curlew has not been recorded within 50km of the subject land. No suitable habitat is available within the subject land, such as coastal estuaries, inlets or embayment's, and the species is not associated with any PCTs within the subject land.
Pedionomus torquatus **Plains-wanderer**	CR	EN	Yes		PMST, Bionet	Plains-wanderers live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. Habitat structure appears to be more important than plant species composition. Preferred	High	Yes	Included – Survey undertaken. Mapped important habitat	Medium	Plains-wanderer has previously been recorded within the subject land. Not recorded in surveys undertaken. Important

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
						habitat typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. They have been recorded in some agricultural land including unimproved pasture, and cropping on long rotation.					areas of Plains wanderer are mapped within the northern section of the subject land. Suitable habitat is present within grassland represented by PCT 46.
Pezoporus occidentalis **Night Parrot**	EN	EX	No	Migratory	PMST, Bionet	The Night Parrot is known to occur within Spinifex grasslands in stony or sandy areas and samphire and chenopod associations on floodplains, salt lakes and clay pans. Suitable habitat is characterized by the presence of large and dense clumps of Spinifex, and it may prefer mature spinifex that is long and unburnt. The Night Parrot builds its nest which consists of a few small sticks at the end of a 'tunnel' that is formed in a Spinifex tussock or a small bush. Up to four white eggs are laid in this nest. Some unconfirmed reports have claimed that the Night Parrot may nest or roost in caves, and one unverified source claimed that it may also excavate burrows in sandy soils.	Negligible	No	Excluded	Negligible	Night Parrot is extinct in NSW. No records occur within 50km of the subject land.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Plegadis falcinellus **Glossy Ibis**			No	Migratory	Bionet	The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons	Low	No	BUS survey undertaken	Low	Glossy Ibis has been recorded approximately 6km from the subject land. Suitable habitat occurs within the subject land in wetland communities on floodplains.
Polytelis anthopeplus monarchoides **Regent Parrot (eastern subspecies)**		VU	Yes		Bionet	The species nests within River Red Gum forests along the Murray, Wakool and lower Murrumbidgee Rivers, and possibly the Darling River downstream of Pooncarie. Typical nest trees are large, mature healthy trees with many spouts (though dead trees are used) and are usually located close to a watercourse. Principal foraging habitat is mallee woodlands, though foraging also occurs in riverine forests and woodlands. Mallee woodland within 20 kilometres of nesting sites is critical foraging habitat for breeding birds. They may utilise cereal crops and will feed on spilt grain. Is claimed to be a pest in almond orchards. Birds move	Low	Yes	BUS survey undertaken Excluded – Geographical limitations	Negligible	Regent Parrot (eastern subspecies) has not been recorded within 50km of the subject land. Woodland habitat is broadly available within PCTs 13 and 15 however the subject land does not contain Mallee woodland or located near the Murray River.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						between the riverine nesting habitat and foraging sites along corridors of natural vegetation. Outside the breeding season birds may move away from the riverine plain, with birds observed in mallee over 60 kilometres from the river. However, there are very few records in NSW away from the Murray River during the non-breeding season and it has been speculated that most birds may join non-breeding flocks in Victoria.					
Polytelis swainsonii **Superb Parrot**	VU	VU	Yes		PMST, Bionet	Found mainly in open, tall riparian River Red Gum forest or woodland. Often found in farmland including grazing land with patches of remnant vegetation. Forages primarily in grassy box woodland, feeding in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants.	Known	Yes	BUS survey undertaken	High	Superb Parrot has previously been recorded within the subject land and was recorded during the field investigation. Suitable habitat is present within grazing land, and native woodland and grassland vegetation within PCTs 10, 13, 15, 26 and 45. At risk of collisions.
Rostratula australis	EN	EN	No		Bionet	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They	Low	No	BUS survey undertaken	Low	Australian Painted Snipe has been recorded approximately 25km

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Australian Painted Snipe						prefer freshwater wetlands, but have been recorded in brackish waters. Forages on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.					from the subject land over 15 years ago. Suitable habitat is broadly available within farm dams, and freshwater Lignum wetlands and shrublands within PCTs 13 and 17.
Stagonopleua guttata **Diamond Firetail**	VU	VU	No		Bionet PMST	Diamond firetails occur in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover	Known	No	BUS survey undertaken	Low	Diamond Firetail has been recorded within and adjacent to the subject land. Suitable habitat is available in woodland, scattered trees and open farmland associated with PCT's 13, 15, and 26. Preferred intact habitat has been avoided. Minor impacts to fringing vegetation.
Tringa nebularia **Common Greenshank**			No	Migratory	Bionet	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons	Low	No	BUS survey undertaken	Low	Common Greenshank has been recorded approximately 5km from the subject land. Suitable habitat occurs within the subject land in wetland communities.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (Himantopus himantopus) in pasture, but are generally not found in dry grassland (Higgins & Davies 1996).					
Tyto novaehollandiae **Masked Owl**		VU	Yes		Bionet	The Masked Owl is found in range of wooded habitats that provide tall or dense mature trees with hollows suitable for nesting and roosting. It is mostly seen in open forests and woodlands adjacent to cleared lands. Prey includes hollow-dependent arboreal	Medium	Yes	Hollow bearing tree survey undertaken	Low	Masked Owl has been recorded approximately 24km from the subject land over 20 years ago. Suitable habitat is available within woodland in PCTs 10,

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
						marsupials and terrestrial mammals.					13, 15 and 26 and large hollows.
Mammals											
Phascolarctos cinereus **Koala**	VU	VU	Yes		PMST, Bionet	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus camaldulensis* within the Riverina. They are solitary with varying home ranges.	Low	Yes	Excluded – Limited habitat in subject land	Low	Koala has been recorded approximately 14km from the subject land. Suitable habitat is broadly available within woodland communities 10 13, and 15. The subject land contains sporadic occurrences and low condition patches of preferred Koala feed tree species *Eucalyptus camaldulensis* in suboptimal condition. Restricted to major waterways.
Nyctophilus corbeni **Corben's Long-eared Bat**	VU	VU	No		PMST, Bionet	Restricted to the Murray-Darling basin and western slopes. Found in a range of habitats including tall Eucalypt forests, mallee, open savanna and Black Box woodland, preferring habitats with a distinct canopy and cluttered, dense understorey. Roost in tree hollows	Medium	No	Included – Survey undertaken. Recorded as species group.	Low	Corbens Long-eared Bat has not been recorded within 50km of the subject land. May be found in PCT 10, 13, 15 and 28.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
						and fissures and under exfoliating bark.					
Pteropus poliocephalus **Grey-headed Flying Fox**	VU		No	Nomadic	PMST	Occur in various habitat from subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Low	No	Excluded – Geographical limitations and lack of habitat	Low	Grey-headed Flying Fox has not been recorded within 50km of the subject land. The subject does not contain suitable habitat for the species, which is not associated with any PCT's within the subject land.
Frogs											
Crinia sloanei **Sloane's Froglet**	EN	VU	No		PMST, Bionet	Sloane's Froglet is a cryptic species, usually found only after rain. This species has a widely scattered distribution throughout the floodplains of the Murray-Darling Basin in NSW and has been recorded mostly in the Darling Riverine Plains, NSW South Western Slopes, and the Riverina bioregions. It is typically associated with periodically inundated grassland, woodland and disturbed areas.	Low	No	Excluded - vagrant	Low	Sloane's Froglet has been recorded approximately 25km from the subject land over 20 years ago. While the subject land contains periodically inundated grasslands, the species is not associated with any PCT's within the subject land.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EPBC	BC									
Litoria raniformis **Southern Bell Frog**	VU	EN	Yes		PMST, Bionet	In NSW, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.	Known	Yes	Included – Survey undertaken	High	Southern Bell Frog has previously been recorded within the subject land and was observed during the field investigation. Suitable habitat is present within swamp and wetland within PCTs 10, 13, 15, 17, 24 and fringing areas within PCT 26 and PCT 45. This species was also identified within Coleambally irrigation channel, outfall drain and numerous farm dams.
Fish											
Bidyanus bidyanus **Silver Perch**	CE		No		PMST	Only one remaining secure and self sustaining population occurs in NSW in the central Murray River downstream of Yarrawonga weir, as well as several anabranches and tributaries. Very limited potential within the subject land	Low	No	Excluded – No habitat	Low	No records of Silver perch occur within 50km of the subject land. There is mapped habitat for Silver Perch within the subject land as part of the Coleambally Outfall Drain and comprising

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
											Delta Creek outside of the subject land.
Galaxias rostratus **Flathead Galaxias**	CR		No		PMST	Flathead Galaxias are found in still or slow moving water bodies such as wetlands and lowland streams. The species has been recorded forming shoals. They have been associated with a range of habitats including rock and sandy bottoms and aquatic vegetation. Flathead Galaxias spawn in spring and lay slightly adhesive demersal eggs.	Low	No	Excluded – No habitat	Low	No records of Flathead Galaxias occur within 50km of the subject land. There is mapped habitat for Flathead Galaxias within the subject land as part of the Coleambally Outfall Drain and comprising Delta Creek outside of the subject land.
Maccullochella peelii **Murray Cod**	VU		No		PMST	The Murray Cods natural distribution extends throughout the Murray-Darling basin ranging west of the divide from south east Queensland, through NSW into Victoria and South Australia. It is found in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers, billabongs and large deep holes. Murray Cod is entirely a freshwater species and will not tolerate high salinity levels.	Low	No	Excluded – No habitat	Low	No records of Murray Cod occur within 50km of the subject land. No mapped habitat occurs within the subject land. Habitat is not likely suitable within the subject land, given the absence of rocky streams, rivers and deep holes.

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Species	Status		BAM predicted SCS	Migratory	Other Sources	Habitat Description	Potential occurrence in subject land	BAM Candidate species	Survey required/ undertaken	Potential for impact	Conclusion and rationale
	EP BC	BC									
Macquaria australasica **Macquarie Perch**	EN		No		PMST	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their tributaries	Low	No	Excluded – No habitat	Low	No records of Macquarie Perch occur within 50km of the subject land. No mapped habitat occurs within the subject land. Habitat is not likely suitable within the subject land, given the absence of rivers and lakes.
Maccullochella macquariensis **Trout Cod**	EN		No		PMST	The Trout Cod is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. Trout Cod are often found in faster flowing water with rocky and gravel bottoms, but can also be found in some slower flowing, lowland rivers. Large woody snags are very important for the species as they provide complex habitats for each stage of the species' life cycle.	Low	No	Excluded – No habitat	Low	No records of Trout Cod occur within 50km of the subject land. No mapped habitat occurs within the subject land. Habitat is not likely suitable within the subject land, given the absence of rivers, or fast flowing water with gravel bottoms and large woody snags.

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Appendix 3. Flora

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Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.
Native species																								
Aizoaceae	Zaleya galericulata	Hogweed																						
Alismataceae	Alisma plantago-aquatica	Water Plantain																						
Amaranthaceae	Amaranthus spp.	Amaranth																						
Amaranthaceae	Alternanthera nana	Hairy Joyweed																						
Amaranthaceae	Ptilotus semilanatus	Lambs tails															0.2	50						
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed					0.5	60			0.1	20	0.2	400	0.1	10			0.1	10	0.2	50		
Amaranthaceae	Ptilotus erubescens																							
Amaranthaceae	Ptilotus spp.																							
Amaranthaceae	Ptilotus nobilis	Yellowtails																						
Amaryllidaceae	Calostemma purpureum	Garland Lily																						
Anthericaceae	Thysanotus baueri	Fringe-lily																						
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																						
Asphodelaceae	Bulbine bulbosa	Bulbine Lily																						
Asphodelaceae	Bulbine semibarbata	Wild Onion																						
Asteraceae	Craspedia spp.	Billy Buttons																						
Asteraceae	Calotis hispidula	Bogan Flea																						
Asteraceae	Chrysocephalum	Clustered Everlasting																						
Asteraceae	Cotula australis	Common Cotula																						
Asteraceae	Chrysocephalum apiculatum	Common Everlasting															0.1	1	0.1	10				
Asteraceae	Centipeda cunninghamii	Common Sneezeweed											0.3	200							0.1	1		
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																						
Asteraceae	Senecio spp.	Groundsel, Fireweed																						
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy																						
Asteraceae	Leucochrysum molle	Hoary Sunray																						
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																						
Asteraceae	Brachyscome spp.																							
Asteraceae	Calotis scabiosifolia var. scabiosifolia																							
Asteraceae	Euchiton spp.																							
Asteraceae	Leiocarpa spp.																							
Asteraceae	Pycnosorus spp.																							
Asteraceae	Sigesbeckia australiensis																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_W_08	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	
Native species																										
Aizoaceae	Zaleya galericulata	Hogweed																								
Alismataceae	Alisma plantago-aquatica	Water Plantain																								
Amaranthaceae	Amaranthus spp.	Amaranth																								
Amaranthaceae	Alternanthera nana	Hairy Joyweed																								
Amaranthaceae	Ptilotus semilanatus	Lambs tails	0.2	50			0.1	20					0.2	30	0.5	20					0.5	20			0.2	
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed			0.1	10					0.5	20	0.1	10												
Amaranthaceae	Ptilotus erubescens																									
Amaranthaceae	Ptilotus spp.																									
Amaranthaceae	Ptilotus nobilis	Yellowtails			0.1	2																				
Amaryllidaceae	Calostemma purpureum	Garland Lily																								
Anthericaceae	Thysanotus baueri	Fringe-lily																								
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																								
Asphodelaceae	Bulbine bulbosa	Bulbine Lily									0.1	3														
Asphodelaceae	Bulbine semibarbata	Wild Onion																								
Asteraceae	Craspedia spp.	Billy Buttons									0.1	2														
Asteraceae	Calotis hispidula	Bogan Flea																								
Asteraceae	Chrysocephalum	Clustered Everlasting			0.1	1																				
Asteraceae	Cotula australis	Common Cotula			0.1	1																				
Asteraceae	Chrysocephalum apiculatum	Common Everlasting	0.1	10	0.1	2	3	200			0.1	2	0.1	20	0.1	20							0.1	5	0.1	
Asteraceae	Centipeda cunninghamii	Common Sneezeweed																								
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																								
Asteraceae	Senecio spp.	Groundsel, Fireweed																								
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy					0.3	60											0.1	1						
Asteraceae	Leucochrysum molle	Hoary Sunray																					0.2	100	0.1	
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																								
Asteraceae	Brachyscome spp.																									
Asteraceae	Calotis scabiosifolia var. scabiosifolia																									
Asteraceae	Euchiton spp.																									
Asteraceae	Leiocarpa spp.																									
Asteraceae	Pycnosorus spp.																									
Asteraceae	Sigesbeckia australiensis																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%	Abund.	Cvr%
Native species																													
Aizoaceae	Zaleya galericulata	Hogweed							1	0.1																			
Alismataceae	Alisma plantago-aquatica	Water Plantain																											
Amaranthaceae	Amaranthus spp.	Amaranth																					1	0.1					
Amaranthaceae	Alternanthera nana	Hairy Joyweed																											
Amaranthaceae	Ptilotus semilanatus	Lambs tails	20								2	0.1			0.2		20	0.1											
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed																							10	0.1			
Amaranthaceae	Ptilotus erubescens																												
Amaranthaceae	Ptilotus spp.																												
Amaranthaceae	Ptilotus nobilis	Yellowtails																											
Amaryllidaceae	Calostemma purpureum	Garland Lily															6	0.1											
Anthericaceae	Thysanotus baueri	Fringe-lily									2	0.1																	
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																							5	0.1			
Asphodelaceae	Bulbine bulbosa	Bulbine Lily																											
Asphodelaceae	Bulbine semibarbata	Wild Onion					2	0.1																					
Asteraceae	Craspedia spp.	Billy Buttons																											
Asteraceae	Calotis hispidula	Bogan Flea																											
Asteraceae	Chrysocephalum	Clustered Everlasting																			1	0.1							
Asteraceae	Cotula australis	Common Cotula					20	0.1																	100	0.1			
Asteraceae	Chrysocephalum apiculatum	Common Everlasting	20										10	0.1	10	0.1			5	0.1									
Asteraceae	Centipeda cunninghamii	Common Sneezeweed																											
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																											
Asteraceae	Senecio spp.	Groundsel, Fireweed											1	0.1															
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy																											
Asteraceae	Leucochrysum molle	Hoary Sunray	10								2	0.1					100	0.2											
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																											
Asteraceae	Brachyscome spp.																												
Asteraceae	Calotis scabiosifolia var. scabiosifolia																												
Asteraceae	Euchiton spp.																						10	0.1					
Asteraceae	Leiocarpa spp.																												
Asteraceae	Pycnosorus spp.						10	0.1																					
Asteraceae	Sigesbeckia australiensis																												

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Native species																									
Aizoaceae	Zaleya galericulata	Hogweed																							
Alismataceae	Alisma plantago-aquatica	Water Plantain																							
Amaranthaceae	Amaranthus spp.	Amaranth																							
Amaranthaceae	Alternanthera nana	Hairy Joyweed																	0.1	5					
Amaranthaceae	Ptilotus semilanatus	Lambs tails																			0.1	1			0.1
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed							0.1	5					0.2	50					0.1	2			
Amaranthaceae	Ptilotus erubescens																0.1	1							
Amaranthaceae	Ptilotus spp.																								
Amaranthaceae	Ptilotus nobilis	Yellowtails																							
Amaryllidaceae	Calostemma purpureum	Garland Lily																							
Anthericaceae	Thysanotus baueri	Fringe-lily																							
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																							
Asphodelaceae	Bulbine bulbosa	Bulbine Lily																							
Asphodelaceae	Bulbine semibarbata	Wild Onion																							
Asteraceae	Craspedia spp.	Billy Buttons																							
Asteraceae	Calotis hispidula	Bogan Flea																							
Asteraceae	Chrysocephalum	Clustered Everlasting																							
Asteraceae	Cotula australis	Common Cotula																							
Asteraceae	Chrysocephalum apiculatum	Common Everlasting	0.3	50																	0.3	10			0.1
Asteraceae	Centipeda cunninghamii	Common Sneezeweed																							
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																							
Asteraceae	Senecio spp.	Groundsel, Fireweed																							
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy																							
Asteraceae	Leucochrysum molle	Hoary Sunray																			0.1	2			
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																							
Asteraceae	Brachyscome spp.																								
Asteraceae	Calotis scabiosifolia var. scabiosifolia																								
Asteraceae	Euchiton spp.																								
Asteraceae	Leiocarpa spp.																								
Asteraceae	Pycnosorus spp.																								
Asteraceae	Sigesbeckia australiensis						0.1	5																	

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Native species																											
Aizoaceae	Zaleya galericulata	Hogweed																									
Alismataceae	Alisma plantago-aquatica	Water Plantain																									
Amaranthaceae	Amaranthus spp.	Amaranth																									
Amaranthaceae	Alternanthera nana	Hairy Joyweed																									
Amaranthaceae	Ptilotus semilanatus	Lambs tails	5																0.1	5							
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed											0.1	5	0.1	10									0.1	10	
Amaranthaceae	Ptilotus erubescens																										
Amaranthaceae	Ptilotus spp.																										
Amaranthaceae	Ptilotus nobilis	Yellowtails																									
Amaryllidaceae	Calostemma purpureum	Garland Lily																									
Anthericaceae	Thysanotus baueri	Fringe-lily																									
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																									
Asphodelaceae	Bulbine bulbosa	Bulbine Lily																									
Asphodelaceae	Bulbine semibarbata	Wild Onion																									
Asteraceae	Craspedia spp.	Billy Buttons																									
Asteraceae	Calotis hispidula	Bogan Flea																									
Asteraceae	Chrysocephalum	Clustered Everlasting																									
Asteraceae	Cotula australis	Common Cotula																									
Asteraceae	Chrysocephalum apiculatum	Common Everlasting	5	0.1	2	0.5	20	0.2	50														0.1	5			
Asteraceae	Centipeda cunninghamii	Common Sneezeweed																									
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																									
Asteraceae	Senecio spp.	Groundsel, Fireweed																									
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy																									
Asteraceae	Leucochrysum molle	Hoary Sunray																									
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																									
Asteraceae	Brachyscome spp.																										
Asteraceae	Calotis scabiosifolia var. scabiosifolia																		0.1	5							
Asteraceae	Euchiton spp.																										
Asteraceae	Leiocarpa spp.																										
Asteraceae	Pycnosorus spp.																										
Asteraceae	Sigesbeckia australiensis																										

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_001
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Native species																											
Aizoaceae	Zaleya galericulata	Hogweed		0.2	5	0.1	10																				
Alismataceae	Alisma plantago-aquatica	Water Plantain																									
Amaranthaceae	Amaranthus spp.	Amaranth																									
Amaranthaceae	Alternanthera nana	Hairy Joyweed																									
Amaranthaceae	Ptilotus semilanatus	Lambs tails																			0.1	10	0.1	2			
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed											0.1	20													0.1
Amaranthaceae	Ptilotus erubescens																										
Amaranthaceae	Ptilotus spp.																										
Amaranthaceae	Ptilotus nobilis	Yellowtails																									
Amaryllidaceae	Calostemma purpureum	Garland Lily																									
Anthericaceae	Thysanotus baueri	Fringe-lily																									
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily																									
Asphodelaceae	Bulbine bulbosa	Bulbine Lily																									
Asphodelaceae	Bulbine semibarbata	Wild Onion																									
Asteraceae	Craspedia spp.	Billy Buttons																									
Asteraceae	Calotis hispidula	Bogan Flea																							0.5	100	
Asteraceae	Chrysocephalum	Clustered Everlasting																									
Asteraceae	Cotula australis	Common Cotula																									
Asteraceae	Chrysocephalum apiculatum	Common Everlasting					0.1	2																			
Asteraceae	Centipeda cunninghamii	Common Sneezeweed																									
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons																							0.1	1	0.1
Asteraceae	Senecio spp.	Groundsel, Fireweed																									
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy																									
Asteraceae	Leucochrysum molle	Hoary Sunray															0.4	50									
Asteraceae	Calotis cuneata	Mountain Burr-Daisy																									
Asteraceae	Brachyscome spp.																										0.1
Asteraceae	Calotis scabiosifolia var. scabiosifolia																										
Asteraceae	Euchiton spp.																										
Asteraceae	Leiocarpa spp.																										
Asteraceae	Pycnosorus spp.																										
Asteraceae	Sigesbeckia australiensis																										

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Native species																
Aizoaceae	Zaleya galericulata	Hogweed														
Alismataceae	Alisma plantago-aquatica	Water Plantain														
Amaranthaceae	Amaranthus spp.	Amaranth														
Amaranthaceae	Alternanthera nana	Hairy Joyweed														
Amaranthaceae	Ptilotus semilanatus	Lambs tails													0.1	
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed	1	0.1	1								0.5	100		
Amaranthaceae	Ptilotus erubescens															
Amaranthaceae	Ptilotus spp.															
Amaranthaceae	Ptilotus nobilis	Yellowtails														
Amaryllidaceae	Calostemma purpureum	Garland Lily														
Anthericaceae	Thysanotus baueri	Fringe-lily														
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily														
Asphodelaceae	Bulbine bulbosa	Bulbine Lily														
Asphodelaceae	Bulbine semibarbata	Wild Onion														
Asteraceae	Craspedia spp.	Billy Buttons														
Asteraceae	Calotis hispidula	Bogan Flea														
Asteraceae	Chrysocephalum	Clustered Everlasting														
Asteraceae	Cotula australis	Common Cotula														
Asteraceae	Chrysocephalum apiculatum	Common Everlasting														
Asteraceae	Centipeda cunninghamii	Common Sneezeweed													0.1	50
Asteraceae	Leiocarpa brevicompta	Flat Billy-buttons	1													
Asteraceae	Senecio spp.	Groundsel, Fireweed														
Asteraceae	Brachyscome lineariloba	Hard-headed Daisy														
Asteraceae	Leucochrysum molle	Hoary Sunray														
Asteraceae	Calotis cuneata	Mountain Burr-Daisy														
Asteraceae	Brachyscome spp.		1													
Asteraceae	Calotis scabiosifolia var. scabiosifolia															
Asteraceae	Euchiton spp.															
Asteraceae	Leiocarpa spp.			0.1	1											
Asteraceae	Pycnosorus spp.															
Asteraceae	Sigesbeckia australiensis															

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Asteraceae	Vittadinia cuneata														0.1	10	0.3	20	0.1	10				
Asteraceae	Vittadinia cuneata var. cuneata																							
Asteraceae	Vittadinia hispidula																							
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																						
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy																						
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy																						
Asteraceae	Leptorhynchos squamatus	Scaly Buttons																						
Asteraceae	Rhodanthe corymbiflora	Small White Sunray											0.1	1			0.1	5						
Asteraceae	Sonchus spp.	Sowthistle																						
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																						
Asteraceae	Brachyscome ciliaris	Variable Daisy																						
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																						
Asteraceae	Leiocarpa panaetioides	Wooly Buttons																						
Asteraceae	Eclipta platyglossa	Yellow Twin-heads					0.1	1			0.1	5												
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed																						
Boraginaceae	Heliotropium spp.																							
Brassicaceae	Lepidium spp.																							
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																						
Campanulaceae	Wahlenbergia fluminalis	River Bluebell									0.1	1												
Campanulaceae	Wahlenbergia stricta	Tall Bluebell																						
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort																						
Casuarinaceae	Allocasuarina luehmannii	Bulloak																						
Chenopodiaceae	Einadia hastata	Berry Saltbush																						
Chenopodiaceae	Maireana decalvans	Black Cotton Bush																						
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly	1	70	0.1	3	0.1	3			0.1	5			1	50			0.1	20				
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly																					0.3	10
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly																						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Vittadinia cuneata		0.3	40	0.1	20	0.1	20							0.1	10	0.1	20			0.1	5			0.2
Asteraceae	Vittadinia cuneata var. cuneata																								
Asteraceae	Vittadinia hispidula												0.1	5							0.2	20			
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																							
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy			0.1	1																			
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy											0.1	20							0.1	10	0.3	100	
Asteraceae	Leptorhynchos squamatus	Scaly Buttons																							
Asteraceae	Rhodanthe corymbiflora	Small White Sunray	0.1	1			0.1	6					0.1	20	0.5	50	0.1	1			0.1	10	0.1	10	0.1
Asteraceae	Sonchus spp.	Sowthistle																							
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																							
Asteraceae	Brachyscome ciliaris	Variable Daisy																							
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																							
Asteraceae	Leiocarpa panaetioides	Wooly Buttons																							
Asteraceae	Eclipta platyglossa	Yellow Twin-heads							0.1	2															
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed																							
Boraginaceae	Heliotropium spp.																								
Brassicaceae	Lepidium spp.																								
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																			0.1	5			
Campanulaceae	Wahlenbergia fluminalis	River Bluebell																							
Campanulaceae	Wahlenbergia stricta	Tall Bluebell																							
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort																							
Casuarinaceae	Allocasuarina luehmannii	Bulloak																							
Chenopodiaceae	Einadia hastata	Berry Saltbush																							
Chenopodiaceae	Maireana decalvans	Black Cotton Bush									0.6	30													
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly			1	30	0.1	5	0.3	10			0.2	5					0.2	8					
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly									3				0.1	2									
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Vittadinia cuneata		50	0.1	5					0.1	20	0.1	10	0.1	10	0.2	40	0.1	10					0.1	10		
Asteraceae	Vittadinia cuneata var. cuneata																											
Asteraceae	Vittadinia hispidula																											
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																										
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy																										
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy				0.1	2			0.1	30			0.1	2			0.1	20									
Asteraceae	Leptorhynchos squamatus	Scaly Buttons																										
Asteraceae	Rhodanthe corymbiflora	Small White Sunray	50					0.1	5	0.1	50	0.1	20	0.1	20	0.1	20							0.1	20		
Asteraceae	Sonchus spp.	Sowthistle																										
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																										
Asteraceae	Brachyscome ciliaris	Variable Daisy																										
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																										
Asteraceae	Leiocarpa panaetioides	Wooly Buttons																										
Asteraceae	Eclipta platyglossa	Yellow Twin-heads																										
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed																										
Boraginaceae	Heliotropium spp.																				0.1	50						
Brassicaceae	Lepidium spp.																											
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																							0.1	2		
Campanulaceae	Wahlenbergia fluminalis	River Bluebell																										
Campanulaceae	Wahlenbergia stricta	Tall Bluebell		0.1	2																							
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort																										
Casuarinaceae	Allocasuarina luehmannii	Bulloak		1	1																							
Chenopodiaceae	Einadia hastata	Berry Saltbush																										
Chenopodiaceae	Maireana decalvans	Black Cotton Bush																									8	
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly				1		0.5	10	0.3	7	0.3	10	0.1	2			2						1		15		
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly																										
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly																										

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Vittadinia cuneata		0.1	5	0.1	5	0.1	6					0.1	5	0.1	10	0.1	5			0.1	1			0.1
Asteraceae	Vittadinia cuneata var. cuneata																								
Asteraceae	Vittadinia hispidula																								
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																							
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy																					0.1	1	
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy	0.1	20											0.1	1									
Asteraceae	Leptorhynchos squamatus	Scaly Buttons																							
Asteraceae	Rhodanthe corymbiflora	Small White Sunray																							
Asteraceae	Sonchus spp.	Sowthistle																							
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																							
Asteraceae	Brachyscome ciliaris	Variable Daisy													0.1	5									
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																							
Asteraceae	Leiocarpa panaetioides	Wooly Buttons																							
Asteraceae	Eclipta platyglossa	Yellow Twin-heads							0.1	5									0.1	2			0.1	1	
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed																							
Boraginaceae	Heliotropium spp.																								
Brassicaceae	Lepidium spp.																								
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																							
Campanulaceae	Wahlenbergia fluminalis	River Bluebell																							
Campanulaceae	Wahlenbergia stricta	Tall Bluebell																							
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort																							
Casuarinaceae	Allocasuarina luehmannii	Bulloak																							
Chenopodiaceae	Einadia hastata	Berry Saltbush																							
Chenopodiaceae	Maireana decalvans	Black Cotton Bush					0.1	2																	
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly	0.1	2	15	100	3	40	0.5	10			0.1	10	50	300	0.1	5	0.4	20	0.5	20	10	80	1
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly																							
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Asteraceae	Vittadinia cuneata		5										0.2	20	0.1	5							0.1	1			
Asteraceae	Vittadinia cuneata var. cuneata																0.1	10									
Asteraceae	Vittadinia hispidula																										
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																							0.1	5	
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy		0.5	80			0.1	5																		
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy						0.1	2	0.1	3																
Asteraceae	Leptorhynchos squamatus	Scaly Buttons													0.1	1											
Asteraceae	Rhodanthe corymbiflora	Small White Sunray						0.1	1										0.1	4							
Asteraceae	Sonchus spp.	Sowthistle																									
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																									
Asteraceae	Brachyscome ciliaris	Variable Daisy																									
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																									
Asteraceae	Leiocarpa panaetioides	Wooly Buttons																	0.1	1							
Asteraceae	Eclipta platyglossa	Yellow Twin-heads																									
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed																							0.5	100	0.1
Boraginaceae	Heliotropium spp.																										
Brassicaceae	Lepidium spp.														0.1	10											
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																									
Campanulaceae	Wahlenbergia fluminalis	River Bluebell																									
Campanulaceae	Wahlenbergia stricta	Tall Bluebell																									
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort																									0.7
Casuarinaceae	Allocasuarina luehmannii	Bulloak																									
Chenopodiaceae	Einadia hastata	Berry Saltbush																									
Chenopodiaceae	Maireana decalvans	Black Cotton Bush											0.6	30	1	20					0.1	1	0.1	1	0.1	5	
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly	40	1	40	0.5	30								0.5	10							0.1	20			
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly																									
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly								0.3	10	0.4	20				1		0.4	5	1				0.2	10	0.2

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Asteraceae	Vittadinia cuneata			0.1	5	0.1	5	0.1	5					0.1	3	0.1	5	0.1	1	0.1	4			0.1	1	
Asteraceae	Vittadinia cuneata var. cuneata																										
Asteraceae	Vittadinia hispidula																										
Asteraceae	Calocephalus sonderi	Pale Beauty-heads																		0.1	1	0.1	1				
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy																									
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy														1								0.2	100		
Asteraceae	Leptorhynchos squamatus	Scaly Buttons																									
Asteraceae	Rhodanthe corymbiflora	Small White Sunray													0.1	2											
Asteraceae	Sonchus spp.	Sowthistle									0.1	3															
Asteraceae	Senecio glossanthus	Streaked Poverty Bush																									
Asteraceae	Brachyscome ciliaris	Variable Daisy																									
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy																									
Asteraceae	Leiocarpa panaetioides	Wooly Buttons													0.1	1									0.1	10	
Asteraceae	Eclipta platyglossa	Yellow Twin-heads																									
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed	5								0.1	100	0.1	5													
Boraginaceae	Heliotropium spp.																										
Brassicaceae	Lepidium spp.																										
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress																									
Campanulaceae	Wahlenbergia fluminalis	River Bluebell																									
Campanulaceae	Wahlenbergia stricta	Tall Bluebell																									
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort	20																								
Casuarinaceae	Allocasuarina luehmannii	Bulloak																									
Chenopodiaceae	Einadia hastata	Berry Saltbush																									
Chenopodiaceae	Maireana decalvans	Black Cotton Bush		0.1	10			0.5	8	0.2	20	0.1	10			0.1	10	0.5									
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly				0.1	2											0.1	1			0.2					
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly											1														
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly	10	1				3		15					0.2	5	1			2					0.1	1	

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Vittadinia cuneata															
Asteraceae	Vittadinia cuneata var. cuneata															
Asteraceae	Vittadinia hispidula															
Asteraceae	Calocephalus sonderi	Pale Beauty-heads														
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy														
Asteraceae	Calotis scabiosifolia	Rough Burr-daisy														
Asteraceae	Leptorhynchos squamatus	Scaly Buttons														
Asteraceae	Rhodanthe corymbiflora	Small White Sunray														
Asteraceae	Sonchus spp.	Sowthistle														
Asteraceae	Senecio glossanthus	Streaked Poverty Bush														
Asteraceae	Brachyscome ciliaris	Variable Daisy														
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy														
Asteraceae	Leiocarpa panaetioides	Wooly Buttons														
Asteraceae	Eclipta platyglossa	Yellow Twin-heads														
Asteraceae	Centipeda minima subsp. minima	spreading sneezeweed														
Boraginaceae	Heliotropium spp.															
Brassicaceae	Lepidium spp.															
Brassicaceae	Lepidium pseudohyssopifolium	Peppercress														
Campanulaceae	Wahlenbergia fluminalis	River Bluebell														
Campanulaceae	Wahlenbergia stricta	Tall Bluebell														
Caryophyllaceae	Stellaria angustifolia	Swamp Starwort														
Casuarinaceae	Allocasuarina luehmannii	Bulloak														
Chenopodiaceae	Einadia hastata	Berry Saltbush														
Chenopodiaceae	Maireana decalvans	Black Cotton Bush													0.1	5
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly														
Chenopodiaceae	Sclerolaena muricata var. muricata	Black Rolypoly					0.1	1	1	8						
Chenopodiaceae	Sclerolaena muricata var. semiglabra	Black Rolypoly													0.2	4

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																						
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort																						
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																						
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr																						
Chenopodiaceae	Einadia nutans	Climbing Saltbush																						
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																						
Chenopodiaceae	Maireana aphylla	Cotton Bush															0.2	2						
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed																						
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush					0.3	1			0.2	10					0.4	20			0.1	5		
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																						
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot																						
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush																						
Chenopodiaceae	Einadia trigonos	Fishweed																						
Chenopodiaceae	Maireana ciliata	Fissure Weed																						
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr																						
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr																						
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																						
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr													0.1	5	0.4	5	0.1	1	0.2	20		
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed													0.1	20								
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot																						
Chenopodiaceae	Dissocarpus biflorus var. biflorus																							
Chenopodiaceae	Maireana brevifolia																							
Chenopodiaceae	Maireana excavata																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_W_08	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																								
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort									1										0.1	3	1		0.1	
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																								
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr									0.2	5	0.1	5			0.1	3					0.8	50		
Chenopodiaceae	Einadia nutans	Climbing Saltbush									0.2	20									0.1	40				
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																								
Chenopodiaceae	Maireana aphylla	Cotton Bush			0.1	2															3		0.4	2	5	
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed																								
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush					0.1	5	0.1	2	0.5	50									10		0.1	1	0.1	
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																								
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot																								
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush																								
Chenopodiaceae	Einadia trigonos	Fishweed																								
Chenopodiaceae	Maireana ciliata	Fissure Weed																								
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr			0.1	1																				
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr																								
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																								
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr	0.2	20																					0.1	
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed			0.1	2																			1	
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot																								
Chenopodiaceae	Dissocarpus biflorus var. biflorus																									
Chenopodiaceae	Maireana brevifolia																									
Chenopodiaceae	Maireana excavata						0.1	10							0.1	10	0.1	8							0.1	

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																										
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort	5										0.1	10														
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																							0.1	5		
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr																										
Chenopodiaceae	Einadia nutans	Climbing Saltbush											0.1	5					0.2	50					0.1	10	2	
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																										
Chenopodiaceae	Maireana aphylla	Cotton Bush									4		0.5	5														
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed																										
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush	2								0.1	5	0.1	5					1	5					0.1	1	3	
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																										
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot																										
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush																										
Chenopodiaceae	Einadia trigonos	Fishweed							0.1	2																		
Chenopodiaceae	Maireana ciliata	Fissure Weed																										
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr							0.1	2																		
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr																										
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																										
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr	2																0.1	10								
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed									0.3	50	0.1	50	0.1	20	0.1	100	4						0.1	5		
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot																										
Chenopodiaceae	Dissocarpus biflorus var. biflorus																											
Chenopodiaceae	Maireana brevifolia																											
Chenopodiaceae	Maireana excavata		10								0.1	20																

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																							
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort			0.1	1							0.1	5	0.1	2	0.2	20			0.1	3	0.2	40	0.1
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																							
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr																			0.2	10			
Chenopodiaceae	Einadia nutans	Climbing Saltbush			3	300	0.1	5					0.1	2	0.1	30	0.2	20					2	100	
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																							
Chenopodiaceae	Maireana aphylla	Cotton Bush	2																				20	300	0.1
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed																							
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush			4	300			0.1	1			0.1	10	25	100	0.3	20			0.5	20			
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																							
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot																							
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush											0.1	2											
Chenopodiaceae	Einadia trigonos	Fishweed																							
Chenopodiaceae	Maireana ciliata	Fissure Weed																							
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr			0.5	1																			
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr													0.1	4									
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																							
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr															0.5	20			0.3	20			0.1
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed	0.2	50	0.2	20	0.5	80									0.1	5			0.3	30	0.1	1	
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot									50	500													
Chenopodiaceae	Dissocarpus biflorus var. biflorus																								
Chenopodiaceae	Maireana brevifolia																								
Chenopodiaceae	Maireana excavata						0.2	30															0.1	2	

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																									
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort	1	0.1	4	0.4	80	0.1	5			0.2	10	1	30	0.1	7			1		0.1	20			
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																									
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr		0.1	1																						
Chenopodiaceae	Einadia nutans	Climbing Saltbush				0.2	10	0.1	2					0.1	1					0.2	30						
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																									
Chenopodiaceae	Maireana aphylla	Cotton Bush	5	5	30	8	90	20	80										1		0.5	2					
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed										0.1	10							0.1	5						
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush		5	100	2	40	0.2	10							1				0.6	20						
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																									
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot				5	60																				
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush																									
Chenopodiaceae	Einadia trigonos	Fishweed																									
Chenopodiaceae	Maireana ciliata	Fissure Weed																									
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr																			0.1	2	0.1	5			
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr																									
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																									
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr	5			0.1	5																				
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed				0.3	50	0.2	30							0.1	2	0.1	10								
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot												0.1	1					0.7	1			40		50	
Chenopodiaceae	Dissocarpus biflorus var. biflorus																										
Chenopodiaceae	Maireana brevifolia																										
Chenopodiaceae	Maireana excavata																										

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly																									
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort		0.3	10	0.1	5	0.1	5										0.1	10					0.1	1	
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort																									
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr																									
Chenopodiaceae	Einadia nutans	Climbing Saltbush						2		0.1	30	0.2	20						0.5	20					0.1	10	
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush																									
Chenopodiaceae	Maireana aphylla	Cotton Bush												7		2									15	100	0.1
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed																									
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush								0.1	5								1		0.1	2			0.1	1	
Chenopodiaceae	Dysphania cristata	Crested Crumbweed																									
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot																									
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush																									
Chenopodiaceae	Einadia trigonos	Fishweed																									
Chenopodiaceae	Maireana ciliata	Fissure Weed																									
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr		0.1	4	0.1	2																				
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr																									
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr																									
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr																									
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed												0.1	5	0.1	10				0.1	10	0.1	5	0.1	1	
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot						4		35		10															5
Chenopodiaceae	Dissocarpus biflorus var. biflorus																										
Chenopodiaceae	Maireana brevifolia			0.3	3	0.2	1	0.5	6	0.5	10																
Chenopodiaceae	Maireana excavata			0.1	6					0.1	5					0.1	5						0.5	50			

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Sclerolaena muricata var. villosa	Black Rolypoly			1	0.1										
Chenopodiaceae	Salsola tragus	Buckbush,Soft Rolpoly, Saltwort							1	0.1	5	0.1	1	0.1		
Chenopodiaceae	Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort														
Chenopodiaceae	Dissocarpus paradoxus	Cannonball Burr														
Chenopodiaceae	Einadia nutans	Climbing Saltbush							3	0.2			8	0.1		
Chenopodiaceae	Sclerolaena spp.	Copperburr, Poverty-bush														
Chenopodiaceae	Maireana aphylla	Cotton Bush	1												2	0.1
Chenopodiaceae	Maireana spp.	Cotton Bush, Bluebush, Fissure-weed														
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush							20	0.5			100	1		
Chenopodiaceae	Dysphania cristata	Crested Crumbweed														
Chenopodiaceae	Chenopodium desertorum	Desert Goosefoot														
Chenopodiaceae	Atriplex lindleyi	Eastern Flat-top Saltbush														
Chenopodiaceae	Einadia trigonos	Fishweed														
Chenopodiaceae	Maireana ciliata	Fissure Weed														
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr							4	0.1	1	30				
Chenopodiaceae	Sclerolaena tricuspis	Giant Redburr														
Chenopodiaceae	Sclerolaena bicornis	Goathead Burr														
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr														
Chenopodiaceae	Maireana pentagona	Hairy Bluebush, Slender Fissure-weed													10	0.1
Chenopodiaceae	Chenopodium nitrariaceum	Nitre Goosefoot	20		10	10							50	25		
Chenopodiaceae	Dissocarpus biflorus var. biflorus															
Chenopodiaceae	Maireana brevifolia															
Chenopodiaceae	Maireana excavata															

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Chenopodiaceae	Maireana humillima												0.1	1	0.1	10	0.3	20						
Chenopodiaceae	Maireana trichoptera																							
Chenopodiaceae	Salsola australis																							
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush									0.3	1												
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush																						
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																						
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																						
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush															1	30						
Chenopodiaceae	Dysphania pumilio	Small Crumbweed																						
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr																						
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr											0.1	10			1	10			0.2	20		
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush															0.1	10						
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed																						
Clusiaceae	Hypericum spp.																							
Convolvulaceae	Convolvulus angustissimus								0.1	2											0.1	2		
Convolvulaceae	Convolvulus spp.																							
Crassulaceae	Crassula colorata	Dense Stonecrop																						
Crassulaceae	Crassula spp.	Stonecrop																						
Cupressaceae	Callitris glaucophylla	White Cypress Pine																						
Cyperaceae	Isolepis spp.	Club-rush																						
Cyperaceae	Cyperus difformis	Dirty Dora																						
Cyperaceae	Carex inversa	Knob Sedge											0.2	30					0.1	20				
Cyperaceae	Isolepis cernua	Nodding Club-rush											0.3	80							0.1	10		
Cyperaceae	Carpha nivicola																							
Cyperaceae	Eleocharis acuta		60	5000	40	1000	65	3000	60	5000	30	3000	10	900	0.1	50			1	20	20	3000		
Cyperaceae	Eleocharis pallens	Pale Spike Sedge	5	400	5	200	1	100	5	500	5	300									5	1000	20	
Cyperaceae	Cyperus gracilis	Slender Flat-sedge																						
Euphorbiaceae	Euphorbia drummondii	Caustic Weed									0.1	1												
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea																	0.1	1				
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee																			0.1	1		

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Maireana humillima		0.1	20			0.1	20															0.4	50	
Chenopodiaceae	Maireana trichoptera																								
Chenopodiaceae	Salsola australis																								
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush																							
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush			0.1	10					1						0.1	1			0.2	10			
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																							
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																							
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush					0.1	5																	1
Chenopodiaceae	Dysphania pumilio	Small Crumbweed									0.2	20													
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr																							
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr					0.1	10																	
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush									2						0.2	2			3				4
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed																							
Clusiaceae	Hypericum spp.						0.1	5																	
Convolvulaceae	Convolvulus angustissimus		0.1	1	0.1	8																			
Convolvulaceae	Convolvulus spp.														0.1	10	0.1								
Crassulaceae	Crassula colorata	Dense Stonecrop									0.1	100													
Crassulaceae	Crassula spp.	Stonecrop																							
Cupressaceae	Callitris glaucophylla	White Cypress Pine																							
Cyperaceae	Isolepis spp.	Club-rush																							
Cyperaceae	Cyperus difformis	Dirty Dora																							
Cyperaceae	Carex inversa	Knob Sedge	0.1	10																	0.1	10			
Cyperaceae	Isolepis cernua	Nodding Club-rush					0.1	2																	
Cyperaceae	Carpha nivicola						0.1	6																	
Cyperaceae	Eleocharis acuta								20	2000									40						
Cyperaceae	Eleocharis pallens	Pale Spike Sedge							0.5	200			0.1	20					5						
Cyperaceae	Cyperus gracilis	Slender Flat-sedge											0.1	50											
Euphorbiaceae	Euphorbia drummondii	Caustic Weed			0.1	5			0.1	10	0.1	50	0.1	50											
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea																					0.1	1	
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee	0.2	3																					

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Maireana humillima																											
Chenopodiaceae	Maireana trichoptera				1	0.1																						
Chenopodiaceae	Salsola australis																											
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush																										
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush											1	0.1														
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																										
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																										
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush					10	1			50	0.4	4	0.1					20	0.5					10	0.2		10
Chenopodiaceae	Dysphania pumilio	Small Crumbweed																										
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr					5	0.1																				
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr											1	0.1														
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush	1				2		5	0.7										7								5
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed													1	0.1									5	0.1		
Clusiaceae	Hypericum spp.																											
Convolvulaceae	Convolvulus angustissimus																											
Convolvulaceae	Convolvulus spp.																										5	0.1
Crassulaceae	Crassula colorata	Dense Stonecrop			5	0.1											20	0.1										
Crassulaceae	Crassula spp.	Stonecrop																										
Cupressaceae	Callitris glaucophylla	White Cypress Pine				15				15												10		15				
Cyperaceae	Isolepis spp.	Club-rush					10	0.1																				
Cyperaceae	Cyperus difformis	Dirty Dora																									40	0.2
Cyperaceae	Carex inversa	Knob Sedge					20	0.1																				
Cyperaceae	Isolepis cernua	Nodding Club-rush																										
Cyperaceae	Carpha nivicola																											
Cyperaceae	Eleocharis acuta																											
Cyperaceae	Eleocharis pallens	Pale Spike Sedge					15																				30	0.4
Cyperaceae	Cyperus gracilis	Slender Flat-sedge																										
Euphorbiaceae	Euphorbia drummondii	Caustic Weed																			3	0.1						
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea					20	0.1																				
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee																	1	1								

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Maireana humillima																								
Chenopodiaceae	Maireana trichoptera																								
Chenopodiaceae	Salsola australis																								
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush																							
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush			0.3	20	0.1	2					0.2	4	0.1	5	0.1	5			0.5	20	1	50	
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																							
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																							
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush																							
Chenopodiaceae	Dysphania pumilio	Small Crumbweed													0.1	2									
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr																							
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr	0.3	4																					
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush																							
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed																							
Clusiaceae	Hypericum spp.																								
Convolvulaceae	Convolvulus angustissimus						0.1	2							0.1	4	0.1	1							
Convolvulaceae	Convolvulus spp.																								
Crassulaceae	Crassula colorata	Dense Stonecrop																							
Crassulaceae	Crassula spp.	Stonecrop																							
Cupressaceae	Callitris glaucophylla	White Cypress Pine											5	1											
Cyperaceae	Isolepis spp.	Club-rush																							
Cyperaceae	Cyperus difformis	Dirty Dora																							
Cyperaceae	Carex inversa	Knob Sedge																			0.1	2			
Cyperaceae	Isolepis cernua	Nodding Club-rush																							
Cyperaceae	Carpha nivicola																								
Cyperaceae	Eleocharis acuta								20	2000	0.1	10							10	400					
Cyperaceae	Eleocharis pallens	Pale Spike Sedge							0.1	2															
Cyperaceae	Cyperus gracilis	Slender Flat-sedge																							
Euphorbiaceae	Euphorbia drummondii	Caustic Weed					0.1	5							0.1	5	0.1	5			0.1	3	0.1	5	0.1
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea																							
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee			0.1	1									0.1	2	0.1	1	0.1	1	0.5	10			

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Chenopodiaceae	Maireana humillima																										
Chenopodiaceae	Maireana trichoptera																										
Chenopodiaceae	Salsola australis																										
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush																									
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush		0.5	60	0.5	50							0.1	1	1				0.5	20			0.1	5		
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																									
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																									
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush											3		1	10	0.1	5			0.2	20	0.1	20			
Chenopodiaceae	Dysphania pumilio	Small Crumbweed																					0.1	5			
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr																					0.1	1			
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr																									
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush													0.1	1	1				2						
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed																									
Clusiaceae	Hypericum spp.																										
Convolvulaceae	Convolvulus angustissimus																										
Convolvulaceae	Convolvulus spp.										0.1	20															
Crassulaceae	Crassula colorata	Dense Stonecrop																									
Crassulaceae	Crassula spp.	Stonecrop																			0.1	20					
Cupressaceae	Callitris glaucophylla	White Cypress Pine															20										
Cyperaceae	Isolepis spp.	Club-rush																									
Cyperaceae	Cyperus difformis	Dirty Dora																									
Cyperaceae	Carex inversa	Knob Sedge																									
Cyperaceae	Isolepis cernua	Nodding Club-rush																									
Cyperaceae	Carpha nivicola																										
Cyperaceae	Eleocharis acuta																										5
Cyperaceae	Eleocharis pallens	Pale Spike Sedge																							15		
Cyperaceae	Cyperus gracilis	Slender Flat-sedge																									
Euphorbiaceae	Euphorbia drummondii	Caustic Weed	10			0.1	5	0.1	5								0.1	5					0.1	1	0.1	10	
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea																									
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Chenopodiaceae	Maireana humillima																										
Chenopodiaceae	Maireana trichoptera																										
Chenopodiaceae	Salsola australis																										
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush																									
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush							2										0.1						0.1	1	
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr																									
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr																									
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush		1		0.1	2	0.2	20			0.1	10												0.1	10	
Chenopodiaceae	Dysphania pumilio	Small Crumbweed		0.1	10	0.1	3																				
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr								0.1	1			0.1	5			0.1	10								
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr																									
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush																	2						7	20	
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed										0.1	8														
Clusiaceae	Hypericum spp.																										
Convolvulaceae	Convolvulus angustissimus																										
Convolvulaceae	Convolvulus spp.					0.1	5													0.1	20	0.1	5				
Crassulaceae	Crassula colorata	Dense Stonecrop																									
Crassulaceae	Crassula spp.	Stonecrop																									
Cupressaceae	Callitris glaucophylla	White Cypress Pine		7		15	1																				
Cyperaceae	Isolepis spp.	Club-rush																									
Cyperaceae	Cyperus difformis	Dirty Dora																									
Cyperaceae	Carex inversa	Knob Sedge																									
Cyperaceae	Isolepis cernua	Nodding Club-rush																									
Cyperaceae	Carpha nivicola																										
Cyperaceae	Eleocharis acuta																										
Cyperaceae	Eleocharis pallens	Pale Spike Sedge								0.5	40					0.2	30										15
Cyperaceae	Cyperus gracilis	Slender Flat-sedge																									
Euphorbiaceae	Euphorbia drummondii	Caustic Weed		0.1	10															0.1	10						
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea																									
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee																	0.1	1							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Chenopodiaceae	Maireana humillima															
Chenopodiaceae	Maireana trichoptera															
Chenopodiaceae	Salsola australis															
Chenopodiaceae	Atriplex nummularia	Old Man Saltbush														
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush														
Chenopodiaceae	Sclerolaena brachyptera	Short-winged Copperburr														
Chenopodiaceae	Sclerolaena eriacantha	Silky Copperburr														
Chenopodiaceae	Atriplex leptocarpa	Slender-fruit Saltbush											0.1	1		
Chenopodiaceae	Dysphania pumilio	Small Crumbweed														
Chenopodiaceae	Sclerolaena stelligera	Star Copperburr														
Chenopodiaceae	Sclerolaena divaricata	Tangled Copperburr														
Chenopodiaceae	Rhagodia spinescens	Thorny Saltbush							0.1	1	0.1	1				
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed									0.1	1				
Clusiaceae	Hypericum spp.															
Convolvulaceae	Convolvulus angustissimus															
Convolvulaceae	Convolvulus spp.															
Crassulaceae	Crassula colorata	Dense Stonecrop														
Crassulaceae	Crassula spp.	Stonecrop														
Cupressaceae	Callitris glaucophylla	White Cypress Pine					0.1	1	15	1						
Cyperaceae	Isolepis spp.	Club-rush														
Cyperaceae	Cyperus difformis	Dirty Dora														
Cyperaceae	Carex inversa	Knob Sedge											8	700		
Cyperaceae	Isolepis cernua	Nodding Club-rush														
Cyperaceae	Carpha nivicola															
Cyperaceae	Eleocharis acuta															
Cyperaceae	Eleocharis pallens	Pale Spike Sedge	500												5	
Cyperaceae	Cyperus gracilis	Slender Flat-sedge														
Euphorbiaceae	Euphorbia drummondii	Caustic Weed			0.1	1					0.1	1				
Fabaceae (Faboideae)	Swainsona procumbens	Broughton Pea														
Fabaceae (Mimosoideae)	Acacia oswaldii	Miljee														

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree									0.1	1	0.2	1			5	1	10	10	1	2		
Geraniaceae	Erodium crinitum	Blue Crowfoot																						
Geraniaceae	Erodium spp.	Crowfoot																						
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia							0.1	2														
Goodeniaceae	Goodenia gracilis																							
Goodeniaceae	Goodenia pusilliflora						0.1	5	0.1	1	0.1	20	0.1	20	0.1	6	0.1	10	0.1	30	1	500		
Goodeniaceae	Goodenia spp.																							
Goodeniaceae	Goodenia glauca	Pale Goodenia																						
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																						
Juncaceae	Juncus subsecundus	Finger Rush	0.1	20	0.1	10			2	400	0.1	5									4	1000		
Juncaceae	Juncus filicaulis		0.1	10	0.1	5																		
Juncaceae	Juncus flavidus								0.1	10														
Juncaceae	Juncus spp.										0.2	20											0.1	20
Juncaceae	Juncus usitatus																							
Juncaginaceae	Triglochin spp.						0.1	5																
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																						
Lamiaceae	Teucrium racemosum	Grey Germander																						
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																						
Malvaceae	Sida corrugata	Corrugated Sida											0.2	50	0.1	10			0.3	60				
Malvaceae	Sida trichopoda	High Sida																						
Malvaceae	Malva spp.	Mallow																						
Malvaceae	Sida spp.																							
Malvaceae	Sida cunninghamii	Ridge Sida																						
Marsileaceae	Marsilea drummondii	Common Nardoo	10	400	10	500	3	400	5	500	1	200	0.1	50					0.3	200	0.1	50	0.2	200
Marsileaceae	Marsilea costulifera						0.5	20	0.5	200	0.3	50												
Myrtaceae	Eucalyptus largiflorens	Black Box																						
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																						
Nyctaginaceae	Boerhavia dominii	Tarvine																						
Nyctaginaceae	Boerhavia repleta	Tarvine																						
Oxalidaceae	Oxalis perennans												0.1	20	0.2	100	0.1	10						
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																						
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain																						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree	0.1	3													3				15				10
Geraniaceae	Erodium crinitum	Blue Crowfoot	0.1	10			0.1	10																	
Geraniaceae	Erodium spp.	Crowfoot													0.1	10									
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia			0.1	2					0.1	5	0.1	50			0.1	6					0.1	20	
Goodeniaceae	Goodenia gracilis												0.1	10							0.1	1	0.3	200	
Goodeniaceae	Goodenia pusilliflora						0.1	5																	0.1
Goodeniaceae	Goodenia spp.																								
Goodeniaceae	Goodenia glauca	Pale Goodenia																							
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																							
Juncaceae	Juncus subsecundus	Finger Rush	0.1	10	0.1	2	0.1	5	0.1	2															
Juncaceae	Juncus filicaulis																								
Juncaceae	Juncus flavidus																		0.1	2					
Juncaceae	Juncus spp.												0.2	20											
Juncaceae	Juncus usitatus																								
Juncaginaceae	Triglochin spp.																								
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																							
Lamiaceae	Teucrium racemosum	Grey Germander			0.1	2													0.1	20					
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																							
Malvaceae	Sida corrugata	Corrugated Sida	0.1	5	0.1	20	2	200	0.1	2	0.1	20	0.2	100			0.1	20					0.1	20	
Malvaceae	Sida trichopoda	High Sida																							
Malvaceae	Malva spp.	Mallow																							
Malvaceae	Sida spp.																								
Malvaceae	Sida cunninghamii	Ridge Sida																							
Marsileaceae	Marsilea drummondii	Common Nardoo			0.1	4			3	300	0.1	30					0.1	10	0.1	100					
Marsileaceae	Marsilea costulifera								0.5	10															
Myrtaceae	Eucalyptus largiflorens	Black Box									20														
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																							
Nyctaginaceae	Boerhavia dominii	Tarvine									0.2	20													
Nyctaginaceae	Boerhavia repleta	Tarvine																							
Oxalidaceae	Oxalis perennans		0.3	300	0.1	10	2	200	0.1	2	0.1	50	0.1	100	0.5	200	0.1	50			0.1	100	0.1	100	0.1
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																							
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree						7																		40		
Geraniaceae	Erodium crinitum	Blue Crowfoot																										
Geraniaceae	Erodium spp.	Crowfoot			0.1	20			0.1	50													0.7	100				
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia																										
Goodeniaceae	Goodenia gracilis																								0.1	20		
Goodeniaceae	Goodenia pusilliflora		20				0.1	20							0.1	20	0.1	100	0.1	20								
Goodeniaceae	Goodenia spp.																											
Goodeniaceae	Goodenia glauca	Pale Goodenia																										
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																										
Juncaceae	Juncus subsecundus	Finger Rush																										
Juncaceae	Juncus filicaulis																											
Juncaceae	Juncus flavidus																											
Juncaceae	Juncus spp.																								0.1	20	0.1	10
Juncaceae	Juncus usitatus																											
Juncaginaceae	Triglochin spp.																											
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																										
Lamiaceae	Teucrium racemosum	Grey Germander					0.1	5																				
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																										
Malvaceae	Sida corrugata	Corrugated Sida			0.1	5			0.1	20					0.1	20			0.1	30	0.1	5			0.1	5	0.1	10
Malvaceae	Sida trichopoda	High Sida									0.1	20			0.1	5												
Malvaceae	Malva spp.	Mallow			5																0.3	20	0.2	20				
Malvaceae	Sida spp.																											
Malvaceae	Sida cunninghamii	Ridge Sida																										
Marsileaceae	Marsilea drummondii	Common Nardoo					1												0.1	200							0.2	100
Marsileaceae	Marsilea costulifera																											
Myrtaceae	Eucalyptus largiflorens	Black Box																	20								25	
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																			4							
Nyctaginaceae	Boerhavia dominii	Tarvine																										
Nyctaginaceae	Boerhavia repleta	Tarvine																										
Oxalidaceae	Oxalis perennans		100				0.1	50			0.1	50	0.1	50					0.1	100	0.1	20			0.1	50	0.1	100
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																										
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain													0.1													

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree															4	5			0.1	1	10	8	
Geraniaceae	Erodium crinitum	Blue Crowfoot			0.1	5	0.1	5	0.1	1			1	200	0.1	2	0.1	5							0.3
Geraniaceae	Erodium spp.	Crowfoot																							
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia																					0.1	20	
Goodeniaceae	Goodenia gracilis																								
Goodeniaceae	Goodenia pusilliflora								0.3	80							0.1	1							
Goodeniaceae	Goodenia spp.																								
Goodeniaceae	Goodenia glauca	Pale Goodenia																							
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																							
Juncaceae	Juncus subsecundus	Finger Rush					0.1	2	5	100									0.2	70					
Juncaceae	Juncus filicaulis																								
Juncaceae	Juncus flavidus																		0.5	60					
Juncaceae	Juncus spp.																								
Juncaceae	Juncus usitatus								0.1	5											0.1	2			
Juncaginaceae	Triglochin spp.								0.5	60															
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																							
Lamiaceae	Teucrium racemosum	Grey Germander																							
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																							
Malvaceae	Sida corrugata	Corrugated Sida	0.2	20	0.1	10	0.1	5					4	200			0.1	20			0.1	10	0.1	4	0.1
Malvaceae	Sida trichopoda	High Sida	0.1	5																					
Malvaceae	Malva spp.	Mallow																							
Malvaceae	Sida spp.																								
Malvaceae	Sida cunninghamii	Ridge Sida																							
Marsileaceae	Marsilea drummondii	Common Nardoo							2	200	1	1000			0.1	2			3	300	0.1	10			
Marsileaceae	Marsilea costulifera																								
Myrtaceae	Eucalyptus largiflorens	Black Box			15	20					25	6			30	4			40	5					
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																							
Nyctaginaceae	Boerhavia dominii	Tarvine			0.1	1																			
Nyctaginaceae	Boerhavia repleta	Tarvine																							
Oxalidaceae	Oxalis perennans		0.1	100					0.1	5							0.1	1					0.1	2	0.1
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																							
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree					20	15					10		10	20					10				1	0.4	
Geraniaceae	Erodium crinitum	Blue Crowfoot	30																								
Geraniaceae	Erodium spp.	Crowfoot																									
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia							4	0.1																	
Goodeniaceae	Goodenia gracilis																										
Goodeniaceae	Goodenia pusilliflora																										
Goodeniaceae	Goodenia spp.																		10	0.1							
Goodeniaceae	Goodenia glauca	Pale Goodenia																									
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																									3
Juncaceae	Juncus subsecundus	Finger Rush																									
Juncaceae	Juncus filicaulis																										
Juncaceae	Juncus flavidus																										
Juncaceae	Juncus spp.														30	0.1									20	0.1	0.1
Juncaceae	Juncus usitatus																										
Juncaginaceae	Triglochin spp.																										
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																									
Lamiaceae	Teucrium racemosum	Grey Germander											20	0.1	20	0.2									20	0.1	0.1
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																									
Malvaceae	Sida corrugata	Corrugated Sida	5		3	0.1	5	0.1	10	0.1			30	0.1	5	0.1	2						200	5			
Malvaceae	Sida trichopoda	High Sida									30	0.1															
Malvaceae	Malva spp.	Mallow																									
Malvaceae	Sida spp.																										
Malvaceae	Sida cunninghamii	Ridge Sida																									
Marsileaceae	Marsilea drummondii	Common Nardoo									20	0.1			30	0.1									1000	1	3
Marsileaceae	Marsilea costulifera																								50	0.1	0.3
Myrtaceae	Eucalyptus largiflorens	Black Box																									
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																									
Nyctaginaceae	Boerhavia dominii	Tarvine															20	0.2					5	0.1			
Nyctaginaceae	Boerhavia repleta	Tarvine																									
Oxalidaceae	Oxalis perennans		10												20	0.1											
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																									
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree																	6	1	20		0.5	4	7	3	
Geraniaceae	Erodium crinitum	Blue Crowfoot																									
Geraniaceae	Erodium spp.	Crowfoot																									
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia																									
Goodeniaceae	Goodenia gracilis																										
Goodeniaceae	Goodenia pusilliflora														0.1	1											
Goodeniaceae	Goodenia spp.																										
Goodeniaceae	Goodenia glauca	Pale Goodenia							0.1	5			0.1	10													
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily																									
Juncaceae	Juncus subsecundus	Finger Rush																									
Juncaceae	Juncus filicaulis																										
Juncaceae	Juncus flavidus																										
Juncaceae	Juncus spp.		5										0.1	5					0.1	10	0.1	5	0.2	40			0.1
Juncaceae	Juncus usitatus																										
Juncaginaceae	Triglochin spp.																										
Juncaginaceae	Triglochin striata	Streaked Arrowgrass																									
Lamiaceae	Teucrium racemosum	Grey Germander	20						0.1	10	0.1	20			0.1	5	0.1	10	0.1	1	0.1	20					
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife																									
Malvaceae	Sida corrugata	Corrugated Sida		1		0.2	200						0.1	10	0.1	5			0.1	10	0.2	70	0.1	20			
Malvaceae	Sida trichopoda	High Sida																									
Malvaceae	Malva spp.	Mallow		0.1	1						0.1	5															
Malvaceae	Sida spp.								0.1	1	0.1	2															
Malvaceae	Sida cunninghamii	Ridge Sida																							0.5	100	
Marsileaceae	Marsilea drummondii	Common Nardoo	500						0.1	100	0.2	400	0.1	100			0.1	100	0.1	10							0.1
Marsileaceae	Marsilea costulifera		200																								
Myrtaceae	Eucalyptus largiflorens	Black Box							25		25		30														
Myrtaceae	Eucalyptus camaldulensis	River Red Gum																									
Nyctaginaceae	Boerhavia dominii	Tarvine		0.1	10	0.1	1	0.1	20	0.1	10	0.1	20														
Nyctaginaceae	Boerhavia repleta	Tarvine																									
Oxalidaceae	Oxalis perennans																				0.1	3					
Phrymaceae	Mimulus gracilis	Slender Monkey-flower																									
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree														
Geraniaceae	Erodium crinitum	Blue Crowfoot														
Geraniaceae	Erodium spp.	Crowfoot														
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia														
Goodeniaceae	Goodenia gracilis															
Goodeniaceae	Goodenia pusilliflora															
Goodeniaceae	Goodenia spp.															
Goodeniaceae	Goodenia glauca	Pale Goodenia														
Hydrocharitaceae	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily														
Juncaceae	Juncus subsecundus	Finger Rush														
Juncaceae	Juncus filicaulis															
Juncaceae	Juncus flavidus												5	700		
Juncaceae	Juncus spp.		1	0.1	1											
Juncaceae	Juncus usitatus															
Juncaginaceae	Triglochin spp.															
Juncaginaceae	Triglochin striata	Streaked Arrowgrass														
Lamiaceae	Teucrium racemosum	Grey Germander														
Lythraceae	Lythrum hyssopifolia	Hyssop Loosestrife														
Malvaceae	Sida corrugata	Corrugated Sida					0.5	100	2	300	10	500				
Malvaceae	Sida trichopoda	High Sida														
Malvaceae	Malva spp.	Mallow														
Malvaceae	Sida spp.															
Malvaceae	Sida cunninghamii	Ridge Sida									0.2	30				
Marsileaceae	Marsilea drummondii	Common Nardoo	1	0.1	100								0.1	100	0.1	200
Marsileaceae	Marsilea costulifera															
Myrtaceae	Eucalyptus largiflorens	Black Box														
Myrtaceae	Eucalyptus camaldulensis	River Red Gum											10	2		
Nyctaginaceae	Boerhavia dominii	Tarvine					0.1	1	0.1	10	0.5	200				
Nyctaginaceae	Boerhavia repleta	Tarvine					0.1	1								
Oxalidaceae	Oxalis perennans								0.1	10						
Phrymaceae	Mimulus gracilis	Slender Monkey-flower														
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain														

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass	8	300	0.1	5	0.1	1	0.1	20	0.1	1	1	20	0.5	50	2	100			15	2000	2	
Poaceae	Aristida behriana	Bunch Wiregrass																						
Poaceae	Eragrostis australasica	Canegrass																						
Poaceae	Cynodon dactylon	Common Couch																						
Poaceae	Enteropogon acicularis	Curly Windmill Grass	2	80			3	300	0.2	200	0.3	60	0.1	10	4	200	0.1	10	5	50	0.5	50	2	
Poaceae	Enteropogon ramosus	Curly Windmill Grass																						
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																						
Poaceae	Sporobolus caroli	Fairy Grass													2	200					0.2	50	0.1	10
Poaceae	Tripogon loliiformis	Fiveminute Grass																						
Poaceae	Paspalidium constrictum	Knottybutt Grass																						
Poaceae	Eragrostis setifolia	Neverfail																						
Poaceae	Austrostipa nodosa																							
Poaceae	Austrostipa spp.																							
Poaceae	Eragrostis spp.																							
Poaceae	Lachnagrostis filiformis																							
Poaceae	Rytidosperma spp.																						0.5	50
Poaceae	Walwhalleya proluta		2	100			5	500	0.4	300	1	40	4	40	40	2000			5	2000	1	100	25	
Poaceae	Eragrostis leptostachya	Paddock Lovegrass																						
Poaceae	Panicum spp.	Panicum																						
Poaceae	Austrostipa aristiglumis	Plains Grass	1												5	400							0.1	2
Poaceae	Eragrostis lacunaria	Purple Lovegrass																						
Poaceae	Bothriochloa macra	Red Grass													0.2	40			0.1	10	1	200		
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass																						
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass																						
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																						
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																						
Poaceae	Tragus australianus	Small Burrgrass																						
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass													0.1	50			1	500				

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass							0.5	20			0.5	30					0.5	20					
Poaceae	Aristida behriana	Bunch Wiregrass																							
Poaceae	Eragrostis australasica	Canegrass																	25						
Poaceae	Cynodon dactylon	Common Couch							0.5	10															
Poaceae	Enteropogon acicularis	Curly Windmill Grass	0.3	100	20	500	0.2	20	25	2000	2		5		0.3	50					1		1		4
Poaceae	Enteropogon ramosus	Curly Windmill Grass																							
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																							
Poaceae	Sporobolus caroli	Fairy Grass							0.5	30	0.1	20	10		5		3						3		
Poaceae	Tripogon loliiformis	Fiveminute Grass																							
Poaceae	Paspalidium constrictum	Knottybutt Grass																							
Poaceae	Eragrostis setifolia	Neverfail																							
Poaceae	Austrostipa nodosa						4	300							0.3	20					0.1	5			3
Poaceae	Austrostipa spp.																								
Poaceae	Eragrostis spp.																								
Poaceae	Lachnagrostis filiformis																		0.5	30					
Poaceae	Rytidosperma spp.																								
Poaceae	Walwhalleya proluta		3	200	15	400	2	50	3	300	0.1	20	3		0.2	10	10						5		
Poaceae	Eragrostis leptostachya	Paddock Lovegrass																							
Poaceae	Panicum spp.	Panicum																							
Poaceae	Austrostipa aristiglumis	Plains Grass			20	1000	10	1000					2		20		50		1		10		5		15
Poaceae	Eragrostis lacunaria	Purple Lovegrass																							
Poaceae	Bothriochloa macra	Red Grass					2	50																	
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass			10	300	0.2	50			0.2	20	30		5		5				15		10		5
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass	0.5	30																					
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																							
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																							
Poaceae	Tragus australianus	Small Burrgrass																							
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass	0.3	60	10	400	0.5	100			0.1	10	2								5		0.5	20	10

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass					20	0.3																				
Poaceae	Aristida behriana	Bunch Wiregrass															2	0.1										
Poaceae	Eragrostis australasica	Canegrass																										
Poaceae	Cynodon dactylon	Common Couch																										
Poaceae	Enteropogon acicularis	Curly Windmill Grass		0.5	20	40		0.1	5	5		5		3	30	15		5						1		3		
Poaceae	Enteropogon ramosus	Curly Windmill Grass																										
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																										
Poaceae	Sporobolus caroli	Fairy Grass								1		0.2	20	0.1	10	0.1	10	0.1	5									
Poaceae	Tripogon loliiformis	Fiveminute Grass																										
Poaceae	Paspalidium constrictum	Knottybutt Grass		0.2	10			1													25							
Poaceae	Eragrostis setifolia	Neverfail		1														2					0.1	10				
Poaceae	Austrostipa nodosa									5		0.1	10	0.1	2	5												
Poaceae	Austrostipa spp.																											
Poaceae	Eragrostis spp.																											
Poaceae	Lachnagrostis filiformis																											
Poaceae	Rytidosperma spp.																										0.1	4
Poaceae	Walwhalleya proluta									3		5		15		10		4										
Poaceae	Eragrostis leptostachya	Paddock Lovegrass		0.2	20																							
Poaceae	Panicum spp.	Panicum																										
Poaceae	Austrostipa aristiglumis	Plains Grass								7				5				0.2	5									
Poaceae	Eragrostis lacunaria	Purple Lovegrass		3				0.1	10																			
Poaceae	Bothriochloa macra	Red Grass																										
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass				3				2		10		3		1		2				0.1	10	30				
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass																										
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																				2						
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																										
Poaceae	Tragus australianus	Small Burrgrass																										
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass									20	0.2		1		0.3	20							1				

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass			2	200			15	500			0.1	5			20	3000							
Poaceae	Aristida behriana	Bunch Wiregrass																							
Poaceae	Eragrostis australasica	Canegrass									0.1	5													
Poaceae	Cynodon dactylon	Common Couch																							
Poaceae	Enteropogon acicularis	Curly Windmill Grass	10		15	1000	5	500	2	500	0.1	20			0.1	20	1	40	0.1	20	60	3000	1	200	5
Poaceae	Enteropogon ramosus	Curly Windmill Grass																							
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																							
Poaceae	Sporobolus caroli	Fairy Grass	1		0.1	5	15	600	0.3	10									0.1	5	3	300	1	500	0.1
Poaceae	Tripogon loliiformis	Fiveminute Grass																							
Poaceae	Paspalidium constrictum	Knottybutt Grass																							
Poaceae	Eragrostis setifolia	Neverfail																							
Poaceae	Austrostipa nodosa						5	300											0.1	5			20	500	
Poaceae	Austrostipa spp.																								
Poaceae	Eragrostis spp.																								
Poaceae	Lachnagrostis filiformis										0.2	30													
Poaceae	Rytidosperma spp.																						2	100	
Poaceae	Walwhalleya proluta		60		0.5	30			15	1000	1		0.1		6	600	5	300	0.1	40	1	100	0.5	400	65
Poaceae	Eragrostis leptostachya	Paddock Lovegrass																							
Poaceae	Panicum spp.	Panicum																					0.1	1	
Poaceae	Austrostipa aristiglumis	Plains Grass					0.2	10	0.1	5															
Poaceae	Eragrostis lacunaria	Purple Lovegrass																							
Poaceae	Bothriochloa macra	Red Grass																							
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	1				50	1000							5	300			0.1	20	3	300	15	300	
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass																							
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																							
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																							
Poaceae	Tragus australianus	Small Burrgrass																							
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass									1				1	10											
Poaceae	Aristida behriana	Bunch Wiregrass															0.2	20									
Poaceae	Eragrostis australasica	Canegrass																							0.2	3	10
Poaceae	Cynodon dactylon	Common Couch																									
Poaceae	Enteropogon acicularis	Curly Windmill Grass	500	10	400	0.1	1	30	1000	3				1	50			10		10		20	200	0.4	20		
Poaceae	Enteropogon ramosus	Curly Windmill Grass																									
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																									
Poaceae	Sporobolus caroli	Fairy Grass	1	5	200			5	200	1		1		2	50			3									
Poaceae	Tripogon loliiformis	Fiveminute Grass																									
Poaceae	Paspalidium constrictum	Knottybutt Grass																									
Poaceae	Eragrostis setifolia	Neverfail																									0.1
Poaceae	Austrostipa nodosa			0.1	10	0.2	10					0.5	30	1	100	4		15				2	50				
Poaceae	Austrostipa spp.																										
Poaceae	Eragrostis spp.																										
Poaceae	Lachnagrostis filiformis																										0.1
Poaceae	Rytidosperma spp.					1	100	10	200									1									
Poaceae	Walwhalleya proluta		3000	15	600	5	100	10	300	25		10		1	200			2		0.2		1	100	1			
Poaceae	Eragrostis leptostachya	Paddock Lovegrass																									
Poaceae	Panicum spp.	Panicum																									
Poaceae	Austrostipa aristiglumis	Plains Grass								25		15		25	200												
Poaceae	Eragrostis lacunaria	Purple Lovegrass																									
Poaceae	Bothriochloa macra	Red Grass																									
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass		20	600	2	200	25	800							0.5	50	0.1	10	1							
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass																									
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																									
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																									
Poaceae	Tragus australianus	Small Burrgrass																									
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass								0.1	10	0.1	10							0.1	20						

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass															1						2				
Poaceae	Aristida behriana	Bunch Wiregrass																									
Poaceae	Eragrostis australasica	Canegrass													0.4	1											0.5
Poaceae	Cynodon dactylon	Common Couch																									
Poaceae	Enteropogon acicularis	Curly Windmill Grass		10		2		4		1		2		10		15		5		10				2	100	0.1
Poaceae	Enteropogon ramosus	Curly Windmill Grass																									
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass																									
Poaceae	Sporobolus caroli	Fairy Grass						0.1	3	0.1	10			0.2	20	0.1	20							4	600	
Poaceae	Tripogon loliiformis	Fiveminute Grass																									
Poaceae	Paspalidium constrictum	Knottybutt Grass		1		1																					
Poaceae	Eragrostis setifolia	Neverfail	10																								
Poaceae	Austrostipa nodosa					0.1	5									10				2		0.5	50			
Poaceae	Austrostipa spp.																										
Poaceae	Eragrostis spp.																										
Poaceae	Lachnagrostis filiformis		5																								
Poaceae	Rytidosperma spp.																										
Poaceae	Walwhalleya proluta					1		3		1		3		35		30		1		1				20	1000	10
Poaceae	Eragrostis leptostachya	Paddock Lovegrass																									
Poaceae	Panicum spp.	Panicum																									
Poaceae	Austrostipa aristiglumis	Plains Grass								0.2	5	0.1	1	0.2	2					1							
Poaceae	Eragrostis lacunaria	Purple Lovegrass																									
Poaceae	Bothriochloa macra	Red Grass																									
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass		1		1		3						1		1		2		0.2	20	2		3	300	
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass																									
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass																									
Poaceae	Rytidosperma carphoides	Short Wallaby Grass																									
Poaceae	Tragus australianus	Small Burrgrass														0.1	2									
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass																		0.1	10			4	700	

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Rytidosperma duttonianum	Brown-back Wallaby Grass														
Poaceae	Aristida behriana	Bunch Wiregrass														
Poaceae	Eragrostis australasica	Canegrass	40	2	30											
Poaceae	Cynodon dactylon	Common Couch														
Poaceae	Enteropogon acicularis	Curly Windmill Grass	1	1	100	30	1000	5	300	6	300			20		
Poaceae	Enteropogon ramosus	Curly Windmill Grass														
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass														
Poaceae	Sporobolus caroli	Fairy Grass						0.1	1					0.1	10	
Poaceae	Tripogon loliiformis	Fiveminute Grass										0.1	1			
Poaceae	Paspalidium constrictum	Knottybutt Grass														
Poaceae	Eragrostis setifolia	Neverfail														
Poaceae	Austrostipa nodosa							0.1	10	0.2	30					
Poaceae	Austrostipa spp.															
Poaceae	Eragrostis spp.													0.1	1	
Poaceae	Lachnagrostis filiformis															
Poaceae	Rytidosperma spp.															
Poaceae	Walwhalleya proluta		300	50	2000									1		
Poaceae	Eragrostis leptostachya	Paddock Lovegrass														
Poaceae	Panicum spp.	Panicum														
Poaceae	Austrostipa aristiglumis	Plains Grass														
Poaceae	Eragrostis lacunaria	Purple Lovegrass														
Poaceae	Bothriochloa macra	Red Grass														
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass				0.5	100							5		
Poaceae	Austrostipa scabra subsp. falcata	Rough Speargrass														
Poaceae	Austrostipa scabra subsp. scabra	Rough Speargrass														
Poaceae	Rytidosperma carphoides	Short Wallaby Grass														
Poaceae	Tragus australianus	Small Burrgrass														
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass								2	200			0.1	10	

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Poaceae	Austrostipa scabra	Speargrass									0.1	1					9	300						
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass																						
Poaceae	Paspalidium jubiflorum	Warrego Grass																						
Poaceae	Microlaena stipoides	Weeping Grass																						
Poaceae	Eragrostis parviflora	Weeping Lovegrass																						
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass																						
Poaceae	Chloris truncata	Windmill Grass											0.5	50	3	200	0.1	9	0.5	90	0.5	100		
Poaceae	Austrostipa bigeniculata	Yanganbil					0.1	1					0.1	5	8	500	7	100	0.1	10	0.5	50		
Polygonaceae	Persicaria prostrata	Creeping Knotweed			5	600	0.1	5																
Polygonaceae	Duma florulenta	Lignum	10	30	30	50	10	50	30	100	35	50											8	
Polygonaceae	Rumex tenax	Shiny Dock	0.1	5			0.1	5			0.1	5	0.2	30	0.1	10			0.1	10	0.1	10		
Polygonaceae	Rumex brownii	Swamp Dock																						
Polygonaceae	Rumex dumosus	Wiry Dock																						
Potamogetonaceae	Potamogeton cheesemanii																							
Proteaceae	Hakea leucoptera	Needlewood																						
Pteridaceae	Cheilanthes sieberi	Rock Fern																						
Rubiaceae	Asperula conferta	Common Woodruff											0.2	400							0.1	50		
Sapindaceae	Alectryon oleifolius	Western Rosewood																						
Scrophulariaceae	Limosella curdieana	Large Mudwort											0.1	10										
Solanaceae	Lycium australe	Australian Boxthorn																						
Solanaceae	Solanum esuriale	Quena											0.1	2					0.1	10				
Solanaceae	Solanum coactiliferum	Western Nightshade																						
Urticaceae	Urtica spp.																							
Urticaceae	Urtica incisa	Stinging Nettle																						
Zygophyllaceae	Roepera glauca	Pale Twinleaf																						
Introduced species																								
Asteraceae	Arctotheca calendula	Capeweed																						
Asteraceae	Chondrilla juncea	Skeleton Weed											0.1	20							0.1	1		
Asteraceae	Cirsium vulgare	Spear Thistle																						
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane																						
Asteraceae	Conyza spp.														7	500			0.2	60				
Asteraceae	Cotula bipinnata	Ferny Cotula																						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_W_08	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	
Poaceae	Austrostipa scabra	Speargrass			5	200	7	200	0.1	2	7										1		0.3	50	5	
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass																								
Poaceae	Paspalidium jubiflorum	Warrego Grass																								
Poaceae	Microlaena stipoides	Weeping Grass	0.2																							
Poaceae	Eragrostis parviflora	Weeping Lovegrass																	0.5	40						
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass																								
Poaceae	Chloris truncata	Windmill Grass	0.4	200	0.1	20	2	300			0.1	20			0.5	30			1				0.5	50	0.1	
Poaceae	Austrostipa bigeniculata	Yanganbil	60	2000	10	200	20	2000	0.2	10													15			
Polygonaceae	Persicaria prostrata	Creeping Knotweed							3	200																
Polygonaceae	Duma florulenta	Lignum			0.1	2			1	5									0.5	2						
Polygonaceae	Rumex tenax	Shiny Dock	0.1	3					0.2	10	0.1	2							0.1	20						
Polygonaceae	Rumex brownii	Swamp Dock																								
Polygonaceae	Rumex dumosus	Wiry Dock																								
Potamogetonaceae	Potamogeton cheesemanii																									
Proteaceae	Hakea leucoptera	Needlewood																								
Pteridaceae	Cheilanthes sieberi	Rock Fern															0.1	3								
Rubiaceae	Asperula conferta	Common Woodruff	0.2	200																						
Sapindaceae	Alectryon oleifolius	Western Rosewood																								
Scrophulariaceae	Limosella curdieana	Large Mudwort																								
Solanaceae	Lycium australe	Australian Boxthorn									1															
Solanaceae	Solanum esuriale	Quena	0.3	10	0.1	3	0.1	10	0.1	2					0.1	2					0.1	20			0.1	
Solanaceae	Solanum coactiliferum	Western Nightshade																								
Urticaceae	Urtica spp.																									
Urticaceae	Urtica incisa	Stinging Nettle																								
Zygophyllaceae	Roepera glauca	Pale Twinleaf																			0.8	20				
Introduced species																										
Asteraceae	Arctotheca calendula	Capeweed																								
Asteraceae	Chondrilla juncea	Skeleton Weed					0.2	50					0.1	20	0.1	20	0.1	10								
Asteraceae	Cirsium vulgare	Spear Thistle																								
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane									0.1	20			5		15						0.1	10	0.1	
Asteraceae	Conyza spp.		0.1	10			0.5	40																		
Asteraceae	Cotula bipinnata	Ferny Cotula																								

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Austrostipa scabra	Speargrass		40				1		10		1		25		20		10						1		0.2	20	
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass																										
Poaceae	Paspalidium jubiflorum	Warrego Grass																										
Poaceae	Microlaena stipoides	Weeping Grass																										
Poaceae	Eragrostis parviflora	Weeping Lovegrass																										
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass																			1							
Poaceae	Chloris truncata	Windmill Grass	20								1		0.2	20			0.1	10										
Poaceae	Austrostipa bigeniculata	Yanganbil																							0.1	10		
Polygonaceae	Persicaria prostrata	Creeping Knotweed																									0.2	30
Polygonaceae	Duma florulenta	Lignum																									1	
Polygonaceae	Rumex tenax	Shiny Dock					0.1	10																	0.1	5	0.1	10
Polygonaceae	Rumex brownii	Swamp Dock																										
Polygonaceae	Rumex dumosus	Wiry Dock																										
Potamogetonaceae	Potamogeton cheesemanii																											
Proteaceae	Hakea leucoptera	Needlewood		4																								
Pteridaceae	Cheilanthes sieberi	Rock Fern																										
Rubiaceae	Asperula conferta	Common Woodruff																										
Sapindaceae	Alectryon oleifolius	Western Rosewood																										
Scrophulariaceae	Limosella curdieana	Large Mudwort																										
Solanaceae	Lycium australe	Australian Boxthorn															0.1	1										
Solanaceae	Solanum esuriale	Quena	3				0.1	2			0.1	20	0.1	20	0.1	20	0.1	1	0.1	20								
Solanaceae	Solanum coactiliferum	Western Nightshade																										
Urticaceae	Urtica spp.			0.1	3																							
Urticaceae	Urtica incisa	Stinging Nettle																					5					
Zygophyllaceae	Roepera glauca	Pale Twinleaf																										
Introduced species																												
Asteraceae	Arctotheca calendula	Capeweed		1																								
Asteraceae	Chondrilla juncea	Skeleton Weed		0.1	5	0.1	20			0.1	20																	
Asteraceae	Cirsium vulgare	Spear Thistle																										
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane	20			0.1	10	0.1	5	0.3	50	7																
Asteraceae	Conyza spp.																											
Asteraceae	Cotula bipinnata	Ferny Cotula		0.1	5			0.5	20										0.1	5	0.2	2	0.2	20				

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Austrostipa scabra	Speargrass			5	200			0.1				7	200	0.5	200	25	2000			0.5	50			
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass																							
Poaceae	Paspalidium jubiflorum	Warrego Grass									0.1	10							0.2	50					
Poaceae	Microlaena stipoides	Weeping Grass																							
Poaceae	Eragrostis parviflora	Weeping Lovegrass																							
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass																							
Poaceae	Chloris truncata	Windmill Grass			0.1	5	0.2	50																	
Poaceae	Austrostipa bigeniculata	Yanganbil			0.5	30											15	1000							0.1
Polygonaceae	Persicaria prostrata	Creeping Knotweed																							
Polygonaceae	Duma florulenta	Lignum	0.3	2					5	30	2	40							5	30					
Polygonaceae	Rumex tenax	Shiny Dock							0.3	30	0.1	3							0.1	2					
Polygonaceae	Rumex brownii	Swamp Dock																							
Polygonaceae	Rumex dumosus	Wiry Dock																							
Potamogetonaceae	Potamogeton cheesemanii																								
Proteaceae	Hakea leucoptera	Needlewood																							
Pteridaceae	Cheilanthes sieberi	Rock Fern																							
Rubiaceae	Asperula conferta	Common Woodruff																							
Sapindaceae	Alectryon oleifolius	Western Rosewood																							
Scrophulariaceae	Limosella curdieana	Large Mudwort																							
Solanaceae	Lycium australe	Australian Boxthorn																							
Solanaceae	Solanum esuriale	Quena			0.1	2	0.1	2	0.1	1			0.1	1			0.1	1			0.1	10	0.2	50	0.1
Solanaceae	Solanum coactiliferum	Western Nightshade																							
Urticaceae	Urtica spp.																								
Urticaceae	Urtica incisa	Stinging Nettle																							
Zygophyllaceae	Roepera glauca	Pale Twinleaf																							
Introduced species																									
Asteraceae	Arctotheca calendula	Capeweed																							
Asteraceae	Chondrilla juncea	Skeleton Weed																							
Asteraceae	Cirsium vulgare	Spear Thistle																							
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane	0.5	100			0.5	200																	
Asteraceae	Conyza spp.								0.1	5															
Asteraceae	Cotula bipinnata	Ferny Cotula																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Austrostipa scabra	Speargrass				0.1	5	5	200			0.1	10	0.2	20	3		5		5		1	100				
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass																									0.1
Poaceae	Paspalidium jubiflorum	Warrego Grass																									
Poaceae	Microlaena stipoides	Weeping Grass																									
Poaceae	Eragrostis parviflora	Weeping Lovegrass																									
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass																									
Poaceae	Chloris truncata	Windmill Grass											0.1	10	0.2	30			1		0.2	10			0.4	50	
Poaceae	Austrostipa bigeniculata	Yanganbil	1																								
Polygonaceae	Persicaria prostrata	Creeping Knotweed																									
Polygonaceae	Duma florulenta	Lignum																							5		8
Polygonaceae	Rumex tenax	Shiny Dock																									
Polygonaceae	Rumex brownii	Swamp Dock																									
Polygonaceae	Rumex dumosus	Wiry Dock																									
Potamogetonaceae	Potamogeton cheesemanii																										
Proteaceae	Hakea leucoptera	Needlewood																									
Pteridaceae	Cheilanthes sieberi	Rock Fern																									
Rubiaceae	Asperula conferta	Common Woodruff																									
Sapindaceae	Alectryon oleifolius	Western Rosewood																			5						
Scrophulariaceae	Limosella curdieana	Large Mudwort																									
Solanaceae	Lycium australe	Australian Boxthorn																									
Solanaceae	Solanum esuriale	Quena	10	0.1	2	0.1	1	0.1	1	0.1	20	0.2	60	0.1	10										0.1	10	
Solanaceae	Solanum coactiliferum	Western Nightshade																									
Urticaceae	Urtica spp.																										
Urticaceae	Urtica incisa	Stinging Nettle																									
Zygophyllaceae	Roepera glauca	Pale Twinleaf																									
Introduced species																											
Asteraceae	Arctotheca calendula	Capeweed																									
Asteraceae	Chondrilla juncea	Skeleton Weed																									
Asteraceae	Cirsium vulgare	Spear Thistle																									
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane			0.1	5			0.1	10	0.1	10															
Asteraceae	Conyza spp.																										
Asteraceae	Cotula bipinnata	Ferny Cotula															1										

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Austrostipa scabra	Speargrass		3				0.2	20					0.2	10	4		5		2		5		1	200	
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass	20																							
Poaceae	Paspalidium jubiflorum	Warrego Grass											10													
Poaceae	Microlaena stipoides	Weeping Grass																								
Poaceae	Eragrostis parviflora	Weeping Lovegrass																								
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass					0.5																			
Poaceae	Chloris truncata	Windmill Grass														0.2	30					0.5	50	0.1	1	
Poaceae	Austrostipa bigeniculata	Yanganbil														0.2	10			10		0.1	5			
Polygonaceae	Persicaria prostrata	Creeping Knotweed																								
Polygonaceae	Duma florulenta	Lignum						2	4	4		7				0.5	1									0.1
Polygonaceae	Rumex tenax	Shiny Dock																								
Polygonaceae	Rumex brownii	Swamp Dock																								
Polygonaceae	Rumex dumosus	Wiry Dock								0.1	5															
Potamogetonaceae	Potamogeton cheesemanii																									
Proteaceae	Hakea leucoptera	Needlewood																								
Pteridaceae	Cheilanthes sieberi	Rock Fern																								
Rubiaceae	Asperula conferta	Common Woodruff																								
Sapindaceae	Alectryon oleifolius	Western Rosewood																								
Scrophulariaceae	Limosella curdieana	Large Mudwort																								
Solanaceae	Lycium australe	Australian Boxthorn																								
Solanaceae	Solanum esuriale	Quena					0.1	50			0.2	50	0.1	20			0.1	20			0.1	10					
Solanaceae	Solanum coactiliferum	Western Nightshade																	0.1		0.1	2					
Urticaceae	Urtica spp.																										
Urticaceae	Urtica incisa	Stinging Nettle																								
Zygophyllaceae	Roepera glauca	Pale Twinleaf																								
Introduced species																										
Asteraceae	Arctotheca calendula	Capeweed																								
Asteraceae	Chondrilla juncea	Skeleton Weed																								
Asteraceae	Cirsium vulgare	Spear Thistle																								
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane													0.1	5	0.2	20								
Asteraceae	Conyza spp.																								0.1	1	
Asteraceae	Cotula bipinnata	Ferny Cotula		0.5	20																					

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Austrostipa scabra	Speargrass				1	100	0.5	100	1	100			0.1	10	
Poaceae	Amphibromus nervosus	Swamp Wallaby Grass														
Poaceae	Paspalidium jubiflorum	Warrego Grass														
Poaceae	Microlaena stipoides	Weeping Grass														
Poaceae	Eragrostis parviflora	Weeping Lovegrass														
Poaceae	Anthosachne scabra	Wheatgrass, Common Wheatgrass														
Poaceae	Chloris truncata	Windmill Grass														
Poaceae	Austrostipa bigeniculata	Yanganbil														
Polygonaceae	Persicaria prostrata	Creeping Knotweed														
Polygonaceae	Duma florulenta	Lignum	1	7	30								5	40		
Polygonaceae	Rumex tenax	Shiny Dock														
Polygonaceae	Rumex brownii	Swamp Dock											0.1	10		
Polygonaceae	Rumex dumosus	Wiry Dock														
Potamogetonaceae	Potamogeton cheesemanii															
Proteaceae	Hakea leucoptera	Needlewood														
Pteridaceae	Cheilanthes sieberi	Rock Fern														
Rubiaceae	Asperula conferta	Common Woodruff														
Sapindaceae	Alectryon oleifolius	Western Rosewood														
Scrophulariaceae	Limosella curdieana	Large Mudwort														
Solanaceae	Lycium australe	Australian Boxthorn														
Solanaceae	Solanum esuriale	Quena		0.1	1	0.2	100	0.2	100	2	500					
Solanaceae	Solanum coactiliferum	Western Nightshade														
Urticaceae	Urtica spp.															
Urticaceae	Urtica incisa	Stinging Nettle														
Zygophyllaceae	Roepera glauca	Pale Twinleaf														
Introduced species																
Asteraceae	Arctotheca calendula	Capeweed														
Asteraceae	Chondrilla juncea	Skeleton Weed														
Asteraceae	Cirsium vulgare	Spear Thistle														
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane														
Asteraceae	Conyza spp.			0.1	1	2	100			8	1000					
Asteraceae	Cotula bipinnata	Ferny Cotula														

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Asteraceae	Hypochaeris glabra	Smooth Catsear																						
Asteraceae	Hypochaeris radicata	Catsear																						
Asteraceae	Lactuca serriola	Prickly Lettuce																						
Asteraceae	Lactuca spp.																							
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																						
Asteraceae	Sonchus oleraceus	Common Sowthistle																						
Asteraceae	Taraxacum officinale	Dandelion																						
Asteraceae	Xanthium spinosum	Bathurst Burr																						
Asteraceae	Xanthium strumarium																							
Boraginaceae	Echium plantagineum	Patterson's Curse																						
Boraginaceae	Echium spp.												0.1	5					0.1	10	0.1	1		
Boraginaceae	Echium vulgare	Viper's Bugloss																						
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope																						
Boraginaceae	Heliotropium europaeum	Potato Weed																						
Brassicaceae	Brassica spp.	Brassica																						
Brassicaceae	Lepidium africanum	Common Peppercress													0.1	3	0.1	1						
Brassicaceae	Lepidium bonariense	Argentine Peppercress																						
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard																						
Brassicaceae	Sisymbrium irio	London Rocket																						
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard											0.1	1	0.1	3	0.1	10						
Brassicaceae	Sisymbrium spp.																							
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot																						
Clusiaceae	Hypericum perforatum	St. Johns Wort																						
Cucurbitaceae	Citrullus amarus						0.1	1			0.1	1							0.1	1				
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus												0.1	1										
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed																						
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil											0.1	1			0.1	2						
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic																						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_W_08	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	
Asteraceae	Hypochaeris glabra	Smooth Catsear																								
Asteraceae	Hypochaeris radicata	Catsear																								
Asteraceae	Lactuca serriola	Prickly Lettuce									0.1	1														
Asteraceae	Lactuca spp.		0.1	10																						
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																								
Asteraceae	Sonchus oleraceus	Common Sowthistle																								
Asteraceae	Taraxacum officinale	Dandelion																								
Asteraceae	Xanthium spinosum	Bathurst Burr																								
Asteraceae	Xanthium strumarium																									
Boraginaceae	Echium plantagineum	Patterson's Curse																								
Boraginaceae	Echium spp.						0.1	1																		
Boraginaceae	Echium vulgare	Viper's Bugloss															0.1	5								
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope									0.1	1														
Boraginaceae	Heliotropium europaeum	Potato Weed																								
Brassicaceae	Brassica spp.	Brassica																								
Brassicaceae	Lepidium africanum	Common Peppercress					0.1	10																		
Brassicaceae	Lepidium bonariense	Argentine Peppercress																								
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard			0.1	5																				
Brassicaceae	Sisymbrium irio	London Rocket									20				5								0.1	10	1	
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard	0.1	10			0.3	40																		
Brassicaceae	Sisymbrium spp.																									
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot	0.1	1																						
Clusiaceae	Hypericum perforatum	St. Johns Wort																								
Cucurbitaceae	Citrullus amarus				0.1	1							0.1	3												
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus																									
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed																								
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil	0.1	1																						
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic																								

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Hypochaeris glabra	Smooth Catsear																										
Asteraceae	Hypochaeris radicata	Catsear																										
Asteraceae	Lactuca serriola	Prickly Lettuce																										
Asteraceae	Lactuca spp.																											
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																										
Asteraceae	Sonchus oleraceus	Common Sowthistle																										
Asteraceae	Taraxacum officinale	Dandelion																			0.1	2	0.1	4				
Asteraceae	Xanthium spinosum	Bathurst Burr																										
Asteraceae	Xanthium strumarium																						0.1	1				
Boraginaceae	Echium plantagineum	Patterson's Curse																										
Boraginaceae	Echium spp.																											
Boraginaceae	Echium vulgare	Viper's Bugloss		0.3	10	0.1	3	1													0.2	10	0.2	4				
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope																										
Boraginaceae	Heliotropium europaeum	Potato Weed																										
Brassicaceae	Brassica spp.	Brassica																										
Brassicaceae	Lepidium africanum	Common Peppercress																										
Brassicaceae	Lepidium bonariense	Argentine Peppercress																										
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard																										
Brassicaceae	Sisymbrium irio	London Rocket		10		3		20		1									2		5		10				1	50
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard																										
Brassicaceae	Sisymbrium spp.																											
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot																					0.1	3				
Clusiaceae	Hypericum perforatum	St. Johns Wort																										
Cucurbitaceae	Citrullus amarus																											
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus																											
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed				0.1	20																					
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil																										
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic																										

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Hypochaeris glabra	Smooth Catsear																							
Asteraceae	Hypochaeris radicata	Catsear																							
Asteraceae	Lactuca serriola	Prickly Lettuce																							
Asteraceae	Lactuca spp.																								0.1
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																							
Asteraceae	Sonchus oleraceus	Common Sowthistle											0.1	5											
Asteraceae	Taraxacum officinale	Dandelion																							
Asteraceae	Xanthium spinosum	Bathurst Burr																							
Asteraceae	Xanthium strumarium																								0.2
Boraginaceae	Echium plantagineum	Patterson's Curse													0.1	2									
Boraginaceae	Echium spp.												0.1	5			0.1	1							0.1
Boraginaceae	Echium vulgare	Viper's Bugloss																							
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope																							
Boraginaceae	Heliotropium europaeum	Potato Weed																							
Brassicaceae	Brassica spp.	Brassica																							
Brassicaceae	Lepidium africanum	Common Peppercress																							
Brassicaceae	Lepidium bonariense	Argentine Peppercress																							
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard					0.1	1					0.2	20											0.1
Brassicaceae	Sisymbrium irio	London Rocket																							
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard			1	80							0.1	5	0.1	10									
Brassicaceae	Sisymbrium spp.																								
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot																							
Clusiaceae	Hypericum perforatum	St. Johns Wort																							
Cucurbitaceae	Citrullus amarus				0.1	5	0.1	1	0.1	5			0.5	90	0.1	2									0.1
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus																								
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed																							
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil			0.1	5																			0.1
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Asteraceae	Hypochaeris glabra	Smooth Catsear																									
Asteraceae	Hypochaeris radicata	Catsear																									
Asteraceae	Lactuca serriola	Prickly Lettuce																									
Asteraceae	Lactuca spp.		5																								
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																									
Asteraceae	Sonchus oleraceus	Common Sowthistle															0.5	50									
Asteraceae	Taraxacum officinale	Dandelion																									
Asteraceae	Xanthium spinosum	Bathurst Burr																									
Asteraceae	Xanthium strumarium		10																								
Boraginaceae	Echium plantagineum	Patterson's Curse																									
Boraginaceae	Echium spp.		5				0.1	5									0.1	20									
Boraginaceae	Echium vulgare	Viper's Bugloss																									
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope																									
Boraginaceae	Heliotropium europaeum	Potato Weed																									
Brassicaceae	Brassica spp.	Brassica																	0.1	4							
Brassicaceae	Lepidium africanum	Common Peppercress																									
Brassicaceae	Lepidium bonariense	Argentine Peppercress																					0.2	100			
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard	10														0.1	50							0.1	10	
Brassicaceae	Sisymbrium irio	London Rocket																					0.1	5			
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard																									
Brassicaceae	Sisymbrium spp.																										
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot																									
Clusiaceae	Hypericum perforatum	St. Johns Wort																									
Cucurbitaceae	Citrullus amarus		10				0.1	1															0.1	1			
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus																										
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed																									
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil	5																								
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic															0.1	5									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Asteraceae	Hypochaeris glabra	Smooth Catsear																									
Asteraceae	Hypochaeris radicata	Catsear																									
Asteraceae	Lactuca serriola	Prickly Lettuce																									
Asteraceae	Lactuca spp.																										
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle																									
Asteraceae	Sonchus oleraceus	Common Sowthistle					0.1	5																			
Asteraceae	Taraxacum officinale	Dandelion																									
Asteraceae	Xanthium spinosum	Bathurst Burr																									
Asteraceae	Xanthium strumarium			0.1	3	0.1	1																				
Boraginaceae	Echium plantagineum	Patterson's Curse																									
Boraginaceae	Echium spp.																										
Boraginaceae	Echium vulgare	Viper's Bugloss									0.1	3															
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope																									
Boraginaceae	Heliotropium europaeum	Potato Weed																									
Brassicaceae	Brassica spp.	Brassica																									
Brassicaceae	Lepidium africanum	Common Peppercress																									
Brassicaceae	Lepidium bonariense	Argentine Peppercress																									
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard		0.3	100	0.5	100				0.1	10									0.1	30					
Brassicaceae	Sisymbrium irio	London Rocket				0.2	20																				
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard																									
Brassicaceae	Sisymbrium spp.																										
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot																									
Clusiaceae	Hypericum perforatum	St. Johns Wort																									
Cucurbitaceae	Citrullus amarus			0.1	3	0.5	50	0.1	5	0.1	3	0.1	4			0.1	2			0.1	3						
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus																										
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed																									
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil																									
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Asteraceae	Hypochaeris glabra	Smooth Catsear														
Asteraceae	Hypochaeris radicata	Catsear														
Asteraceae	Lactuca serriola	Prickly Lettuce														
Asteraceae	Lactuca spp.															
Asteraceae	Onopordum acanthium subsp. acanthium	Scotch Thistle														
Asteraceae	Sonchus oleraceus	Common Sowthistle														
Asteraceae	Taraxacum officinale	Dandelion														
Asteraceae	Xanthium spinosum	Bathurst Burr														
Asteraceae	Xanthium strumarium															
Boraginaceae	Echium plantagineum	Patterson's Curse														
Boraginaceae	Echium spp.						1	0.1	10	0.1	1	0.1	50	0.5		
Boraginaceae	Echium vulgare	Viper's Bugloss														
Boraginaceae	Heliotropium amplexicaule	Blue Heliotrope														
Boraginaceae	Heliotropium europaeum	Potato Weed														
Brassicaceae	Brassica spp.	Brassica														
Brassicaceae	Lepidium africanum	Common Peppercress														
Brassicaceae	Lepidium bonariense	Argentine Peppercress														
Brassicaceae	Sisymbrium erysimoides	Smooth Mustard							100	0.2	200	0.5				
Brassicaceae	Sisymbrium irio	London Rocket														
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard					1	0.1	1000	7	2000	20	500	4		
Brassicaceae	Sisymbrium spp.															
Chenopodiaceae	Chenopodium murale	Nettle-leaf Goosefoot														
Clusiaceae	Hypericum perforatum	St. Johns Wort														
Cucurbitaceae	Citrullus amarus								1	0.1						
Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus															
Euphorbiaceae	Euphorbia prostrata	Red Caustic Weed														
Fabaceae (Faboideae)	Lotus angustissimus	Slender Birds-foot Trefoil														
Fabaceae (Faboideae)	Medicago polymorpha	Burr Medic														

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Fabaceae (Faboideae)	Medicago spp.																							
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic																						
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover																						
Fabaceae (Faboideae)	Trifolium repens	White Clover																						
Fabaceae (Faboideae)	Trifolium spp.												50	3000	15	1000	0.1	50	0.1	10	0.3	50	2	
Iridaceae	Romulea rosea var. australis	Onion Grass																						
Juncaceae	Juncus articulatus																							
Lamiaceae	Marrubium vulgare	White Horehound															0.1	2	0.1	2				
Malvaceae	Malva parviflora	Small-flowered Mallow																						
Malvaceae	Modiola caroliniana	Red-flowered Mallow																						
Malvaceae	Sida rhombifolia	Paddy's Lucerne											0.3	30	5	200	0.5	200						
Oleaceae	Olea europaea	Common Olive																						
Oxalidaceae	Oxalis pes-caprae	Soursob															2	60			0.1	40		
Plantaginaceae	Plantago lanceolata	Lamb's Tongues																						
Poaceae	Aira caryophyllea	Silvery Hairgrass																						
Poaceae	Avena barbata	Bearded Oats																						
Poaceae	Avena fatua	Wild Oats																			0.2	80		
Poaceae	Avena spp.	Oats																						
Poaceae	Bromus hordeaceus	Soft Brome																						
Poaceae	Cynosurus echinatus	Rough Dog's Tail																						
Poaceae	Ehrharta longiflora	Annual Veldtgrass					0.1	3																
Poaceae	Eragrostis cilianensis	Stinkgrass													0.1	10								
Poaceae	Hordeum leporinum	Barley Grass																						
Poaceae	Hordeum spp.																							
Poaceae	Lamarckia aurea	Goldentop																						
Poaceae	Lolium perenne	Perennial Ryegrass																						
Poaceae	Lolium rigidum	Wimmera Ryegrass																						
Poaceae	Lolium spp.																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Faboideae)	Medicago spp.										0.1	10													
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic																							
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover																							
Fabaceae (Faboideae)	Trifolium repens	White Clover			0.1	20																			
Fabaceae (Faboideae)	Trifolium spp.		0.1	10			5	300			1		20		20						15		25		25
Iridaceae	Romulea rosea var. australis	Onion Grass																							
Juncaceae	Juncus articulatus																								
Lamiaceae	Marrubium vulgare	White Horehound																							
Malvaceae	Malva parviflora	Small-flowered Mallow	0.1	10																					
Malvaceae	Modiola caroliniana	Red-flowered Mallow																							
Malvaceae	Sida rhombifolia	Paddy's Lucerne	2	200			3	50			1				15		15				15		10		25
Oleaceae	Olea europaea	Common Olive																							
Oxalidaceae	Oxalis pes-caprae	Soursob					4	200																	
Plantaginaceae	Plantago lanceolata	Lamb's Tongues																							
Poaceae	Aira caryophyllea	Silvery Hairgrass																							
Poaceae	Avena barbata	Bearded Oats																							
Poaceae	Avena fatua	Wild Oats					0.1	10																	
Poaceae	Avena spp.	Oats																							
Poaceae	Bromus hordeaceus	Soft Brome	0.1	20																					
Poaceae	Cynosurus echinatus	Rough Dog's Tail																							
Poaceae	Ehrharta longiflora	Annual Veldtgrass																							
Poaceae	Eragrostis cilianensis	Stinkgrass																							
Poaceae	Hordeum leporinum	Barley Grass																							
Poaceae	Hordeum spp.																								
Poaceae	Lamarckia aurea	Goldentop																							
Poaceae	Lolium perenne	Perennial Ryegrass																							
Poaceae	Lolium rigidum	Wimmera Ryegrass																							
Poaceae	Lolium spp.																								

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Faboideae)	Medicago spp.																								0.1	10		
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic																										
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover																										
Fabaceae (Faboideae)	Trifolium repens	White Clover																										
Fabaceae (Faboideae)	Trifolium spp.			20		30		10		15		15		5		10		15		25		25		2		5		
Iridaceae	Romulea rosea var. australis	Onion Grass																										
Juncaceae	Juncus articulatus																											
Lamiaceae	Marrubium vulgare	White Horehound																							0.5	2	0.2	4
Malvaceae	Malva parviflora	Small-flowered Mallow							0.3	50																		
Malvaceae	Modiola caroliniana	Red-flowered Mallow							3												0.7	7	0.2	10				
Malvaceae	Sida rhombifolia	Paddy's Lucerne							3				5		2		3		5		1				1		0.3	50
Oleaceae	Olea europaea	Common Olive																										
Oxalidaceae	Oxalis pes-caprae	Soursob																										
Plantaginaceae	Plantago lanceolata	Lamb's Tongues																										
Poaceae	Aira caryophyllea	Silvery Hairgrass																										
Poaceae	Avena barbata	Bearded Oats																										
Poaceae	Avena fatua	Wild Oats																										
Poaceae	Avena spp.	Oats							0.1	2																		
Poaceae	Bromus hordeaceus	Soft Brome																										
Poaceae	Cynosurus echinatus	Rough Dog's Tail																										
Poaceae	Ehrharta longiflora	Annual Veldtgrass																										
Poaceae	Eragrostis cilianensis	Stinkgrass																										
Poaceae	Hordeum leporinum	Barley Grass																										
Poaceae	Hordeum spp.																											
Poaceae	Lamarckia aurea	Goldentop																										
Poaceae	Lolium perenne	Perennial Ryegrass																										
Poaceae	Lolium rigidum	Wimmera Ryegrass																										
Poaceae	Lolium spp.			0.1	3																0.1	2						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Faboideae)	Medicago spp.																								
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic			0.1	1																			
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover																							
Fabaceae (Faboideae)	Trifolium repens	White Clover																							
Fabaceae (Faboideae)	Trifolium spp.		15																						
Iridaceae	Romulea rosea var. australis	Onion Grass																							
Juncaceae	Juncus articulatus																								
Lamiaceae	Marrubium vulgare	White Horehound			0.3	10							0.1	2	0.1	1							0.1	1	
Malvaceae	Malva parviflora	Small-flowered Mallow																							
Malvaceae	Modiola caroliniana	Red-flowered Mallow											0.3	30											0.1
Malvaceae	Sida rhombifolia	Paddy's Lucerne	0.5	100																					
Oleaceae	Olea europaea	Common Olive																							
Oxalidaceae	Oxalis pes-caprae	Soursob																							
Plantaginaceae	Plantago lanceolata	Lamb's Tongues			0.1	1																			
Poaceae	Aira caryophyllea	Silvery Hairgrass																							
Poaceae	Avena barbata	Bearded Oats																							
Poaceae	Avena fatua	Wild Oats																							
Poaceae	Avena spp.	Oats																							
Poaceae	Bromus hordeaceus	Soft Brome																							
Poaceae	Cynosurus echinatus	Rough Dog's Tail																							
Poaceae	Ehrharta longiflora	Annual Veldtgrass																			0.1	10			
Poaceae	Eragrostis cilianensis	Stinkgrass																							
Poaceae	Hordeum leporinum	Barley Grass							0.1	1															
Poaceae	Hordeum spp.																								
Poaceae	Lamarckia aurea	Goldentop																							
Poaceae	Lolium perenne	Perennial Ryegrass																							
Poaceae	Lolium rigidum	Wimmera Ryegrass																							
Poaceae	Lolium spp.				0.1	10							0.4	50											

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Fabaceae (Faboideae)	Medicago spp.																										
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic																									
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover															0.1	10									
Fabaceae (Faboideae)	Trifolium repens	White Clover																									
Fabaceae (Faboideae)	Trifolium spp.										5		4						5								
Iridaceae	Romulea rosea var. australis	Onion Grass																									
Juncaceae	Juncus articulatus																										
Lamiaceae	Marrubium vulgare	White Horehound		0.1	1	0.5	1								0.1	1	0.2	2			3						
Malvaceae	Malva parviflora	Small-flowered Mallow																									
Malvaceae	Modiola caroliniana	Red-flowered Mallow	1																								
Malvaceae	Sida rhombifolia	Paddy's Lucerne																									
Oleaceae	Olea europaea	Common Olive																									
Oxalidaceae	Oxalis pes-caprae	Soursob																									
Plantaginaceae	Plantago lanceolata	Lamb's Tongues																									
Poaceae	Aira caryophyllea	Silvery Hairgrass																									
Poaceae	Avena barbata	Bearded Oats																									
Poaceae	Avena fatua	Wild Oats																									
Poaceae	Avena spp.	Oats																									
Poaceae	Bromus hordeaceus	Soft Brome																									
Poaceae	Cynosurus echinatus	Rough Dog's Tail																									
Poaceae	Ehrharta longiflora	Annual Veldtgrass																									
Poaceae	Eragrostis cilianensis	Stinkgrass																									
Poaceae	Hordeum leporinum	Barley Grass																									
Poaceae	Hordeum spp.																										
Poaceae	Lamarckia aurea	Goldentop																									
Poaceae	Lolium perenne	Perennial Ryegrass																									
Poaceae	Lolium rigidum	Wimmera Ryegrass																									
Poaceae	Lolium spp.																0.1	3									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_001
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Fabaceae (Faboideae)	Medicago spp.																										
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic					10	0.1																			
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover		0.1	6																						
Fabaceae (Faboideae)	Trifolium repens	White Clover																									
Fabaceae (Faboideae)	Trifolium spp.			5		0.1	10								1		3								200	0.5	0.2
Iridaceae	Romulea rosea var. australis	Onion Grass																									
Juncaceae	Juncus articulatus																										
Lamiaceae	Marrubium vulgare	White Horehound		0.2	1			0.1	1																		
Malvaceae	Malva parviflora	Small-flowered Mallow				0.1																					
Malvaceae	Modiola caroliniana	Red-flowered Mallow																									
Malvaceae	Sida rhombifolia	Paddy's Lucerne																									
Oleaceae	Olea europaea	Common Olive																									
Oxalidaceae	Oxalis pes-caprae	Soursob																									
Plantaginaceae	Plantago lanceolata	Lamb's Tongues																									
Poaceae	Aira caryophyllea	Silvery Hairgrass																									
Poaceae	Avena barbata	Bearded Oats																									
Poaceae	Avena fatua	Wild Oats																									
Poaceae	Avena spp.	Oats																									
Poaceae	Bromus hordeaceus	Soft Brome																									
Poaceae	Cynosurus echinatus	Rough Dog's Tail																									
Poaceae	Ehrharta longiflora	Annual Veldtgrass																									
Poaceae	Eragrostis cilianensis	Stinkgrass																									
Poaceae	Hordeum leporinum	Barley Grass											10	0.1													
Poaceae	Hordeum spp.																										
Poaceae	Lamarckia aurea	Goldentop																									
Poaceae	Lolium perenne	Perennial Ryegrass																									
Poaceae	Lolium rigidum	Wimmera Ryegrass																									
Poaceae	Lolium spp.			0.1	3	0.1	2																				

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Fabaceae (Faboideae)	Medicago spp.															
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic					1	0.1					100	0.2		
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover														
Fabaceae (Faboideae)	Trifolium repens	White Clover														
Fabaceae (Faboideae)	Trifolium spp.		100	1	100	0.1	1	4	800				1	0.1	5	
Iridaceae	Romulea rosea var. australis	Onion Grass														
Juncaceae	Juncus articulatus															
Lamiaceae	Marrubium vulgare	White Horehound				0.4	3	1	10							
Malvaceae	Malva parviflora	Small-flowered Mallow						0.1	1							
Malvaceae	Modiola caroliniana	Red-flowered Mallow						1	10				1	0.1		
Malvaceae	Sida rhombifolia	Paddy's Lucerne														
Oleaceae	Olea europaea	Common Olive														
Oxalidaceae	Oxalis pes-caprae	Soursob				5	500	0.1	1	0.1	30					
Plantaginaceae	Plantago lanceolata	Lamb's Tongues														
Poaceae	Aira caryophyllea	Silvery Hairgrass														
Poaceae	Avena barbata	Bearded Oats														
Poaceae	Avena fatua	Wild Oats														
Poaceae	Avena spp.	Oats														
Poaceae	Bromus hordeaceus	Soft Brome														
Poaceae	Cynosurus echinatus	Rough Dog's Tail														
Poaceae	Ehrharta longiflora	Annual Veldtgrass														
Poaceae	Eragrostis cilianensis	Stinkgrass														
Poaceae	Hordeum leporinum	Barley Grass														
Poaceae	Hordeum spp.															
Poaceae	Lamarckia aurea	Goldentop														
Poaceae	Lolium perenne	Perennial Ryegrass														
Poaceae	Lolium rigidum	Wimmera Ryegrass						0.1	1				500	1		
Poaceae	Lolium spp.															

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_11		DEH_S_12		DEH_S_13		DEH_S_14		DEH_S_15		DEH_S_16		DEH_S_20		DEH_S_24		DEH_S_25		DEH_S_29		DEH_S_31	
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund
Poaceae	Phalaris paradoxa	Paradoxa Grass											0.1	8	0.2	50	0.1	10	0.1	10	0.1	6		
Poaceae	Vulpia bromoides	Squirrel Tail Fesque																						
Poaceae	Vulpia myuros	Rat's Tail Fescue																						
Polygonaceae	Polygonum aviculare	Wireweed																						
Polygonaceae	Rumex crispus	Curled Dock																	0.1	50				
Solanaceae	Lycium ferocissimum	African Boxthorn																						
Solanaceae	Solanum nigrum	Black-berry Nightshade																						
Zygophyllaceae	Tribulus terrestris	Cat-head																						

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_S_35		DEH_S_43		DEH_S_44		DEH_S_52		DEH_W_01		DEH_W_02		DEH_W_03		DEH_W_04		DEH_W_05		DEH_W_06		DEH_W_07		DEH_8
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass	0.1	20			0.1	3			0.2	10			0.1	10	0.1	10							0.1
Poaceae	Vulpia bromoides	Squirrel Tail Fesque	0.1	10																					
Poaceae	Vulpia myuros	Rat's Tail Fescue																							
Polygonaceae	Polygonum aviculare	Wireweed																							
Polygonaceae	Rumex crispus	Curled Dock																							
Solanaceae	Lycium ferocissimum	African Boxthorn																							
Solanaceae	Solanum nigrum	Black-berry Nightshade																							
Zygophyllaceae	Tribulus terrestris	Cat-head																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_0		DEH_W_09		DEH_W_10		DEH_W_11		DEH_W_12		DEH_W_13		DEH_W_14		DEH_W_15		DEH_W_500		DEH_W_501		DEH_W_502		DEH_W_503		DEH_W_504	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass	5	0.1	3										10	0.1	5	0.1	10	0.1	3	0.1	4	0.1	10			
Poaceae	Vulpia bromoides	Squirrel Tail Fesque																										
Poaceae	Vulpia myuros	Rat's Tail Fescue																										
Polygonaceae	Polygonum aviculare	Wireweed		25					30												40		20					
Polygonaceae	Rumex crispus	Curled Dock																										
Solanaceae	Lycium ferocissimum	African Boxthorn																									0.5	50
Solanaceae	Solanum nigrum	Black-berry Nightshade																										
Zygophyllaceae	Tribulus terrestris	Cat-head																					1				0.5	100

Table A3 BAM plot floristics

Family	Scientific name	Common name	DEH_W_505		DEH_W_601		DEH_W_602		DEH_W_603		DEH_W_604		DEH_W_605		DEH_W_606		DEH_W_607		DEH_W_608		DEH_W_609		DEH_W_610		DEH_1
			Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass			0.1	5							0.1	1			0.1	5			0.1	1			0.1
Poaceae	Vulpia bromoides	Squirrel Tail Fesque																							
Poaceae	Vulpia myuros	Rat's Tail Fescue																							
Polygonaceae	Polygonum aviculare	Wireweed																							
Polygonaceae	Rumex crispus	Curled Dock																							
Solanaceae	Lycium ferocissimum	African Boxthorn																							
Solanaceae	Solanum nigrum	Black-berry Nightshade																							
Zygophyllaceae	Tribulus terrestris	Cat-head																							

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_61		DEH_W_612		DEH_W_613		DEH_W_614		DEH_W_801		DEH_W_802		DEH_W_803		DEH_W_804		DEH_W_805		DEH_W_807		DEH_W_808		DEH_W_809		DEH_10
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass	5																								
Poaceae	Vulpia bromoides	Squirrel Tail Fesque																									
Poaceae	Vulpia myuros	Rat's Tail Fescue																									
Polygonaceae	Polygonum aviculare	Wireweed																									
Polygonaceae	Rumex crispus	Curled Dock																									
Solanaceae	Lycium ferocissimum	African Boxthorn																									
Solanaceae	Solanum nigrum	Black-berry Nightshade																									
Zygophyllaceae	Tribulus terrestris	Cat-head																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_8		DEH_W_811		DEH_W_812		DEH_W_813		DEH_W_814		DEH_W_815		DEH_W_816		DEH_W_817		DEH_W_818		DEH_W_819		DEH_W_820		DEH_W_900		DEH_01
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass											5	0.1													
Poaceae	Vulpia bromoides	Squirrel Tail Fesque																									
Poaceae	Vulpia myuros	Rat's Tail Fescue																									
Polygonaceae	Polygonum aviculare	Wireweed		5		0.2	20																				
Polygonaceae	Rumex crispus	Curled Dock																									
Solanaceae	Lycium ferocissimum	African Boxthorn																									
Solanaceae	Solanum nigrum	Black-berry Nightshade																							50	0.1	0.1
Zygophyllaceae	Tribulus terrestris	Cat-head																									

Table A3 BAM plot floristics

Family	Scientific name	Common name	W_9		DEH_W_902		DEH_W_903		DEH_W_904		DEH_W_905		DEH_W_906		DEH_W_806	
			Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%	Abund	Cvr%
Poaceae	Phalaris paradoxa	Paradoxa Grass				0.1	100			0.1	1	0.1	1			
Poaceae	Vulpia bromoides	Squirrel Tail Fesque														
Poaceae	Vulpia myuros	Rat's Tail Fescue						0.1	1							
Polygonaceae	Polygonum aviculare	Wireweed				15	1000	1	300	4	200	0.5	100			
Polygonaceae	Rumex crispus	Curled Dock														
Solanaceae	Lycium ferocissimum	African Boxthorn														
Solanaceae	Solanum nigrum	Black-berry Nightshade	1			15	1000	5	1000	15	1000	3	400			
Zygophyllaceae	Tribulus terrestris	Cat-head				5	700					0.1	40			

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	comp Tree	comp Shrub	comp Grass	comp Forbs	comp Ferns	comp Other	struc Tree	struc Shrub	struc Grass	struc Forbs	struc Ferns	struc Other
DEH_W_904	10	0.33	100	Moderate	55	358641	6125949	10	1	5	4	5	0	0	15.0	1.8	5.7	2.6	0.0	0.0
DEH_W_906	10	0.33	100	Moderate	55	357292	6127374	60	1	5	3	3	1	0	10.0	31.2	13.1	0.7	0.1	0.0
DEH_W_604	13	4.82	100	Moderate	55	371952	6122967	215	1	2	6	1	1	0	25.0	52.0	1.6	0.1	1.0	0.0
DEH_W_606	13	4.82	100	Moderate	55	372749	6129433	152	2	5	4	8	1	1	30.1	75.3	11.6	0.9	0.1	0.1
DEH_W_601	13	9.14	100	Thinned	55	385396	6120782	150	2	5	7	7	0	0	15.1	19.9	23.2	3.7	0.0	0.0
DEH_W_608	13	9.14	100	Thinned	55	363033	6134151	119	2	2	9	3	1	0	40.1	5.4	11.4	0.3	3.0	0.0
DEH_W_815	13	9.14	100	Thinned	55	358442	6137002	13	1	5	5	8	1	0	30.0	18.2	15.2	0.9	0.1	0.0
DEH_W_01	15	6.19	100	Moderate	55	377145	6125847	91	1	8	7	13	1	0	20.0	9.3	9.6	2.0	0.1	0.0
DEH_W_500	15	6.19	100	Moderate	55	364398	6130438	241	2	5	7	9	1	0	21.0	10.6	23.3	4.9	0.1	0.0
DEH_W_504	15	6.19	100	Moderate	55	363072	6131346	105	1	7	6	5	1	1	25.0	42.0	4.0	2.5	0.2	0.1
DEH_W_813	15	1.6	100	Thinned	55	358537	6135349	128	1	8	5	6	1	0	25.0	12.3	10.3	2.5	0.1	0.0
DEH_W_814	15	1.6	100	Thinned	55	357519	6136326	193	1	8	5	9	1	0	25.0	55.0	2.8	1.0	0.2	0.0
DEH_S_11	17	1.84	100	Mod_Good	55	389910	6119366	308	0	2	8	1	1	0	0.0	11.0	78.2	0.1	10.0	0.0
DEH_S_12	17	1.84	100	Mod_Good	55	382321	6116931	134	0	2	5	1	1	0	0.0	30.1	45.3	5.0	10.0	0.0
DEH_S_13	17	1.84	100	Mod_Good	55	384802	6117845	90	0	3	6	6	2	0	0.0	10.4	74.2	1.0	3.5	0.0
DEH_S_14	17	1.84	100	Mod_Good	55	386897	6118371	37	0	1	7	2	2	1	0.0	30.0	67.8	0.2	5.5	0.1
DEH_S_15	17	1.84	100	Mod_Good	55	386997	6118458	60	1	4	8	6	2	0	0.1	35.6	36.8	0.6	1.3	0.0
DEH_W_603	17	1.84	100	Mod_Good	55	383325	6123014	240	0	3	10	8	1	0	0.0	5.6	57.7	1.6	2.0	0.0
DEH_S_31	17	1.08	100	Moderate	55	383901	6118765	286	0	2	8	0	1	0	0.0	8.3	49.8	0.0	0.2	0.0
DEH_S_52	17	1.08	100	Moderate	55	382089	6116925	80	0	3	10	7	2	0	0.0	1.4	50.4	3.7	3.5	0.0
DEH_W_05	24	0.23	100	Moderate	55	374996	6122508	125	0	2	9	3	1	0	0.0	0.7	73.6	0.3	0.1	0.0
DEH_S_20	26	395.93	100	DNG	55	389353	6118060	273	0	3	10	7	0	0	0.0	1.2	62.9	0.8	0.0	0.0
DEH_W_02	26	395.93	100	DNG	55	382792	6123688	86	0	2	10	11	0	0	0.0	0.3	52.9	1.3	0.0	0.0
DEH_W_03	26	395.93	100	DNG	55	383677	6124944	234	0	2	7	7	0	1	0.0	0.2	31.3	1.9	0.0	0.1
DEH_W_07	26	395.93	100	DNG	55	377941	6123936	82	0	5	9	9	0	0	0.0	2.7	40.3	1.4	0.0	0.0
DEH_W_12	26	395.93	100	DNG	55	357202	6129073	254	0	5	9	10	0	0	0.0	4.9	34.2	1.2	0.0	0.0
DEH_W_13	26	395.93	100	DNG	55	354830	6126327	92	0	7	8	8	0	0	0.0	1.3	22.5	0.8	0.0	0.0
DEH_W_14	26	395.93	100	DNG	55	360882	6137355	15	0	1	8	12	0	0	0.0	0.1	51.5	1.3	0.0	0.0
DEH_W_602	26	395.93	100	DNG	55	382581	6122713	236	0	4	7	8	0	1	0.0	3.4	75.5	1.2	0.0	0.1
DEH_W_609	26	395.93	100	DNG	55	360890	6138928	240	2	6	7	9	1	0	0.6	2.1	67.7	1.3	0.1	0.0
DEH_W_614	26	395.93	100	DNG	55	358436	6140312	220	0	3	6	10	0	0	0.0	20.3	85.0	1.2	0.0	0.0

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
DEH_W_904	10	0.33	100	Moderate	1	0	30.0	3.0	0	0	0	1	0	0	1.1
DEH_W_906	10	0.33	100	Moderate	1	2	24.0	20.0	0	0	0	1	1	0	0.0
DEH_W_604	13	4.82	100	Moderate	4	1	0.0	5.0	1	1	0	1	1	0	0.0
DEH_W_606	13	4.82	100	Moderate	4	1	18.0	0.0	1	0	1	1	1	0	0.2
DEH_W_601	13	9.14	100	Thinned	2	4	20.0	2.0	0	1	1	1	0	0	0.4
DEH_W_608	13	9.14	100	Thinned	6	0	25.0	15.0	0	1	1	1	1	0	0.0
DEH_W_815	13	9.14	100	Thinned	1	3	10.2	10.0	1	1	1	1	0	0	0.1
DEH_W_01	15	6.19	100	Moderate	3	3	15.0	5.0	0	0	0	0	1	0	0.0
DEH_W_500	15	6.19	100	Moderate	2	2	5.6	3.0	0	0	0	0	1	0	0.0
DEH_W_504	15	6.19	100	Moderate	2	3	12.4	6.0	0	0	0	0	1	1	0.2
DEH_W_813	15	1.6	100	Thinned	0	2	11.2	7.0	0	0	1	0	0	0	0.2
DEH_W_814	15	1.6	100	Thinned	1	4	17.0	8.0	1	1	1	1	0	1	0.1
DEH_S_11	17	1.84	100	Mod_Good	0	0	3.0	0.0	0	0	0	0	0	0	0.0
DEH_S_12	17	1.84	100	Mod_Good	0	0	12.0	0.0	0	0	0	0	0	0	0.0
DEH_S_13	17	1.84	100	Mod_Good	0	0	2.0	0.0	0	0	0	0	0	0	0.2
DEH_S_14	17	1.84	100	Mod_Good	0	0	8.0	0.0	0	0	0	0	0	0	0.0
DEH_S_15	17	1.84	100	Mod_Good	0	0	7.0	0.0	0	0	0	0	0	0	0.1
DEH_W_603	17	1.84	100	Mod_Good	0	0	5.0	0.0	0	0	0	0	0	0	0.1
DEH_S_31	17	1.08	100	Moderate	0	0	51.0	0.0	0	0	0	0	0	0	0.0
DEH_S_52	17	1.08	100	Moderate	0	0	7.0	3.0	0	0	0	0	0	0	0.0
DEH_W_05	24	0.23	100	Moderate	0	0	4.0	0.0	0	0	0	0	0	0	0.0
DEH_S_20	26	395.93	100	DNG	0	0	10.0	0.0	0	0	0	0	0	0	0.0
DEH_W_02	26	395.93	100	DNG	0	0	29.0	0.0	0	0	0	0	0	0	0.1
DEH_W_03	26	395.93	100	DNG	0	0	27.0	0.0	0	0	0	0	0	0	0.0
DEH_W_07	26	395.93	100	DNG	0	0	16.0	0.0	0	0	0	0	0	0	0.0
DEH_W_12	26	395.93	100	DNG	0	0	15.4	0.0	0	0	0	0	0	0	0.0
DEH_W_13	26	395.93	100	DNG	0	0	10.8	0.0	0	0	0	0	0	0	0.0
DEH_W_14	26	395.93	100	DNG	0	0	7.0	0.0	0	0	0	0	0	0	0.0
DEH_W_602	26	395.93	100	DNG	0	0	7.0	0.0	0	0	0	0	0	0	0.1
DEH_W_609	26	395.93	100	DNG	0	0	4.4	0.0	1	0	0	0	0	1	0.1
DEH_W_614	26	395.93	100	DNG	0	0	13.0	0.0	0	0	0	0	0	0	0.0

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	comp Tree	comp Shrub	comp Grass	comp Forbs	comp Ferns	comp Other	struc Tree	struc Shrub	struc Grass	struc Forbs	struc Ferns	struc Other
DEH_W_808	26	395.93	100	DNG	55	354212	6132146	300	0	6	4	6	0	0	0.0	0.6	24.0	5.5	0.0	0.0
DEH_S_24	26	133.44	100	Intact	55	382492	6119224	290	1	7	5	6	0	0	5.0	3.4	18.2	0.9	0.0	0.0
DEH_S_25	26	133.44	100	Intact	55	381485	6116262	168	1	2	8	8	1	0	10.0	0.2	12.8	1.0	0.3	0.0
DEH_W_06	26	133.44	100	Intact	55	374939	6123472	339	1	5	7	11	0	0	15.0	16.3	32.2	2.3	0.0	0.0
DEH_W_08	26	133.44	100	Intact	55	364826	6129827	310	1	7	7	9	0	0	10.0	10.4	42.1	2.0	0.0	0.0
DEH_W_503	26	133.44	100	Intact	55	359711	6131089	135	1	4	6	13	0	0	40.0	1.4	33.2	1.3	0.0	0.0
DEH_W_607	26	133.44	100	Intact	55	373462	6129894	215	2	5	5	10	0	1	4.1	1.2	66.0	1.1	0.0	0.1
DEH_W_610	26	133.44	100	Intact	55	357609	6138306	159	1	5	7	9	0	0	10.0	31.3	39.6	2.9	0.0	0.0
DEH_W_613	26	133.44	100	Intact	55	359861	6141538	220	1	7	6	6	0	0	15.0	16.5	8.4	1.3	0.0	0.0
DEH_W_802	26	133.44	100	Intact	55	385346	6124837	129	1	5	7	5	0	0	10.0	4.3	26.8	0.7	0.0	0.0
DEH_W_803	26	133.44	100	Intact	55	378264	6129336	12	1	7	9	9	1	0	20.0	3.8	31.5	1.0	0.1	0.0
DEH_W_807	26	133.44	100	Intact	55	354259	6132250	121	2	11	6	2	0	0	15.0	6.8	16.5	0.3	0.0	0.0
DEH_W_819	26	133.44	100	Intact	55	380767	6117092	212	1	2	9	10	0	1	20.0	2.1	26.4	1.1	0.0	0.1
DEH_W_900	26	133.44	100	Intact	55	359266	6141778	40	1	7	7	8	0	0	7.0	22.5	34.1	1.7	0.0	0.0
DEH_S_16	26	416.6	100	Sparse	55	381857	6116299	324	1	2	8	10	1	0	0.2	0.2	16.2	1.6	0.1	0.0
DEH_S_29	26	416.6	100	Sparse	55	382086	6118783	116	2	3	11	5	1	1	1.1	0.5	47.8	1.5	0.1	0.1
DEH_S_35	26	416.6	100	Sparse	55	382282	6119129	336	2	2	9	10	0	1	0.3	0.3	64.9	1.8	0.0	0.1
DEH_W_04	26	416.6	100	Sparse	55	381838	6124623	338	1	4	4	5	2	1	3.0	0.5	68.0	0.5	0.2	0.1
DEH_W_10	26	416.6	100	Sparse	55	358338	6128447	261	1	4	6	10	1	0	7.0	4.1	58.5	1.0	1.0	0.0
DEH_W_818	26	416.6	100	Sparse	55	364001	6140584	290	2	7	5	5	1	0	6.1	3.9	13.1	0.9	0.1	0.0
DEH_W_820	26	416.6	100	Sparse	55	381860	6117367	260	1	2	7	4	0	1	0.5	0.7	10.3	0.4	0.0	0.1
DEH_W_605	28	54	100	Low	55	371327	6129443	40	1	4	3	6	0	0	5.0	0.5	7.2	5.4	0.0	0.0
DEH_W_811	28	54	100	Low	55	361561	6129140	103	1	7	4	7	0	0	7.0	2.9	15.0	1.7	0.0	0.0
DEH_W_812	28	54	100	Low	55	360051	6129613	40	1	5	6	7	0	1	15.0	0.6	5.6	0.8	0.0	0.1
DEH_W_903	28	54	100	Low	55	358130	6130641	230	1	1	3	4	0	0	0.1	0.1	31.5	0.9	0.0	0.0
DEH_W_905	28	54	100	Low	55	357938	6126527	260	0	3	4	6	0	0	0.0	1.2	9.2	12.9	0.0	0.0
DEH_W_09	28	0.98	100	Moderate	55	366258	6131584	358	2	2	6	7	0	0	16.0	4.1	44.9	5.6	0.0	0.0
DEH_W_11	28	0.98	100	Moderate	55	358200	6128607	235	1	3	4	5	0	0	15.0	1.3	2.2	0.5	0.0	0.0
DEH_W_501	28	0.98	100	Moderate	55	358269	6126133	97	2	0	2	6	0	0	14.0	0.0	26.0	0.8	0.0	0.0
DEH_W_502	28	0.98	100	Moderate	55	359489	6131722	330	1	0	3	5	0	0	15.0	0.0	2.2	6.1	0.0	0.0
DEH_W_804	28	0.98	100	Moderate	55	378142	6128999	80	1	6	4	5	0	0	20.0	4.2	7.7	2.5	0.0	0.0

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
DEH_W_808	26	395.93	100	DNG	0	0	4.0	0.0	0	0	0	0	0	0	0.3
DEH_S_24	26	133.44	100	Intact	0	0	1.4	0.0	0	0	1	0	0	1	0.1
DEH_S_25	26	133.44	100	Intact	0	0	17.0	20.0	1	1	1	0	0	1	0.2
DEH_W_06	26	133.44	100	Intact	1	0	10.0	0.0	0	1	1	0	1	0	0.0
DEH_W_08	26	133.44	100	Intact	0	0	14.0	4.0	0	1	1	0	0	0	0.0
DEH_W_503	26	133.44	100	Intact	4	0	45.4	2.0	1	1	1	0	1	0	0.5
DEH_W_607	26	133.44	100	Intact	0	0	14.0	0.0	1	1	0	0	0	0	0.0
DEH_W_610	26	133.44	100	Intact	0	0	29.0	3.0	1	1	1	0	0	1	0.1
DEH_W_613	26	133.44	100	Intact	0	0	4.0	0.0	1	1	0	0	0	0	0.6
DEH_W_802	26	133.44	100	Intact	0	0	70.0	10.0	0	0	1	0	0	0	0.0
DEH_W_803	26	133.44	100	Intact	0	0	12.0	22.0	1	1	1	0	0	1	0.1
DEH_W_807	26	133.44	100	Intact	0	0	5.6	20.0	1	1	1	0	0	0	3.0
DEH_W_819	26	133.44	100	Intact	0	0	21.6	2.0	1	1	0	0	0	1	0.1
DEH_W_900	26	133.44	100	Intact	0	0	12.0	1.0	1	1	0	0	0	0	0.0
DEH_S_16	26	416.6	100	Sparse	0	0	5.0	0.0	1	0	0	0	0	1	0.1
DEH_S_29	26	416.6	100	Sparse	0	0	0.0	0.0	1	0	0	0	0	0	0.0
DEH_S_35	26	416.6	100	Sparse	0	0	18.0	0.0	1	0	0	0	0	1	0.0
DEH_W_04	26	416.6	100	Sparse	0	0	51.0	0.0	1	1	1	0	0	0	0.0
DEH_W_10	26	416.6	100	Sparse	0	0	20.0	0.0	0	1	1	0	0	0	0.1
DEH_W_818	26	416.6	100	Sparse	1	0	9.0	12.0	1	0	0	0	0	1	0.0
DEH_W_820	26	416.6	100	Sparse	0	0	3.8	3.0	0	0	0	0	0	1	0.0
DEH_W_605	28	54	100	Low	1	0	39.0	0.0	0	0	0	1	0	0	0.6
DEH_W_811	28	54	100	Low	1	0	14.0	3.0	0	0	0	1	0	0	0.3
DEH_W_812	28	54	100	Low	2	1	12.0	2.0	0	0	0	0	1	0	0.5
DEH_W_903	28	54	100	Low	0	0	10.0	0.0	0	0	1	0	0	0	0.4
DEH_W_905	28	54	100	Low	0	0	16.0	0.0	0	0	0	0	0	0	0.0
DEH_W_09	28	0.98	100	Moderate	3	2	60.0	0.0	0	0	0	0	1	0	0.0
DEH_W_11	28	0.98	100	Moderate	2	2	60.0	0.0	0	0	0	0	1	0	0.0
DEH_W_501	28	0.98	100	Moderate	4	2	24.6	6.0	0	0	0	0	1	0	0.0
DEH_W_502	28	0.98	100	Moderate	5	1	33.0	6.0	0	0	0	0	1	0	0.0
DEH_W_804	28	0.98	100	Moderate	1	0	45.2	5.0	1	1	1	0	0	0	0.2

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	comp Tree	comp Shrub	comp Grass	comp Forbs	comp Ferns	comp Other	struc Tree	struc Shrub	struc Grass	struc Forbs	struc Ferns	struc Other
DEH_S_43	45	8.82	100	Mod_Good	55	384746	6118249	201	0	5	9	14	1	1	0.0	1.4	90.2	1.4	0.1	0.1
DEH_S_44	45	8.82	100	Mod_Good	55	387464	6118621	120	0	6	13	11	0	0	0.0	0.6	48.2	8.0	0.0	0.0
DEH_W_801	45	8.82	100	Mod_Good	55	384624	6121230	121	0	1	6	3	1	1	0.0	0.3	55.1	0.3	0.1	0.1
DEH_W_15	46	105.59	100	Moderate	55	358977	6137590	156	0	1	8	9	0	0	0.0	0.1	51.3	1.1	0.0	0.0
DEH_W_505	46	105.59	100	Moderate	55	362283	6135803	121	0	4	4	7	0	0	0.0	2.7	72.0	1.1	0.0	0.0
DEH_W_611	46	105.59	100	Moderate	55	354916	6137799	20	0	4	4	8	0	0	0.0	1.3	70.2	1.0	0.0	0.0
DEH_W_612	46	105.59	100	Moderate	55	355104	6139187	171	0	6	5	4	0	0	0.0	11.7	50.1	0.8	0.0	0.0
DEH_W_805	46	105.59	100	Moderate	55	377210	6124624	19	0	2	8	6	0	0	0.0	1.4	37.1	0.6	0.0	0.0
DEH_W_816	46	105.59	100	Moderate	55	356478	6139471	286	0	3	7	7	0	0	0.0	7.3	47.0	0.7	0.0	0.0
DEH_W_817	46	105.59	100	Moderate	55	362855	6137350	32	0	5	11	6	1	0	0.0	3.7	61.8	1.8	0.1	0.0
DEH_W_806	46	105.59	100	Moderate	55	377024	6124547	225	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
DEH_W_809	160	4.07	100	Mod_Good	55	357646	6123845	10	1	5	6	6	2	0	0.4	45.4	17.1	1.0	1.1	0.0
DEH_W_810	160	4.07	100	Mod_Good	55	360171	6125590	130	0	3	6	4	2	0	0.0	58.2	15.4	3.9	3.3	0.0
DEH_W_902	160	4.07	100	Mod_Good	55	355131	6139356	270	0	3	4	4	1	0	0.0	17.1	53.1	0.4	0.1	0.0
DEH_W_901	160	0.84	100	Moderate	55	355957	6139996	320	0	3	5	3	1	0	0.0	5.2	25.7	0.3	0.1	0.0

Table A4 BAM plot summary

plot	pct	area	patchsize	conditionclass	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
DEH_S_43	45	8.82	100	Mod_Good	0	0	15.0	0.0	0	0	0	0	0	0	0.1
DEH_S_44	45	8.82	100	Mod_Good	0	0	3.0	0.0	0	0	0	1	1	0	0.0
DEH_W_801	45	8.82	100	Mod_Good	0	0	40.0	0.0	0	0	0	0	0	0	0.0
DEH_W_15	46	105.59	100	Moderate	0	0	5.0	0.0	0	0	0	0	0	0	0.0
DEH_W_505	46	105.59	100	Moderate	0	0	9.2	0.0	0	0	0	0	0	0	0.0
DEH_W_611	46	105.59	100	Moderate	0	0	35.0	0.0	0	0	0	0	0	0	0.1
DEH_W_612	46	105.59	100	Moderate	0	0	33.0	0.0	0	0	0	0	0	0	0.1
DEH_W_805	46	105.59	100	Moderate	0	0	15.0	0.0	0	0	0	0	0	0	0.0
DEH_W_816	46	105.59	100	Moderate	0	0	15.0	0.0	0	0	0	0	0	0	0.0
DEH_W_817	46	105.59	100	Moderate	0	0	9.0	0.0	0	0	0	0	0	0	0.1
DEH_W_806	46	105.59	100	Moderate	0	0	22.0	0.0	0	0	0	0	0	0	0.0
DEH_W_809	160	4.07	100	Mod_Good	0	0	11.0	0.0	0	0	0	0	0	0	0.0
DEH_W_810	160	4.07	100	Mod_Good	0	0	4.4	0.0	0	0	0	0	0	0	0.0
DEH_W_902	160	4.07	100	Mod_Good	0	0	2.0	0.0	0	0	0	0	0	0	0.0
DEH_W_901	160	0.84	100	Moderate	0	0	1.0	0.0	0	0	0	0	0	0	0.0

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	03/02/2023	Dinewan		Moderate	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_S_11	Plot dimensions	50x20	Orientation of middle	308
Easting 389911	Northing 6119366	IBRA region	Riverina	Photo #			
Plant Community Type		17				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	8
	Forbs	1
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	11
	Grasses etc.	78.2
	Forbs	0.1
	Ferns	10
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	0	5	5	5
Average of the 5 subplots	3				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Orange brown	Site Drainage	Poor	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	03/02/2023	Dinewan	DEH_S_11	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	1		
SG	Duma florulenta	N	10	30	
GG	Eleocharis acuta	N	60	5000	
GG	Eleocharis pallens	N	5	400	
GG	Enteropogon acicularis	N	2	80	
GG	Juncus filicaulis	N	0.1	10	
GG	Juncus subsecundus	N	0.1	20	
EG	Marsilea drummondii	N	10	400	
FG	Rumex tenax	N	0.1	5	
GG	Rytidosperma duttonianum	N	8	300	
SG	Sclerolaena muricata	N	1	70	
GG	Walwhalleya proluta	N	2	100	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	02/02/2023	Dinewan		Moderate	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_S_12	Plot dimensions	50x20	Orientation of middle	134
Easting 382321	Northing 6116931	IBRA region	New England Tablelands	Photo #			
Plant Community Type		17				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	5
	Forbs	1
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	30.1
	Grasses etc.	45.3
	Forbs	5
	Ferns	10
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	30	10	5	10	5
Average of the 5 subplots	12				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay sand
Soil Colour	Dark brown	Site Drainage	Poor	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	Chewed plants, sheep scat
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Dinewan	DEH_S_12	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Duma florulenta	N	30	50	
GG	Eleocharis acuta	N	40	1000	
GG	Eleocharis pallens	N	5	200	
GG	Juncus filicaulis	N	0.1	5	
GG	Juncus subsecundus	N	0.1	10	
EG	Marsilea drummondii	N	10	500	
FG	Persicaria prostrata	N	5	600	
GG	Rytidosperma duttonianum	N	0.1	5	
SG	Sclerolaena muricata	N	0.1	3	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	02/02/2023	Solar Farm		Moderate	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_S_13	Plot dimensions	50x20	Orientation of middle	90	
Easting 384803	Northing 6117845	IBRA region	Riverina	Photo #				
Plant Community Type		17				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	6
	Forbs	6
	Ferns	2
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	10.4
	Grasses etc.	74.2
	Forbs	1
	Ferns	3.5
	Other	0
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	5	0	0	0
Average of the 5 subplots	2				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay very hard
Soil Colour	Grey brown	Site Drainage	Low	Distance to nearest water	0m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	NR	
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Solar Farm	DEH_S_13	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.5	60	
SG	Atriplex semibaccata	N	0.3	1	
GG	Austrostipa bigeniculata	N	0.1	1	
SG	Duma florulenta	N	10	50	
FG	Eclipta platyglossa	N	0.1	1	
GG	Eleocharis acuta	N	65	3000	
GG	Eleocharis pallens	N	1	100	
GG	Enteropogon acicularis	N	3	300	
FG	Goodenia pusilliflora	N	0.1	5	
EG	Marsilea costulifera	N	0.5	20	
EG	Marsilea drummondii	N	3	400	
FG	Persicaria prostrata	N	0.1	5	
	Romulea rosea var. australis	HTE	0.1	3	
FG	Rumex tenax	N	0.1	5	
GG	Rytidosperma duttonianum	N	0.1	1	
SG	Sclerolaena muricata	N	0.1	3	
FG	Triglochin spp.	N	0.1	5	
GG	Walwhalleya proluta	N	5	500	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	02/02/2023	Dinewan		Moderate	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_S_14	Plot dimensions	50x20	Orientation of middle	37	
Easting 386897	Northing 6118372	IBRA region	Riverina	Photo #				
Plant Community Type		17				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	7
	Forbs	2
	Ferns	2
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	30
	Grasses etc.	67.8
	Forbs	0.2
	Ferns	5.5
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	0	15	20	0
Average of the 5 subplots	8				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	Poor	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Dinewan	DEH_S_14	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
OG	Convolvulus angustissimus	N	0.1	2	
SG	Duma florulenta	N	30	100	
GG	Eleocharis acuta	N	60	5000	
GG	Eleocharis pallens	N	5	500	
GG	Enteropogon acicularis	N	0.2	200	
FG	Goodenia fascicularis	N	0.1	2	
FG	Goodenia pusilliflora	N	0.1	1	
GG	Juncus flavidus	N	0.1	10	
GG	Juncus subsecundus	N	2	400	
EG	Marsilea costulifera	N	0.5	200	
EG	Marsilea drummondii	N	5	500	
GG	Rytidosperma duttonianum	N	0.1	20	
GG	Walwhalleya proluta	N	0.4	300	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	02/02/2023	Solar Farm		Moderate	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_S_15	Plot dimensions	50x20	Orientation of middle	60
Easting 386997	Northing 6118459	IBRA region	Riverina	Photo #			
Plant Community Type		17				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	4
	Grasses etc.	8
	Forbs	6
	Ferns	2
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0.1
	Shrubs	35.6
	Grasses etc.	36.8
	Forbs	0.6
	Ferns	1.3
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	0	0	5	10
Average of the 5 subplots	7				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay very hard
Soil Colour	Greyish brown	Site Drainage	Low	Distance to nearest water	0m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Solar Farm	DEH_S_15	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	0.1	1	
FG	Alternanthera denticulata	N	0.1	20	
SG	Atriplex nummularia	N	0.3	1	
SG	Atriplex semibaccata	N	0.2	10	
GG	Austrostipa scabra	N	0.1	1	
SG	Duma florulenta	N	35	50	
FG	Eclipta platyglossa	N	0.1	5	
GG	Eleocharis acuta	N	30	3000	
GG	Eleocharis pallens	N	5	300	
GG	Enteropogon acicularis	N	0.3	60	
FG	Euphorbia drummondii	N	0.1	1	
FG	Goodenia pusilliflora	N	0.1	20	
GG	Juncus spp.	N	0.2	20	
GG	Juncus subsecundus	N	0.1	5	
EG	Marsilea costulifera	N	0.3	50	
EG	Marsilea drummondii	N	1	200	
FG	Rumex tenax	N	0.1	5	
GG	Rytidosperma duttonianum	N	0.1	1	
SG	Sclerolaena muricata	N	0.1	5	
FG	Wahlenbergia fluminalis	N	0.1	1	
GG	Walwhalleya proluta	N	1	40	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2022	Dinawan		Sparse	NL JRS		
Zone 55	Datum GDA94	Plot ID	DEH_S_16	Plot dimensions	50x20	Orientation of middle	324
Easting 381857	Northing 6116299	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: No	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	2
	Grasses etc.	8
	Forbs	10
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0.2
	Shrubs	0.2
	Grasses etc.	16.2
	Forbs	1.6
	Ferns	0.1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	0	10	5	0
Average of the 5 subplots	5				

Notes	NL; NL; NL; NL

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	Flat	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2022	Dinawan	DEH_S_16	NL JRS

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	0.2	1	
FG	Alternanthera denticulata	N	0.2	400	
	Arctotheca calendula	E	0.1	20	
FG	Asperula conferta	N	0.2	400	
GG	Austrostipa bigeniculata	N	0.1	5	
GG	Carex inversa	N	0.2	30	
FG	Centipeda cunninghamii	N	0.3	200	
GG	Chloris truncata	N	0.5	50	
	Echium plantagineum	E	0.1	5	
GG	Eleocharis acuta	N	10	900	
GG	Enteropogon acicularis	N	0.1	10	
FG	Goodenia pusilliflora	N	0.1	20	
	Hordeum spp.	E	0.1	1	
GG	Isolepis cernua	N	0.3	80	
	Lactuca serriola	E	0.1	1	
FG	Limosella curdieana	N	0.1	10	
	Lolium rigidum	E	50	3000	
SG	Maireana humillima	N	0.1	1	
EG	Marsilea drummondii	N	0.1	50	
	Medicago polymorpha	E	0.3	30	
FG	Oxalis perennans	N	0.1	20	
FG	Rhodanthe corymbiflora	N	0.1	1	
FG	Rumex tenax	N	0.2	30	
GG	Rytidosperma duttonianum	N	1	20	
SG	Sclerolaena divaricata	N	0.1	10	
FG	Sida corrugata	N	0.2	50	
FG	Solanum esuriale	N	0.1	2	
	Sonchus oleraceus	E	0.1	8	
GG	Walwhalleya proluta	N	4	40	
	Xanthium strumarium	HTE	0.1	1	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinewan		DNG	NL JRS		
Zone 55	Datum GDA94	Plot ID	DEH_S_20	Plot dimensions	50x20	Orientation of middle	273
Easting 389354	Northing 6118060	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	10
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.2
	Grasses etc.	62.9
	Forbs	0.8
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	20	0	5	15
Average of the 5 subplots	10				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Light brown	Site Drainage	Moderate with some wet patches	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinewan	DEH_S_20	NL JRS

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	10	
GG	Austrostipa aristiglumis	N	5	400	
GG	Austrostipa bigeniculata	N	8	500	
	Avena spp.	E	7	500	
GG	Bothriochloa macra	N	0.2	40	
GG	Chloris truncata	N	3	200	
GG	Eleocharis acuta	N	0.1	50	
GG	Enteropogon acicularis	N	4	200	
	Euphorbia prostrata	E	0.1	3	
FG	Goodenia pusilliflora	N	0.1	6	
	Hordeum spp.	E	0.1	3	
	Lolium rigidum	E	15	1000	
SG	Maireana humillima	N	0.1	10	
FG	Maireana pentagona	N	0.1	20	
	Medicago polymorpha	E	5	200	
FG	Oxalis perennans	N	0.2	100	
	Rumex crispus	E	0.1	10	
FG	Rumex tenax	N	0.1	10	
GG	Rytidosperma duttonianum	N	0.5	50	
GG	Rytidosperma setaceum	N	0.1	50	
SG	Sclerolaena diacantha	N	0.1	5	
SG	Sclerolaena muricata	N	1	50	
FG	Sida corrugata	N	0.1	10	
	Sonchus oleraceus	E	0.2	50	
GG	Sporobolus caroli	N	2	200	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	40	2000	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	21/11/2022	Dinawan 26 intact		Intact	JRS NL			
Zone 55	Datum GDA94	Plot ID	DEH_S_24	Plot dimensions	50x20	Orientation of middle	290	
Easting 382492	Northing 6119225	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	5
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	5
	Shrubs	3.4
	Grasses etc.	18.2
	Forbs	0.9
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	1
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	0	0	0	2
Average of the 5 subplots	1.4				

Notes	Nl; Nl; Nl; Nl

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Silty clay
Soil Colour	Orange	Site Drainage	Poor	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion	1		Patches of slight erosion
Firewood/CWD removal			
Grazing (identify native/livestock	1		
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2022	Dinawan 26 intact	DEH_S_24	JRS NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	5	1	
SG	Atriplex leptocarpa	N	1	30	
SG	Atriplex semibaccata	N	0.4	20	
GG	Austrostipa bigeniculata	N	7	100	
GG	Austrostipa scabra	N	9	300	
GG	Chloris truncata	N	0.1	9	
FG	Chrysocephalum apiculatum	N	0.1	1	
GG	Enteropogon acicularis	N	0.1	10	
	Euphorbia prostrata	E	0.1	1	
FG	Goodenia pusilliflora	N	0.1	10	
	Hordeum spp.	E	0.1	10	
	Lactuca serriola	E	0.1	2	
	Lolium rigidum	E	0.1	50	
	Lycium ferocissimum	HTE	0.1	2	
SG	Maireana aphylla	N	0.2	2	
SG	Maireana humillima	N	0.3	20	
	Medicago polymorpha	E	0.5	200	
	Medicago truncatula	E	2	60	
FG	Oxalis perennans	N	0.1	10	
FG	Ptilotus semilanatus	N	0.2	50	
SG	Rhagodia spinescens	N	0.1	10	
FG	Rhodanthe corymbiflora	N	0.1	5	
GG	Rytidosperma duttonianum	N	2	100	
SG	Sclerolaena diacantha	N	0.4	5	
SG	Sclerolaena divaricata	N	1	10	
	Sonchus oleraceus	E	0.1	10	
FG	Vittadinia cuneata	N	0.3	20	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2022	Dinawan 26 intact		Intact	NL		
Zone 55	Datum GDA94	Plot ID	DEH_S_25	Plot dimensions	50x20	Orientation of middle	168
Easting 381485	Northing 6116262	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: No	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	2
	Grasses etc.	8
	Forbs	8
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	10
	Shrubs	0.2
	Grasses etc.	12.8
	Forbs	1
	Ferns	0.3
	Other	0
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	20
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	15	20	10	20
Average of the 5 subplots	17				

Notes	NL; NL; NL; NL

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay loam
Soil Colour	Brown	Site Drainage	Flat	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2022	Dinawan 26 intact	DEH_S_25	NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	10	10	
FG	Alternanthera denticulata	N	0.1	10	
GG	Austrostipa bigeniculata	N	0.1	10	
	Avena spp.	E	0.2	60	
GG	Bothriochloa macra	N	0.1	10	
GG	Carex inversa	N	0.1	20	
GG	Chloris truncata	N	0.5	90	
FG	Chrysocephalum apiculatum	N	0.1	10	
	Echium plantagineum	E	0.1	10	
GG	Eleocharis acuta	N	1	20	
GG	Enteropogon acicularis	N	5	50	
FG	Goodenia pusilliflora	N	0.1	30	
	Lolium rigidum	E	0.1	10	
	Lycium ferocissimum	HTE	0.1	2	
EG	Marsilea drummondii	N	0.3	200	
FG	Rumex tenax	N	0.1	10	
GG	Rytidosperma setaceum	N	1	500	
SG	Sclerolaena diacantha	N	0.1	1	
SG	Sclerolaena muricata	N	0.1	20	
FG	Sida corrugata	N	0.3	60	
FG	Solanum esuriale	N	0.1	10	
	Sonchus oleraceus	E	0.1	10	
FG	Swainsona procumbens	N	0.1	1	
	Trifolium repens	E	0.1	50	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	5	2000	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2022	37263		Sparse	JRS NL		
Zone 55	Datum GDA94	Plot ID	DEH_S_29	Plot dimensions	50x20	Orientation of middle	116
Easting 382087	Northing 6118783	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: None	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	3
	Grasses etc.	11
	Forbs	5
	Ferns	1
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	1.1
	Shrubs	0.5
	Grasses etc.	47.8
	Forbs	1.5
	Ferns	0.1
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	0	0	0	0
Average of the 5 subplots	0				

Notes	NL; NL; NL; NL

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flodplain, no slope	Soil Surface Texture	Clay
Soil Colour	Light brown	Site Drainage	Extremely poor, plot inundated	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2022	37263	DEH_S_29	JRS NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	1	
TG	Acacia pendula	N	1	2	
FG	Alternanthera denticulata	N	0.2	50	
	Arctotheca calendula	E	0.1	1	
FG	Asperula conferta	N	0.1	50	
SG	Atriplex semibaccata	N	0.1	5	
GG	Austrostipa bigeniculata	N	0.5	50	
GG	Bothriochloa macra	N	1	200	
FG	Centipeda cunninghamii	N	0.1	1	
GG	Chloris truncata	N	0.5	100	
OG	Convolvulus angustissimus	N	0.1	2	
	Echium plantagineum	E	0.1	1	
GG	Eleocharis acuta	N	20	3000	
GG	Eleocharis pallens	N	5	1000	
GG	Enteropogon acicularis	N	0.5	50	
FG	Goodenia pusilliflora	N	1	500	
GG	Isolepis cernua	N	0.1	10	
GG	Juncus subsecundus	N	4	1000	
	Lolium rigidum	E	0.3	50	
EG	Marsilea drummondii	N	0.1	50	
	Medicago truncatula	E	0.1	40	
	Oxalis pes-caprae	E	0.2	80	
FG	Rumex tenax	N	0.1	10	
GG	Rytidosperma duttonianum	N	15	2000	
SG	Sclerolaena diacantha	N	0.2	20	
SG	Sclerolaena divaricata	N	0.2	20	
	Sonchus oleraceus	E	0.1	6	
GG	Sporobolus caroli	N	0.2	50	
GG	Walwhalleya proluta	N	1	100	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	14/02/2023	Dinewan		Low	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_S_31	Plot dimensions	50x20	Orientation of middle	286
Easting 383902	Northing 6118765	IBRA region	Riverina	Photo #			
Plant Community Type		17				EEC: Yes	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	8
	Forbs	0
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	8.3
	Grasses etc.	49.8
	Forbs	0
	Ferns	0.2
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	45	60	50	30	70
Average of the 5 subplots	51				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	14/02/2023	Dinewan	DEH_S_31	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	0.1	2	
SG	Duma florulenta	N	8		
GG	Eleocharis pallens	N	20		
GG	Enteropogon acicularis	N	2		
GG	Juncus spp.	N	0.1	20	
	Lolium rigidum	E	2		
EG	Marsilea drummondii	N	0.2	200	
GG	Rytidosperma duttonianum	N	2		
GG	Rytidosperma spp.	N	0.5	50	
SG	Sclerolaena muricata var.	N	0.3	10	
GG	Sporobolus caroli	N	0.1	10	
GG	Walwhalleya proluta	N	25		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	21/11/2022	Dinawan 26 intact		Sparse	NL JRS			
Zone 55	Datum GDA94	Plot ID	DEH_S_35	Plot dimensions	50x20	Orientation of middle	336	
Easting 382282	Northing 6119129	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: No	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	2
	Grasses etc.	9
	Forbs	10
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0.3
	Shrubs	0.3
	Grasses etc.	64.9
	Forbs	1.8
	Ferns	0
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	75	10	0	0
Average of the 5 subplots	18				

Notes	NL; NL; NL; NL

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	Flat	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2022	Dinawan 26 intact	DEH_S_35	NL JRS

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.2	3	
TG	Acacia pendula	N	0.1	3	
FG	Asperula conferta	N	0.2	200	
GG	Austrostipa bigeniculata	N	60	2000	
GG	Austrostipa scabra subsp. falcata	N	0.5	30	
	Avena spp.	E	0.1	10	
GG	Carex inversa	N	0.1	10	
GG	Chloris truncata	N	0.4	200	
FG	Chrysocephalum apiculatum	N	0.1	10	
	Cirsium vulgare	E	0.1	10	
OG	Convolvulus angustissimus	N	0.1	1	
GG	Enteropogon acicularis	N	0.3	100	
FG	Erodium crinitum	N	0.1	10	
	Hordeum spp.	E	0.1	10	
	Hypochaeris glabra	E	0.1	1	
GG	Juncus subsecundus	N	0.1	10	
	Lactuca serriola	E	0.1	1	
	Lolium rigidum	E	0.1	10	
SG	Maireana humillima	N	0.1	20	
	Malva parviflora	E	0.1	10	
	Medicago polymorpha	E	2	200	
GG	Microlaena stipoides	N	0.2		
FG	Oxalis perennans	N	0.3	300	
	Plantago lanceolata	E	0.1	20	
FG	Ptilotus semilanatus	N	0.2	50	
FG	Rhodanthe corymbiflora	N	0.1	1	
FG	Rumex tenax	N	0.1	3	
GG	Rytidosperma setaceum	N	0.3	60	
SG	Sclerolaena diacantha	N	0.2	20	
FG	Sida corrugata	N	0.1	5	
FG	Solanum esuriale	N	0.3	10	
	Sonchus oleraceus	E	0.1	20	
	Taraxacum officinale	E	0.1	10	
FG	Vittadinia cuneata	N	0.3	40	
GG	Walwhalleya proluta	N	3	200	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	02/02/2023	Dinewan		Mod_Good	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_S_43	Plot dimensions	50x20	Orientation of middle	201	
Easting 384746	Northing 6118250	IBRA region	Riverina	Photo #				
Plant Community Type		45				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	5
	Grasses etc.	9
	Forbs	14
	Ferns	1
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.4
	Grasses etc.	90.2
	Forbs	1.4
	Ferns	0.1
	Other	0.1
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	15	5	20	30
Average of the 5 subplots	15				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Dark brown	Site Drainage	Moderate	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Dinewan	DEH_S_43	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	10	
GG	Austrostipa aristiglumis	N	20	1000	
GG	Austrostipa bigeniculata	N	10	200	
GG	Austrostipa scabra	N	5	200	
FG	Calotis cuneifolia	N	0.1	1	
GG	Chloris truncata	N	0.1	20	
FG	Chrysocephalum apiculatum	N	0.1	2	
FG	Chrysocephalum semipapposum	N	0.1	1	
OG	Convolvulus angustissimus	N	0.1	8	
FG	Cotula australis	N	0.1	1	
SG	Duma florulenta	N	0.1	2	
SG	Enchylaena tomentosa	N	0.1	10	
GG	Enteropogon acicularis	N	20	500	
FG	Euphorbia drummondii	N	0.1	5	
FG	Goodenia fascicularis	N	0.1	2	
	Heliotropium europaeum	E	0.1	5	
GG	Juncus subsecundus	N	0.1	2	
	Lolium perenne	E	0.1	20	
SG	Maireana aphylla	N	0.1	2	
FG	Maireana pentagona	N	0.1	2	
EG	Marsilea drummondii	N	0.1	4	
FG	Oxalis perennans	N	0.1	10	
FG	Ptilotus nobilis	N	0.1	2	
GG	Rytidosperma caespitosum	N	10	300	
GG	Rytidosperma setaceum	N	10	400	
SG	Sclerolaena birchii	N	0.1	1	
SG	Sclerolaena muricata	N	1	30	
FG	Sida corrugata	N	0.1	20	
FG	Solanum esuriale	N	0.1	3	
FG	Teucrium racemosum	N	0.1	2	
FG	Vittadinia cuneata	N	0.1	20	
GG	Walwhalleya proluta	N	15	400	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	22/11/2022	Dinawan		Mod_Good	JRS NL			
Zone 55	Datum GDA94	Plot ID	DEH_S_44	Plot dimensions	50x20	Orientation of middle	120	
Easting 387465	Northing 6118622	IBRA region	Riverina	Photo #				
Plant Community Type		45				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	6
	Grasses etc.	13
	Forbs	11
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.6
	Grasses etc.	48.2
	Forbs	8
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	5	5	0	5
Average of the 5 subplots	3				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Fkat	Soil Surface Texture	Clay
Soil Colour	Light browm/orange	Site Drainage	Moderate - mostly drt ground with few wet patches	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_S_44	JRS NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
	Arctotheca calendula	E	0.2	50	
SG	Atriplex leptocarpa	N	0.1	5	
SG	Atriplex semibaccata	N	0.1	5	
GG	Austrostipa aristiglumis	N	10	1000	
GG	Austrostipa bigeniculata	N	20	2000	
GG	Austrostipa nodosa	N	4	300	
GG	Austrostipa scabra	N	7	200	
	Avena spp.	E	0.5	40	
GG	Bothriochloa macra	N	2	50	
FG	Brachyscome lineariloba	N	0.3	60	
GG	Carpha nivicola	N	0.1	6	
GG	Chloris truncata	N	2	300	
FG	Chrysocephalum apiculatum	N	3	200	
	Echium plantagineum	E	0.1	1	
GG	Enteropogon acicularis	N	0.2	20	
FG	Erodium crinitum	N	0.1	10	
	Euphorbia prostrata	E	0.1	10	
FG	Goodenia pusilliflora	N	0.1	5	
	Hordeum spp.	E	0.3	40	
FG	Hypericum spp.	N	0.1	5	
GG	Isolepis cernua	N	0.1	2	
GG	Juncus subsecundus	N	0.1	5	
	Lolium rigidum	E	5	300	
SG	Maireana excavata	N	0.1	10	
SG	Maireana humillima	N	0.1	20	
	Medicago polymorpha	E	3	50	
	Medicago truncatula	E	4	200	
FG	Oxalis perennans	N	2	200	
	Oxalis pes-caprae	E	0.1	10	
FG	Ptilotus semilanatus	N	0.1	20	
FG	Rhodanthe corymbiflora	N	0.1	6	
GG	Rytidosperma caespitosum	N	0.2	50	
GG	Rytidosperma setaceum	N	0.5	100	
SG	Sclerolaena divaricata	N	0.1	10	
SG	Sclerolaena muricata	N	0.1	5	
FG	Sida corrugata	N	2	200	
FG	Solanum esuriale	N	0.1	10	
	Sonchus oleraceus	E	0.1	3	
FG	Vittadinia cuneata	N	0.1	20	
GG	Walwhalleya proluta	N	2	50	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	02/02/2023	Solar Farm		Moderate	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_S_52	Plot dimensions	50x20	Orientation of middle	80	
Easting 382090	Northing 6116926	IBRA region	Riverina	Photo #				
Plant Community Type		17				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	10
	Forbs	7
	Ferns	2
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.4
	Grasses etc.	50.4
	Forbs	3.7
	Ferns	3.5
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	3
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	5	15	5	10
Average of the 5 subplots	7				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey light brown	Site Drainage	Low	Distance to nearest water	0m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	3	R	Sheep grazing - fresh scat
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	02/02/2023	Solar Farm	DEH_S_52	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	0.1	2	
GG	Austrostipa bigeniculata	N	0.2	10	
GG	Austrostipa scabra	N	0.1	2	
GG	Cynodon dactylon	N	0.5	10	
SG	Duma florulenta	N	1	5	
FG	Eclipta platyglossa	N	0.1	2	
GG	Eleocharis acuta	N	20	2000	
GG	Eleocharis pallens	N	0.5	200	
GG	Enteropogon acicularis	N	25	2000	
FG	Euphorbia drummondii	N	0.1	10	
GG	Juncus subsecundus	N	0.1	2	
EG	Marsilea costulifera	N	0.5	10	
EG	Marsilea drummondii	N	3	300	
FG	Oxalis perennans	N	0.1	2	
FG	Persicaria prostrata	N	3	200	
FG	Rumex tenax	N	0.2	10	
GG	Rytidosperma duttonianum	N	0.5	20	
SG	Sclerolaena muricata	N	0.3	10	
FG	Sida corrugata	N	0.1	2	
FG	Solanum esuriale	N	0.1	2	
GG	Sporobolus caroli	N	0.5	30	
GG	Walwhalleya proluta	N	3	300	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	22/11/2022	Dinawan		Moderate	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_01	Plot dimensions	50x20	Orientation of middle	91	
Easting 377146	Northing 6125847	IBRA region	Riverina	Photo #				
Plant Community Type		15				EEC: No	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	8
	Grasses etc.	7
	Forbs	13
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	20
	Shrubs	9.3
	Grasses etc.	9.6
	Forbs	2
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	3
50 - 79 cm	0
30 - 49 cm	1
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	5
No. trees with hollows	3

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	20	5	10	25
Average of the 5 subplots	15				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1		
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	2	R	Patersons curse, milk thistle
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_01	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.5	20	
SG	Atriplex semibaccata	N	0.5	50	
GG	Austrostipa scabra	N	7		
	Avena fatua	E	0.1	20	
FG	Boerhavia dominii	N	0.2	20	
FG	Bulbine bulbosa	N	0.1	3	
GG	Chloris truncata	N	0.1	20	
	Chondrilla juncea	E	0.1	1	
FG	Chrysocephalum apiculatum	N	0.1	2	
FG	Craspedia spp.	N	0.1	2	
FG	Crassula colorata	N	0.1	100	
SG	Dissocarpus paradoxus	N	0.2	5	
FG	Dysphania pumilio	N	0.2	20	
	Echium vulgare	E	0.1	1	
FG	Einadia nutans	N	0.2	20	
SG	Enchylaena tomentosa	N	1		
GG	Enteropogon acicularis	N	2		
TG	Eucalyptus largiflorens	N	20		
FG	Euphorbia drummondii	N	0.1	50	
FG	Goodenia fascicularis	N	0.1	5	
	Hordeum leporinum	E	20		
	Lamarckia aurea	E	0.1	10	
	Lolium rigidum	E	1		
SG	Lycium australe	N	1		
SG	Maireana decalvans	N	0.6	30	
EG	Marsilea drummondii	N	0.1	30	
	Medicago polymorpha	E	1		
FG	Oxalis perennans	N	0.1	50	
SG	Rhagodia spinescens	N	2		
FG	Rumex tenax	N	0.1	2	
GG	Rytidosperma caespitosum	N	0.2	20	
GG	Rytidosperma setaceum	N	0.1	10	
SG	Salsola tragus	N	1		
SG	Sclerolaena muricata var.	N	3		
FG	Sida corrugata	N	0.1	20	
	Sonchus oleraceus	E	0.2	10	
GG	Sporobolus caroli	N	0.1	20	
GG	Walwhalleya proluta	N	0.1	20	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	22/11/2022	Dinawan		DNG	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_02	Plot dimensions	50x20	Orientation of middle	86	
Easting 382792	Northing 6123689	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	10
	Forbs	11
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.3
	Grasses etc.	52.9
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	40	15	20	25	45
Average of the 5 subplots	29				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	R	
Cultivation (inc. pasture)	0		
Soil erosion	1	R	
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	Sheep grazing
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_02	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	10	
	Arctotheca calendula	E	0.1	20	
GG	Austrostipa aristiglumis	N	2		
FG	Calotis scabiosifolia	N	0.1	20	
FG	Chrysocephalum apiculatum	N	0.1	20	
GG	Cyperus gracilis	N	0.1	50	
SG	Dissocarpus paradoxus	N	0.1	5	
GG	Eleocharis pallens	N	0.1	20	
GG	Enteropogon acicularis	N	5		
FG	Euphorbia drummondii	N	0.1	50	
FG	Goodenia fascicularis	N	0.1	50	
FG	Goodenia gracilis	N	0.1	10	
GG	Juncus spp.	N	0.2	20	
	Lolium rigidum	E	20		
FG	Oxalis perennans	N	0.1	100	
FG	Ptilotus semilanatus	N	0.2	30	
FG	Rhodanthe corymbiflora	N	0.1	20	
GG	Rytidosperma caespitosum	N	30		
GG	Rytidosperma duttonianum	N	0.5	30	
GG	Rytidosperma setaceum	N	2		
SG	Sclerolaena muricata	N	0.2	5	
FG	Sida corrugata	N	0.2	100	
GG	Sporobolus caroli	N	10		
FG	Vittadinia hispidula	N	0.1	5	
GG	Walwhalleya proluta	N	3		
	Xanthium spinosum	HTE	0.1	3	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	22/11/2022	Dinawan		DNG	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_03	Plot dimensions	50x20	Orientation of middle	234
Easting 383678	Northing 6124945	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	7
	Forbs	7
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.2
	Grasses etc.	31.3
	Forbs	1.9
	Ferns	0
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	50	35	15	20	15
Average of the 5 subplots	27				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	1	NR	
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_03	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
	Arctotheca calendula	E	0.1	20	
GG	Austrostipa aristiglumis	N	20		
GG	Austrostipa nodosa	N	0.3	20	
	Avena fatua	E	5		
GG	Chloris truncata	N	0.5	30	
FG	Chrysocephalum apiculatum	N	0.1	20	
OG	Convolvulus spp.	N	0.1	10	
GG	Enteropogon acicularis	N	0.3	50	
FG	Erodium spp.	N	0.1	10	
	Hordeum leporinum	E	5		
	Lolium rigidum	E	20		
SG	Maireana excavata	N	0.1	10	
	Medicago polymorpha	E	15		
FG	Oxalis perennans	N	0.5	200	
FG	Ptilotus semilanatus	N	0.5	20	
FG	Rhodanthe corymbiflora	N	0.5	50	
GG	Rytidosperma caespitosum	N	5		
SG	Sclerolaena muricata var.	N	0.1	2	
FG	Solanum esuriale	N	0.1	2	
	Sonchus oleraceus	E	0.1	10	
GG	Sporobolus caroli	N	5		
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	0.2	10	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	22/11/2022	Dinawan		Sparse	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_04	Plot dimensions	50x20	Orientation of middle	338
Easting 381838	Northing 6124623	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	4
	Grasses etc.	4
	Forbs	5
	Ferns	2
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	3
	Shrubs	0.5
	Grasses etc.	68
	Forbs	0.5
	Ferns	0.2
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	60	65	30	60	40
Average of the 5 subplots	51				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	0		
Fire damage	0		
Storm damage	0		
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_04	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	3		
	Arctotheca calendula	E	0.1	10	
GG	Austrostipa aristiglumis	N	50		
	Avena fatua	E	15		
EG	Cheilanthes sieberi	N	0.1	3	
OG	Convolvulus spp.	N	0.1		
SG	Dissocarpus paradoxus	N	0.1	3	
	Echium spp.	E	0.1	5	
SG	Enchylaena tomentosa	N	0.1	1	
FG	Goodenia fascicularis	N	0.1	6	
SG	Maireana excavata	N	0.1	8	
EG	Marsilea drummondii	N	0.1	10	
	Medicago polymorpha	E	15		
FG	Oxalis perennans	N	0.1	50	
SG	Rhagodia spinescens	N	0.2	2	
FG	Rhodanthe corymbiflora	N	0.1	1	
GG	Rytidosperma caespitosum	N	5		
FG	Sida corrugata	N	0.1	20	
	Sonchus oleraceus	E	0.1	10	
GG	Sporobolus caroli	N	3		
FG	Vittadinia cuneata	N	0.1	20	
GG	Walwhalleya proluta	N	10		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	22/11/2022	Dinawan		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_05	Plot dimensions	50x20	Orientation of middle	125
Easting 374997	Northing 6122509	IBRA region	Riverina	Photo #			
Plant Community Type		24				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	9
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.7
	Grasses etc.	73.6
	Forbs	0.3
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	2	5	1	2
Average of the 5 subplots	4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	1	R	
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_05	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	1		
FG	Brachyscome lineariloba	N	0.1	1	
GG	Chloris truncata	N	1		
SG	Duma florulenta	N	0.5	2	
GG	Eleocharis acuta	N	40		
GG	Eleocharis pallens	N	5		
GG	Eragrostis australasica	N	25		
GG	Eragrostis parviflora	N	0.5	40	
GG	Juncus flavidus	N	0.1	2	
GG	Lachnagrostis filiformis	N	0.5	30	
EG	Marsilea drummondii	N	0.1	100	
FG	Rumex tenax	N	0.1	20	
GG	Rytidosperma duttonianum	N	0.5	20	
SG	Sclerolaena muricata	N	0.2	8	
FG	Teucrium racemosum	N	0.1	20	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	22/11/2022	Dinawan		Intact	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_06	Plot dimensions	50x20	Orientation of middle	339
Easting 374940	Northing 6123472	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	7
	Forbs	11
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	16.3
	Grasses etc.	32.2
	Forbs	2.3
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	1
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	15	5	15	10
Average of the 5 subplots	10				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_06	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	15		
SG	Atriplex semibaccata	N	10		
GG	Austrostipa aristiglumis	N	10		
GG	Austrostipa nodosa	N	0.1	5	
GG	Austrostipa scabra	N	1		
FG	Calotis scabiosifolia	N	0.1	10	
GG	Carex inversa	N	0.1	10	
FG	Einadia nutans	N	0.1	40	
SG	Enchylaena tomentosa	N	0.2	10	
GG	Enteropogon acicularis	N	1		
FG	Goodenia gracilis	N	0.1	1	
FG	Lepidium pseudohyssopifolium	N	0.1	5	
	Lolium rigidum	E	15		
SG	Maireana aphylla	N	3		
	Medicago polymorpha	E	15		
FG	Oxalis perennans	N	0.1	100	
FG	Ptilotus semilanatus	N	0.5	20	
SG	Rhagodia spinescens	N	3		
FG	Rhodanthe corymbiflora	N	0.1	10	
FG	Roepera glauca	N	0.8	20	
GG	Rytidosperma caespitosum	N	15		
GG	Rytidosperma setaceum	N	5		
SG	Salsola tragus	N	0.1	3	
FG	Solanum esuriale	N	0.1	20	
FG	Vittadinia cuneata	N	0.1	5	
FG	Vittadinia hispidula	N	0.2	20	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	22/11/2022	Dinawan		DNG	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_07	Plot dimensions	50x20	Orientation of middle	82	
Easting 377942	Northing 6123936	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: Yes	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	5
	Grasses etc.	9
	Forbs	9
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	2.7
	Grasses etc.	40.3
	Forbs	1.4
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	25	20	5	15
Average of the 5 subplots	16				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	22/11/2022	Dinawan	DEH_W_07	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	0.1	1	
GG	Austrostipa aristiglumis	N	5		
GG	Austrostipa bigeniculata	N	15		
GG	Austrostipa scabra	N	0.3	50	
	Avena fatua	E	0.1	10	
FG	Calotis scabiosifolia	N	0.3	100	
GG	Chloris truncata	N	0.5	50	
FG	Chrysocephalum apiculatum	N	0.1	5	
SG	Dissocarpus paradoxus	N	0.8	50	
GG	Enteropogon acicularis	N	1		
FG	Goodenia fascicularis	N	0.1	20	
FG	Goodenia gracilis	N	0.3	200	
	Hordeum leporinum	E	0.1	10	
FG	Leucochrysum molle	N	0.2	100	
	Lolium rigidum	E	25		
SG	Maireana aphylla	N	0.4	2	
SG	Maireana humillima	N	0.4	50	
	Medicago polymorpha	E	10		
FG	Oxalis perennans	N	0.1	100	
FG	Rhodanthe corymbiflora	N	0.1	10	
GG	Rytidosperma caespitosum	N	10		
GG	Rytidosperma setaceum	N	0.5	20	
SG	Salsola tragus	N	1		
FG	Sida corrugata	N	0.1	20	
GG	Sporobolus caroli	N	3		
FG	Swainsona procumbens	N	0.1	1	
GG	Walwhalleya proluta	N	5		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		Intact	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_08	Plot dimensions	50x20	Orientation of middle	310
Easting 364827	Northing 6129828	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	7
	Forbs	9
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	10
	Shrubs	10.4
	Grasses etc.	42.1
	Forbs	2
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	4
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	15	15	10	20
Average of the 5 subplots	14				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_08	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	10		
SG	Atriplex leptocarpa	N	1		
SG	Atriplex semibaccata	N	0.1	2	
GG	Austrostipa aristiglumis	N	15		
GG	Austrostipa nodosa	N	3		
GG	Austrostipa scabra	N	5		
	Avena fatua	E	0.1	20	
GG	Chloris truncata	N	0.1	20	
FG	Chrysocephalum apiculatum	N	0.1	20	
GG	Enteropogon acicularis	N	4		
FG	Goodenia pusilliflora	N	0.1	20	
	Hordeum leporinum	E	1		
FG	Leucochrysum molle	N	0.1	10	
	Lolium rigidum	E	25		
SG	Maireana aphylla	N	5		
SG	Maireana excavata	N	0.1	10	
FG	Maireana pentagona	N	1		
	Medicago polymorpha	E	25		
FG	Oxalis perennans	N	0.1	100	
FG	Ptilotus semilanatus	N	0.2	20	
SG	Rhagodia spinescens	N	4	1	
FG	Rhodanthe corymbiflora	N	0.1	50	
GG	Rytidosperma caespitosum	N	5		
GG	Rytidosperma setaceum	N	10		
SG	Salsola tragus	N	0.1	5	
SG	Sclerolaena diacantha	N	0.1	2	
FG	Solanum esuriale	N	0.1	3	
	Sonchus oleraceus	E	0.1	5	
FG	Vittadinia cuneata	N	0.2	50	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_09	Plot dimensions	50x20	Orientation of middle	358
Easting 366258	Northing 6131584	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	2
	Grasses etc.	6
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	16
	Shrubs	4.1
	Grasses etc.	44.9
	Forbs	5.6
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	3
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	55	60	50	65	70
Average of the 5 subplots	60				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	3	Soil Surface Texture	Sandy clay
Soil Colour	Red brown	Site Drainage	3	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_09	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
	Aira caryophyllea	E	1		
TG	Allocasuarina luehmannii	N	1	1	
	Arctotheca calendula	E	0.1	5	
GG	Austrostipa scabra	N	40		
	Brassica spp.	E	0.1	5	
TG	Callitris glaucophylla	N	15		
FG	Crassula colorata	N	0.1	5	
	Echium spp.	E	0.3	10	
GG	Enteropogon acicularis	N	0.5	20	
GG	Eragrostis lacunaria	N	3		
GG	Eragrostis leptostachya	N	0.2	20	
GG	Eragrostis setifolia	N	1		
FG	Erodium spp.	N	0.1	20	
SG	Hakea leucoptera	N	4		
	Hordeum leporinum	E	10		
	Lolium rigidum	E	20		
SG	Maireana trichoptera	N	0.1	1	
FG	Malva spp.	N	5		
GG	Paspalidium constrictum	N	0.2	10	
FG	Sida corrugata	N	0.1	5	
	Solanum nigrum	E	0.1	3	
	Sonchus oleraceus	E	0.1	3	
	Trifolium arvense	E	25		
FG	Urtica spp.	N	0.1	3	
FG	Vittadinia cuneata	N	0.1	5	
FG	Wahlenbergia stricta	N	0.1	2	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		Sparse	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_10	Plot dimensions	50x20	Orientation of middle	261
Easting 358338	Northing 6128448	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	4
	Grasses etc.	6
	Forbs	10
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	7
	Shrubs	4.1
	Grasses etc.	58.5
	Forbs	1
	Ferns	1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	15	45	15	20
Average of the 5 subplots	20				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_10	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	7		
	Arctotheca calendula	E	0.1	20	
SG	Atriplex leptocarpa	N	1	10	
	Avena fatua	E	0.1	10	
FG	Bulbine semibarbata	N	0.1	2	
FG	Calotis scabiosifolia	N	0.1	2	
GG	Carex inversa	N	0.1	20	
FG	Cotula australis	N	0.1	20	
	Echium spp.	E	0.1	3	
GG	Eleocharis pallens	N	15		
GG	Enteropogon acicularis	N	40		
FG	Goodenia pusilliflora	N	0.1	20	
	Hordeum leporinum	E	3		
GG	Isolepis spp.	N	0.1	10	
	Juncus articulatus	HTE	0.1	20	
	Lolium rigidum	E	30		
EG	Marsilea drummondii	N	1		
FG	Oxalis perennans	N	0.1	50	
FG	Pycnosorus spp.	N	0.1	10	
SG	Rhagodia spinescens	N	2		
FG	Rumex tenax	N	0.1	10	
GG	Rytidosperma caespitosum	N	3		
GG	Rytidosperma duttonianum	N	0.3	20	
SG	Sclerolaena muricata	N	1		
SG	Sclerolaena stelligera	N	0.1	5	
FG	Solanum esuriale	N	0.1	2	
FG	Swainsona procumbens	N	0.1	20	
FG	Teucrium racemosum	N	0.1	5	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_11	Plot dimensions	50x20	Orientation of middle	235
Easting 358201	Northing 6128608	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	3
	Grasses etc.	4
	Forbs	5
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	1.3
	Grasses etc.	2.2
	Forbs	0.5
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	2
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	55	65	50	50	80
Average of the 5 subplots	60				

Notes	A lot of dead grass

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Sandy clay
Soil Colour	Red brown	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1		
Fire damage	0		
Storm damage	0		
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_11	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa scabra	N	1		
	Avena fatua	E	0.1	5	
	Brassica spp.	E	0.5	20	
TG	Callitris glaucophylla	N	15		
	Echium spp.	E	1		
FG	Einadia trigonos	N	0.1	2	
GG	Enteropogon acicularis	N	0.1	5	
GG	Eragrostis lacunaria	N	0.1	10	
FG	Erodium spp.	N	0.1	50	
	Hordeum leporinum	E	20		
	Lolium rigidum	E	10		
	Malva parviflora	E	0.3	50	
	Marrubium vulgare	E	3		
	Medicago polymorpha	E	3		
GG	Paspalidium constrictum	N	1		
	Phalaris paradoxa	E	0.1	2	
SG	Rhagodia spinescens	N	0.7	5	
FG	Rhodanthe corymbiflora	N	0.1	5	
SG	Sclerolaena birchii	N	0.1	2	
SG	Sclerolaena muricata	N	0.5	10	
FG	Sida corrugata	N	0.1	20	
	Trifolium arvense	E	30		
FG	Zaleya galericulata	N	0.1	1	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		DNG	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_12	Plot dimensions	50x20	Orientation of middle	254
Easting 357203	Northing 6129074	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	5
	Grasses etc.	9
	Forbs	10
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	4.9
	Grasses etc.	34.2
	Forbs	1.2
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	15	30	17	5
Average of the 5 subplots	15.4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_12	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
	Arctotheca calendula	E	0.1	20	
SG	Atriplex leptocarpa	N	0.4	50	
SG	Atriplex semibaccata	N	0.1	5	
GG	Austrostipa aristiglumis	N	7		
GG	Austrostipa nodosa	N	5		
GG	Austrostipa scabra	N	10		
	Avena fatua	E	0.3	50	
FG	Calotis scabiosifolia	N	0.1	30	
GG	Chloris truncata	N	1		
GG	Enteropogon acicularis	N	5		
	Hordeum leporinum	E	1		
FG	Leucochrysum molle	N	0.1	2	
	Lolium rigidum	E	15		
SG	Maireana aphylla	N	4		
SG	Maireana excavata	N	0.1	20	
FG	Maireana pentagona	N	0.3	50	
FG	Oxalis perennans	N	0.1	50	
FG	Ptilotus semilanatus	N	0.1	2	
FG	Rhodanthe corymbiflora	N	0.1	50	
GG	Rytidosperma caespitosum	N	2		
GG	Rytidosperma setaceum	N	0.2	20	
SG	Sclerolaena muricata	N	0.3	7	
FG	Sida trichopoda	N	0.1	20	
FG	Solanum esuriale	N	0.1	20	
GG	Sporobolus caroli	N	1		
FG	Thysanotus baueri	N	0.1	2	
FG	Vittadinia cuneata	N	0.1	20	
GG	Walwhalleya proluta	N	3		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	23/11/2022	DEH_W_13		DNG	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_13	Plot dimensions	50x20	Orientation of middle	92	
Easting 354831	Northing 6126327	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	7
	Grasses etc.	8
	Forbs	8
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.3
	Grasses etc.	22.5
	Forbs	0.8
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	15	18	6	10
Average of the 5 subplots	10.8				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	DEH_W_13	DEH_W_13	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex leptocarpa	N	0.1	4	
SG	Atriplex semibaccata	N	0.1	5	
GG	Austrostipa nodosa	N	0.1	10	
GG	Austrostipa scabra	N	1		
	Avena fatua	E	7		
GG	Chloris truncata	N	0.2	20	
FG	Chrysocephalum apiculatum	N	0.1	10	
FG	Einadia nutans	N	0.1	5	
SG	Enchylaena tomentosa	N	0.1	1	
GG	Enteropogon acicularis	N	5		
	Lolium rigidum	E	15		
SG	Maireana aphylla	N	0.5	5	
FG	Maireana pentagona	N	0.1	50	
	Medicago polymorpha	E	5		
FG	Oxalis perennans	N	0.1	50	
FG	Rhodanthe corymbiflora	N	0.1	20	
GG	Rytidosperma caespitosum	N	10		
GG	Rytidosperma setaceum	N	1		
SG	Salsola tragus	N	0.1	10	
SG	Sclerolaena divaricata	N	0.1	1	
SG	Sclerolaena muricata	N	0.3	10	
FG	Senecio spp.	N	0.1	1	
FG	Solanum esuriale	N	0.1	20	
GG	Sporobolus caroli	N	0.2	20	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	5		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	24/11/2022	DEH_W_14		DNG	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_14	Plot dimensions	50x20	Orientation of middle	15	
Easting 360882	Northing 6137355	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: Yes	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	8
	Forbs	12
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.1
	Grasses etc.	51.5
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	5	10	5	10
Average of the 5 subplots	7				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	DEH_W_14	DEH_W_14	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	5		
GG	Austrostipa nodosa	N	0.1	2	
GG	Austrostipa scabra	N	25		
FG	Calotis scabiosifolia	N	0.1	2	
FG	Chrysocephalum apiculatum	N	0.1	10	
GG	Enteropogon acicularis	N	3	30	
FG	Goodenia pusilliflora	N	0.1	20	
	Lolium rigidum	E	5		
FG	Maireana enchylaenoides	N	0.1	1	
FG	Maireana pentagona	N	0.1	20	
	Medicago polymorpha	E	2		
FG	Plantago gaudichaudii	N	0.1		
FG	Ptilotus semilanatus	N	0.2		
FG	Rhodanthe corymbiflora	N	0.1	20	
GG	Rytidosperma caespitosum	N	3		
GG	Rytidosperma setaceum	N	0.3	20	
SG	Sclerolaena muricata	N	0.1	2	
FG	Sida corrugata	N	0.1	20	
FG	Sida trichopoda	N	0.1	5	
FG	Solanum esuriale	N	0.1	20	
	Sonchus oleraceus	E	0.1	10	
GG	Sporobolus caroli	N	0.1	10	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	15		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	24/11/2022	DEH_W_15		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_15	Plot dimensions	50x20	Orientation of middle	156
Easting 358977	Northing 6137591	IBRA region	Riverina	Photo #			
Plant Community Type		46				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	8
	Forbs	9
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.1
	Grasses etc.	51.3
	Forbs	1.1
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	3	5	2	5	10
Average of the 5 subplots	5				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	DEH_W_15	DEH_W_15	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Aristida behriana	N	0.1	2	
GG	Austrostipa nodosa	N	5		
GG	Austrostipa scabra	N	20		
FG	Calostemma purpureum	N	0.1	6	
GG	Chloris truncata	N	0.1	10	
FG	Crassula colorata	N	0.1	20	
GG	Enteropogon acicularis	N	15		
FG	Goodenia pusilliflora	N	0.1	100	
FG	Leucochrysum molle	N	0.2	100	
	Lolium rigidum	E	10		
SG	Lycium australe	N	0.1	1	
FG	Maireana pentagona	N	0.1	100	
	Medicago polymorpha	E	3		
FG	Ptilotus semilanatus	N	0.1	20	
FG	Rhodanthe corymbiflora	N	0.1	20	
GG	Rytidosperma caespitosum	N	1		
FG	Solanum esuriale	N	0.1	1	
	Sonchus oleraceus	E	0.1	5	
GG	Sporobolus caroli	N	0.1	10	
FG	Vittadinia cuneata	N	0.2	40	
GG	Walwhalleya proluta	N	10		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	23/11/2022	Dinawan		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_500	Plot dimensions	50x20	Orientation of middle	241
Easting 364398	Northing 6130438	IBRA region	Riverina	Photo #			
Plant Community Type		15				EEC: No	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	7
	Forbs	9
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	21
	Shrubs	10.6
	Grasses etc.	23.3
	Forbs	4.9
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	2
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	3
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	2	4	2	15	5
Average of the 5 subplots	5.6				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Clay loam
Soil Colour	Brown grey	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_500	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	1	1	
SG	Atriplex leptocarpa	N	0.5	20	
SG	Atriplex semibaccata	N	1	5	
GG	Austrostipa aristiglumis	N	0.2	5	
GG	Austrostipa scabra	N	10		
	Brassica spp.	E	0.1	5	
FG	Calotis scabiosifolia	N	0.1	20	
FG	Chrysocephalum apiculatum	N	0.1	5	
FG	Einadia nutans	N	0.2	50	
GG	Enteropogon acicularis	N	5		
GG	Eragrostis setifolia	N	2		
TG	Eucalyptus largiflorens	N	20		
FG	Goodenia pusilliflora	N	0.1	20	
	Hordeum leporinum	E	2		
	Lolium rigidum	E	15		
FG	Maireana pentagona	N	4		
EG	Marsilea drummondii	N	0.1	200	
	Medicago polymorpha	E	5		
FG	Oxalis perennans	N	0.1	100	
SG	Rhagodia spinescens	N	7		
GG	Rytidosperma caespitosum	N	2		
SG	Sclerolaena diacantha	N	0.1	10	
SG	Sclerolaena muricata	N	2		
FG	Sida corrugata	N	0.1	30	
FG	Solanum esuriale	N	0.1	20	
	Sonchus oleraceus	E	0.1	10	
GG	Sporobolus caroli	N	0.1	5	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	4		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	23/11/2022	Dinawan		Moderate	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_501	Plot dimensions	50x20	Orientation of middle	97	
Easting 358270	Northing 6126133	IBRA region	Riverina	Photo #				
Plant Community Type		28				EEC: Yes	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	0
	Grasses etc.	2
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	14
	Shrubs	0
	Grasses etc.	26
	Forbs	0.8
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	4
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	6
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	45	15	18	25
Average of the 5 subplots	24.6				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Sandy clay
Soil Colour	Light brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	23/11/2022	Dinawan	DEH_W_501	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Anthosachne scabra	N	1		
	Brassica spp.	E	0.2	2	
TG	Callitris glaucophylla	N	10		
FG	Chrysocephalum semipapposum	N	0.1	1	
	Conyza spp.	E	0.1	2	
	Echium spp.	E	0.2	10	
TG	Eucalyptus camaldulensis	N	4		
FG	Euphorbia drummondii	N	0.1	3	
FG	Heliotropium spp.	N	0.1	50	
	Hordeum leporinum	E	5		
	Lolium rigidum	E	25		
FG	Malva spp.	N	0.3	20	
	Marrubium vulgare	E	0.7	7	
	Medicago polymorpha	E	1		
FG	Oxalis perennans	N	0.1	20	
GG	Paspalidium constrictum	N	25		
FG	Sida corrugata	N	0.1	5	
	Solanum nigrum	E	0.1	2	
	Sonchus oleraceus	E	0.1	3	
	Trifolium arvense	E	40		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	24/11/2022	DEH_W_502		Moderate	MP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_502	Plot dimensions	50x20	Orientation of middle	330	
Easting 359490	Northing 6131723	IBRA region	Riverina	Photo #				
Plant Community Type		28				EEC: Yes	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	0
	Grasses etc.	3
	Forbs	5
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	0
	Grasses etc.	2.2
	Forbs	6.1
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	5
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	6
No. trees with hollows	1

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	15	60	55	15
Average of the 5 subplots	33				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Sandy clay
Soil Colour	Orange brown	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	DEH_W_502	DEH_W_502	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Amaranthus spp.	N	0.1	1	
GG	Austrostipa scabra subsp. scabra	N	2		
	Brassica spp.	E	0.2	20	
TG	Callitris glaucophylla	N	15		
	Conyza spp.	E	0.1	4	
	Cucumis myriocarpus subsp.	E	0.1	1	
	Echium spp.	E	0.2	4	
GG	Eragrostis setifolia	N	0.1	10	
FG	Erodium spp.	N	0.7	100	
FG	Euchiton spp.	N	0.1	10	
	Hordeum leporinum	E	10		
	Hypochaeris glabra	E	0.1	3	
	Lolium rigidum	E	25		
FG	Malva spp.	N	0.2	20	
	Marrubium vulgare	E	0.2	10	
GG	Rytidosperma caespitosum	N	0.1	10	
	Sonchus oleraceus	E	0.1	4	
	Trifolium arvense	E	20		
FG	Urtica incisa	N	5		
	Vulpia myuros	E	1		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	24/11/2022	Dinawan		Intact	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_503	Plot dimensions	50x20	Orientation of middle	135
Easting 359712	Northing 6131090	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	4
	Grasses etc.	6
	Forbs	13
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	40
	Shrubs	1.4
	Grasses etc.	33.2
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover		0.5

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	4
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	2
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	2	60	75	80
Average of the 5 subplots	45.4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	0		
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	Dinawan	DEH_W_503	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	40		
FG	Alternanthera denticulata	N	0.1	10	
SG	Atriplex leptocarpa	N	0.2	10	
SG	Atriplex semibaccata	N	0.1	1	
GG	Austrostipa bigeniculata	N	0.1	10	
GG	Austrostipa scabra	N	1		
FG	Cotula australis	N	0.1	100	
FG	Einadia nutans	N	0.1	10	
GG	Enteropogon acicularis	N	1		
FG	Goodenia gracilis	N	0.1	20	
GG	Juncus spp.	N	0.1	20	
	Lamarckia aurea	E	0.1	10	
FG	Lepidium pseudohyssopifolium	N	0.1	2	
	Lolium rigidum	E	2		
	Lycium ferocissimum	HTE	0.5	2	
FG	Maireana enchylaenoides	N	0.1	5	
FG	Maireana pentagona	N	0.1	5	
	Medicago polymorpha	E	1		
FG	Oxalis perennans	N	0.1	50	
FG	Rhodanthe corymbiflora	N	0.1	20	
FG	Rumex tenax	N	0.1	5	
GG	Rytidosperma caespitosum	N	30		
GG	Rytidosperma setaceum	N	1		
SG	Salsola tragus subsp. tragus	N	0.1	5	
SG	Sclerolaena muricata	N	1		
FG	Sida corrugata	N	0.1	5	
	Sonchus oleraceus	E	0.1	10	
FG	Tricoryne elatior	N	0.1	5	
FG	Vittadinia cuneata	N	0.1	10	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	24/11/2022	Dinawan		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_504	Plot dimensions	50x20	Orientation of middle	105
Easting 363073	Northing 6131346	IBRA region	Riverina	Photo #			
Plant Community Type		15				EEC: No	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	6
	Forbs	5
	Ferns	1
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	25
	Shrubs	42
	Grasses etc.	4
	Forbs	2.5
	Ferns	0.2
	Other	0.1
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	2
50 - 79 cm	0
30 - 49 cm	1
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	1
Length of logs (m)	6
No. trees with hollows	3

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	35	10	2	5	10
Average of the 5 subplots	12.4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	Dinawan	DEH_W_504	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex leptocarpa	N	10		
SG	Atriplex semibaccata	N	3		
GG	Austrostipa scabra	N	0.2	20	
OG	Convolvulus spp.	N	0.1	5	
GG	Cyperus difformis	N	0.2	40	
SG	Duma florulenta	N	1		
FG	Einadia nutans	N	2		
GG	Eleocharis pallens	N	0.4	30	
GG	Enteropogon acicularis	N	3		
TG	Eucalyptus largiflorens	N	25		
	Hordeum leporinum	E	1	50	
GG	Juncus spp.	N	0.1	10	
	Lolium rigidum	E	5		
	Lycium ferocissimum	HTE	0.2	4	
SG	Maireana decalvans	N	8		
SG	Maireana spp.	N			
EG	Marsilea drummondii	N	0.2	100	
	Medicago polymorpha	E	0.3	50	
FG	Oxalis perennans	N	0.1	100	
FG	Persicaria prostrata	N	0.2	30	
SG	Rhagodia spinescens	N	5		
FG	Rumex tenax	N	0.1	10	
GG	Rytidosperma spp.	N	0.1	4	
SG	Sclerolaena muricata	N	15		
FG	Sida corrugata	N	0.1	10	
	Trifolium spp.	E	0.5	50	
	Vulpia myuros	E	0.5	100	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	24/11/2022	DEH_W_505		Moderate	MP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_505	Plot dimensions	50x20	Orientation of middle	121
Easting 362283	Northing 6135803	IBRA region	Riverina	Photo #			
Plant Community Type		46				EEC: Yes	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	4
	Grasses etc.	4
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	2.7
	Grasses etc.	72
	Forbs	1.1
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	5	10	6	5
Average of the 5 subplots	9.2				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	24/11/2022	DEH_W_505	DEH_W_505	MP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
	Avena fatua	E	0.5	100	
FG	Calotis scabiosifolia	N	0.1	20	
FG	Chrysocephalum apiculatum	N	0.3	50	
SG	Duma florulenta	N	0.3	2	
GG	Enteropogon acicularis	N	10		
	Lolium rigidum	E	15		
SG	Maireana aphylla	N	2		
FG	Maireana pentagona	N	0.2	50	
	Medicago polymorpha	E	0.5	100	
FG	Oxalis perennans	N	0.1	100	
GG	Rytidosperma caespitosum	N	1		
SG	Sclerolaena divaricata	N	0.3	4	
SG	Sclerolaena muricata	N	0.1	2	
FG	Sida corrugata	N	0.2	20	
FG	Sida trichopoda	N	0.1	5	
GG	Sporobolus caroli	N	1		
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	60		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	31/01/2023	Dinawan		Thinned	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_601	Plot dimensions	50x20	Orientation of middle	150	
Easting 385396	Northing 6120782	IBRA region	Riverina	Photo #				
Plant Community Type		13				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	7
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15.1
	Shrubs	19.9
	Grasses etc.	23.2
	Forbs	3.7
	Ferns	0
	Other	0
High Threat Weed cover		0.4

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	2
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	2
No. trees with hollows	4

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	30	5	20	35
Average of the 5 subplots	20				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey brown	Site Drainage	Waterlogged	Distance to nearest water	Within 50m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_601	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	1	
SG	Atriplex semibaccata	N	4	300	
GG	Austrostipa bigeniculata	N	0.5	30	
GG	Austrostipa scabra	N	5	200	
FG	Boerhavia dominii	N	0.1	1	
GG	Chloris truncata	N	0.1	5	
FG	Einadia nutans	N	3	300	
SG	Enchylaena tomentosa	N	0.3	20	
GG	Enteropogon acicularis	N	15	1000	
FG	Erodium crinitum	N	0.1	5	
TG	Eucalyptus largiflorens	N	15	20	
	Hordeum spp.	E	1	80	
	Lactuca serriola	E	0.1	5	
	Lepidium africanum	E	0.1	1	
	Lycium ferocissimum	HTE	0.3	10	
FG	Maireana pentagona	N	0.2	20	
	Modiola caroliniana	E	0.1	1	
GG	Rytidosperma duttonianum	N	2	200	
SG	Salsola tragus	N	0.1	1	
SG	Sclerolaena birchii	N	0.5	1	
SG	Sclerolaena muricata	N	15	100	
FG	Sida corrugata	N	0.1	10	
FG	Solanum esuriale	N	0.1	2	
	Solanum nigrum	E	0.1	10	
	Sonchus oleraceus	E	0.1	5	
GG	Sporobolus caroli	N	0.1	5	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	0.5	30	
	Xanthium spinosum	HTE	0.1	5	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	31/01/2023	Dinawan		DNG	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_W_602	Plot dimensions	50x20	Orientation of middle	236
Easting 382582	Northing 6122714	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	4
	Grasses etc.	7
	Forbs	8
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	3.4
	Grasses etc.	75.5
	Forbs	1.2
	Ferns	0
	Other	0.1
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	5	20	5	0
Average of the 5 subplots	7				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Orange brown	Site Drainage	Moderate	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_602	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	0.2	10	
GG	Austrostipa nodosa	N	5	300	
	Avena fatua	E	0.5	200	
GG	Chloris truncata	N	0.2	50	
OG	Convolvulus angustissimus	N	0.1	2	
FG	Einadia nutans	N	0.1	5	
SG	Enchylaena tomentosa	N	0.1	2	
GG	Enteropogon acicularis	N	5	500	
FG	Erodium crinitum	N	0.1	5	
FG	Euphorbia drummondii	N	0.1	5	
	Heliotropium europaeum	E	0.1	1	
GG	Juncus subsecundus	N	0.1	2	
SG	Maireana decalvans	N	0.1	2	
SG	Maireana excavata	N	0.2	30	
FG	Maireana pentagona	N	0.5	80	
GG	Rytidosperma caespitosum	N	50	1000	
SG	Sclerolaena muricata	N	3	40	
FG	Sida corrugata	N	0.1	5	
FG	Sigesbeckia australiensis	N	0.1	5	
FG	Solanum esuriale	N	0.1	2	
GG	Sporobolus caroli	N	15	600	
FG	Vittadinia cuneata	N	0.1	6	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	31/01/2023	Dinawan		Mod_Good	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_603	Plot dimensions	50x20	Orientation of middle	240	
Easting 383326	Northing 6123015	IBRA region	Riverina	Photo #				
Plant Community Type		17				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	10
	Forbs	8
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	5.6
	Grasses etc.	57.7
	Forbs	1.6
	Ferns	2
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	0	15	0	5
Average of the 5 subplots	5				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	Waterlogged	Distance to nearest water	0m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_603	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	5	
SG	Atriplex semibaccata	N	0.1	1	
GG	Austrostipa aristiglumis	N	0.1	5	
GG	Austrostipa scabra	N	0.1		
	Avena spp.	E	0.1	5	
SG	Duma florulenta	N	5	30	
FG	Eclipta platyglossa	N	0.1	5	
GG	Eleocharis acuta	N	20	2000	
GG	Eleocharis pallens	N	0.1	2	
GG	Enteropogon acicularis	N	2	500	
FG	Erodium crinitum	N	0.1	1	
FG	Goodenia pusilliflora	N	0.3	80	
GG	Juncus subsecundus	N	5	100	
GG	Juncus usitatus	N	0.1	5	
EG	Marsilea drummondii	N	2	200	
FG	Oxalis perennans	N	0.1	5	
FG	Rumex tenax	N	0.3	30	
GG	Rytidosperma duttonianum	N	15	500	
SG	Sclerolaena muricata	N	0.5	10	
	Sida rhombifolia	E	0.1	1	
FG	Solanum esuriale	N	0.1	1	
GG	Sporobolus caroli	N	0.3	10	
FG	Triglochin spp.	N	0.5	60	
GG	Walwhalleya proluta	N	15	1000	
	Xanthium spinosum	HTE	0.1	5	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	31/01/2023	Dinawan		Moderate	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_604	Plot dimensions	50x20	Orientation of middle	215	
Easting 371953	Northing 6122968	IBRA region	Riverina	Photo #				
Plant Community Type		13				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	2
	Grasses etc.	6
	Forbs	1
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	25
	Shrubs	52
	Grasses etc.	1.6
	Forbs	0.1
	Ferns	1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	1
50 - 79 cm	3
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	5
No. trees with hollows	1

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	0	0	0	0
Average of the 5 subplots	0				

Notes	Whole plot approx 30cm underwater

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Brown	Site Drainage	Poor - site inundated	Distance to nearest water	Site underwater

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_604	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Chenopodium nitrariaceum	N	50	500	
SG	Duma florulenta	N	2	40	
GG	Eleocharis acuta	N	0.1	10	
GG	Enteropogon acicularis	N	0.1	20	
GG	Eragrostis australasica	N	0.1	5	
TG	Eucalyptus largiflorens	N	25	6	
GG	Lachnagrostis filiformis	N	0.2	30	
EG	Marsilea drummondii	N	1	1000	
GG	Paspalidium jubiflorum	N	0.1	10	
FG	Rumex tenax	N	0.1	3	
GG	Walwhalleya proluta	N	1		

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	31/01/2023	Dinawan		Low	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_605	Plot dimensions	50x20	Orientation of middle	40	
Easting 371327	Northing 6129444	IBRA region	Riverina	Photo #				
Plant Community Type		28				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	4
	Grasses etc.	3
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	5
	Shrubs	0.5
	Grasses etc.	7.2
	Forbs	5.4
	Ferns	0
	Other	0
High Threat Weed cover		0.6

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	1
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	60	25	20	70	20
Average of the 5 subplots	39				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0-5	Soil Surface Texture	Sandy
Soil Colour	Orange	Site Drainage	Moderate	Distance to nearest water	1.2km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness	3	R	Echium, White horehound, Bathurst Burr, Lycium
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_605	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Atriplex lindleyi	N	0.1	2	
SG	Atriplex semibaccata	N	0.1	10	
GG	Austrostipa scabra	N	7	200	
TG	Callitris glaucophylla	N	5	1	
	Conyza bonariensis	E	0.1	5	
	Echium plantagineum	E	0.1	5	
FG	Einadia nutans	N	0.1	2	
SG	Enchylaena tomentosa	N	0.2	4	
FG	Erodium crinitum	N	1	200	
	Heliotropium europaeum	E	0.2	20	
	Hordeum spp.	E	0.1	5	
	Lycium ferocissimum	HTE	0.1	2	
	Marrubium vulgare	E	0.3	30	
GG	Rytidosperma duttonianum	N	0.1	5	
SG	Salsola tragus	N	0.1	5	
SG	Sclerolaena muricata	N	0.1	10	
FG	Sida corrugata	N	4	200	
FG	Solanum esuriale	N	0.1	1	
	Solanum nigrum	E	0.4	50	
	Sonchus oleraceus	E	0.1	1	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	0.1		
	Xanthium spinosum	HTE	0.5	90	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	31/01/2023	Dinawan		Moderate	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_W_606	Plot dimensions	50x20	Orientation of middle	152
Easting 372750	Northing 6129433	IBRA region	Riverina	Photo #			
Plant Community Type		13				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	4
	Forbs	8
	Ferns	1
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	30.1
	Shrubs	75.3
	Grasses etc.	11.6
	Forbs	0.9
	Ferns	0.1
	Other	0.1
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	1
50 - 79 cm	3
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	1

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	25	35	15	10
Average of the 5 subplots	18				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay silt
Soil Colour	Light brown	Site Drainage	Good	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_606	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	2	
FG	Alternanthera denticulata	N	0.2	50	
SG	Atriplex semibaccata	N	25	100	
GG	Austrostipa scabra	N	0.5	200	
FG	Brachyscome ciliaris	N	0.1	5	
FG	Calotis scabiosifolia	N	0.1	1	
OG	Convolvulus angustissimus	N	0.1	4	
	Cynosurus echinatus	E	0.1	2	
FG	Dysphania pumilio	N	0.1	2	
FG	Einadia nutans	N	0.1	30	
SG	Enchylaena tomentosa	N	0.1	5	
GG	Enteropogon acicularis	N	0.1	20	
FG	Erodium crinitum	N	0.1	2	
TG	Eucalyptus largiflorens	N	30	4	
FG	Euphorbia drummondii	N	0.1	5	
	Hordeum spp.	E	0.1	10	
	Lycium ferocissimum	HTE	0.1	1	
EG	Marsilea drummondii	N	0.1	2	
GG	Rytidosperma caespitosum	N	5	300	
SG	Salsola tragus	N	0.1	2	
SG	Sclerolaena muricata	N	50	300	
SG	Sclerolaena tricuspis	N	0.1	4	
FG	Vittadinia cuneata	N	0.1	10	
GG	Walwhalleya proluta	N	6	600	
	Xanthium spinosum	HTE	0.1	2	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	31/01/2023	Dinawan		Intact	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_607	Plot dimensions	50x20	Orientation of middle	215	
Easting 373462	Northing 6129894	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	5
	Forbs	10
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	4.1
	Shrubs	1.2
	Grasses etc.	66
	Forbs	1.1
	Ferns	0
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	40	25	0	0
Average of the 5 subplots	14				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0-5	Soil Surface Texture	Sand-clay
Soil Colour	Orange brown	Site Drainage	High	Distance to nearest water	3km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	31/01/2023	Dinawan	DEH_W_607	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	1	
TG	Acacia pendula	N	4	5	
SG	Atriplex semibaccata	N	0.3	20	
GG	Austrostipa bigeniculata	N	15	1000	
GG	Austrostipa scabra	N	25	2000	
OG	Convolvulus angustissimus	N	0.1	1	
	Echium plantagineum	E	0.1	1	
FG	Einadia nutans	N	0.2	20	
SG	Enchylaena tomentosa	N	0.1	5	
GG	Enteropogon acicularis	N	1	40	
FG	Erodium crinitum	N	0.1	5	
FG	Euphorbia drummondii	N	0.1	5	
FG	Goodenia pusilliflora	N	0.1	1	
FG	Maireana pentagona	N	0.1	5	
FG	Oxalis perennans	N	0.1	1	
FG	Ptilotus erubescens	N	0.1	1	
GG	Rytidosperma duttonianum	N	20	3000	
SG	Salsola tragus	N	0.2	20	
SG	Sclerolaena diacantha	N	0.5	20	
SG	Sclerolaena muricata	N	0.1	5	
FG	Sida corrugata	N	0.1	20	
FG	Solanum esuriale	N	0.1	1	
	Sonchus oleraceus	E	0.1	5	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	5	300	

BAM Plot Data Sheet								Site Sheet no: 1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	01/02/2023	DEH_W_608		Thinned	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_608	Plot dimensions	50x20	Orientation of middle	119	
Easting 363033	Northing 6134151	IBRA region	Riverina	Photo #				
Plant Community Type		13				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	2
	Grasses etc.	9
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	40.1
	Shrubs	5.4
	Grasses etc.	11.4
	Forbs	0.3
	Ferns	3
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	2
50 - 79 cm	4
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	15
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	60	15	40	5	5
Average of the 5 subplots	25				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Sandy silt
Soil Colour	Light brown	Site Drainage	Moderate	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	DEH_W_608	DEH_W_608	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	1	
FG	Alternanthera nana	N	0.1	5	
GG	Austrostipa nodosa	N	0.1	5	
SG	Duma florulenta	N	5	30	
FG	Eclipta platyglossa	N	0.1	2	
GG	Eleocharis acuta	N	10	400	
GG	Enteropogon acicularis	N	0.1	20	
TG	Eucalyptus largiflorens	N	40	5	
GG	Juncus flavidus	N	0.5	60	
GG	Juncus subsecundus	N	0.2	70	
EG	Marsilea drummondii	N	3	300	
GG	Paspalidium jubiflorum	N	0.2	50	
FG	Rumex tenax	N	0.1	2	
GG	Rytidosperma caespitosum	N	0.1	20	
SG	Sclerolaena muricata	N	0.4	20	
GG	Sporobolus caroli	N	0.1	5	
GG	Walwhalleya proluta	N	0.1	40	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	01/02/2023	Dinawan		DNG	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_609	Plot dimensions	50x20	Orientation of middle	240	
Easting 360890	Northing 6138929	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	6
	Grasses etc.	7
	Forbs	9
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0.6
	Shrubs	2.1
	Grasses etc.	67.7
	Forbs	1.3
	Ferns	0.1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	10	2	5	0
Average of the 5 subplots	4.4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0-5	Soil Surface Texture	Sandy clay
Soil Colour	Orange	Site Drainage	High	Distance to nearest water	1km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_609	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.5	10	
TG	Acacia pendula	N	0.1	1	
FG	Alternanthera denticulata	N	0.1	2	
SG	Atriplex semibaccata	N	0.5	20	
GG	Austrostipa scabra	N	0.5	50	
GG	Carex inversa	N	0.1	2	
FG	Chrysocephalum apiculatum	N	0.3	10	
SG	Dissocarpus paradoxus	N	0.2	10	
SG	Enchylaena tomentosa	N	0.5	20	
GG	Enteropogon acicularis	N	60	3000	
FG	Euphorbia drummondii	N	0.1	3	
GG	Juncus usitatus	N	0.1	2	
FG	Leucochrysum molle	N	0.1	2	
FG	Maireana pentagona	N	0.3	30	
EG	Marsilea drummondii	N	0.1	10	
FG	Ptilotus semilanatus	N	0.1	1	
	Romulea rosea var. australis	HTE	0.1	10	
GG	Rytidosperma caespitosum	N	3	300	
SG	Salsola tragus	N	0.1	3	
SG	Sclerolaena diacantha	N	0.3	20	
SG	Sclerolaena muricata	N	0.5	20	
FG	Sida corrugata	N	0.1	10	
FG	Solanum esuriale	N	0.1	10	
	Sonchus oleraceus	E	0.1	1	
GG	Sporobolus caroli	N	3	300	
FG	Vittadinia cuneata	N	0.1	1	
GG	Walwhalleya proluta	N	1	100	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	01/02/2023	Dinawan		Intact	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_W_610	Plot dimensions	50x20	Orientation of middle	159
Easting 357610	Northing 6138307	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	7
	Forbs	9
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	10
	Shrubs	31.3
	Grasses etc.	39.6
	Forbs	2.9
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	3
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	80	15	5	40	5
Average of the 5 subplots	29				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Sandy clay
Soil Colour	Brown orange	Site Drainage	Moderate	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_610	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	10	8	
GG	Austrostipa nodosa	N	20	500	
FG	Calotis cuneifolia	N	0.1	1	
FG	Eclipta platyglossa	N	0.1	1	
FG	Einadia nutans	N	2	100	
SG	Enchylaena tomentosa	N	1	50	
GG	Enteropogon acicularis	N	1	200	
FG	Euphorbia drummondii	N	0.1	5	
FG	Goodenia fascicularis	N	0.1	20	
	Lycium ferocissimum	HTE	0.1	1	
SG	Maireana aphylla	N	20	300	
SG	Maireana excavata	N	0.1	2	
FG	Maireana pentagona	N	0.1	1	
FG	Oxalis perennans	N	0.1	2	
GG	Panicum spp.	N	0.1	1	
GG	Rytidosperma caespitosum	N	15	300	
GG	Rytidosperma spp.	N	2	100	
SG	Salsola tragus	N	0.2	40	
SG	Sclerolaena muricata	N	10	80	
FG	Sida corrugata	N	0.1	4	
FG	Solanum esuriale	N	0.2	50	
GG	Sporobolus caroli	N	1	500	
GG	Walwhalleya proluta	N	0.5	400	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	01/02/2023	Dinawan		Moderate	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_611	Plot dimensions	50x20	Orientation of middle	20	
Easting 354916	Northing 6137799	IBRA region	Riverina	Photo #				
Plant Community Type		46				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	4
	Grasses etc.	4
	Forbs	8
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.3
	Grasses etc.	70.2
	Forbs	1
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	50	30	50	25	20
Average of the 5 subplots	35				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0-5	Soil Surface Texture	Clay
Soil Colour	Grey brown	Site Drainage	Moderate	Distance to nearest water	1.5

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_611	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa bigeniculata	N	0.1	1	
FG	Chrysocephalum apiculatum	N	0.1	5	
	Cirsium vulgare	E	0.1	5	
	Cucumis myriocarpus subsp.	E	0.2	10	
	Echium plantagineum	E	0.1	5	
GG	Enteropogon acicularis	N	5	500	
FG	Erodium crinitum	N	0.3	30	
FG	Euphorbia drummondii	N	0.1	10	
	Heliotropium europaeum	E	0.1	10	
	Lactuca serriola	E	0.1	5	
SG	Maireana aphylla	N	0.1	5	
	Marrubium vulgare	E	0.1	1	
FG	Oxalis perennans	N	0.1	10	
FG	Ptilotus semilanatus	N	0.1	5	
SG	Salsola tragus	N	0.1	1	
SG	Sclerolaena diacantha	N	0.1	5	
SG	Sclerolaena muricata	N	1	40	
FG	Sida corrugata	N	0.1	5	
FG	Solanum esuriale	N	0.1	10	
	Sonchus oleraceus	E	0.1	5	
GG	Sporobolus caroli	N	0.1	1	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	65	3000	
	Xanthium spinosum	HTE	0.1	10	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	01/02/2023	Dinawan		Moderate	JRS STC		
Zone 55	Datum GDA94	Plot ID	DEH_W_612	Plot dimensions	50x20	Orientation of middle	171
Easting 355105	Northing 6139188	IBRA region	Riverina	Photo #			
Plant Community Type		46				EEC: None	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	6
	Grasses etc.	5
	Forbs	4
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	11.7
	Grasses etc.	50.1
	Forbs	0.8
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	40	15	10	30	70
Average of the 5 subplots	33				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay
Soil Colour	Orange brown	Site Drainage	Good	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_612	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	5	100	
GG	Austrostipa nodosa	N	0.1	10	
	Avena fatua	E	0.1	5	
FG	Calotis cuneifolia	N	0.5	80	
FG	Chrysocephalum apiculatum	N	0.1	2	
SG	Dissocarpus paradoxus	N	0.1	1	
SG	Enchylaena tomentosa	N	0.5	60	
GG	Enteropogon acicularis	N	10	400	
	Lycium ferocissimum	HTE	0.1	1	
SG	Maireana aphylla	N	5	30	
GG	Rytidosperma caespitosum	N	20	600	
SG	Salsola tragus	N	0.1	4	
SG	Sclerolaena muricata	N	1	40	
FG	Sida corrugata	N	0.1	3	
FG	Solanum esuriale	N	0.1	2	
GG	Sporobolus caroli	N	5	200	
GG	Walwhalleya proluta	N	15	600	

BAM Plot Data Sheet								Site Sheet no: 1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	01/02/2023	Dinawan		Intact	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_613	Plot dimensions	50x20	Orientation of middle	220	
Easting 359862	Northing 6141538	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	6
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	16.5
	Grasses etc.	8.4
	Forbs	1.3
	Ferns	0
	Other	0
High Threat Weed cover		0.6

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	0	0	5	10
Average of the 5 subplots	4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0-5	Soil Surface Texture	Clay
Soil Colour	Light brown	Site Drainage	High	Distance to nearest water	800m

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_613	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	15	20	
SG	Atriplex semibaccata	N	2	40	
GG	Austrostipa nodosa	N	0.2	10	
GG	Austrostipa scabra	N	0.1	5	
SG	Chenopodium desertorum	N	5	60	
FG	Chrysocephalum apiculatum	N	0.5	20	
	Echium plantagineum	E	0.1	5	
FG	Einadia nutans	N	0.2	10	
SG	Enchylaena tomentosa	N	0.5	50	
GG	Enteropogon acicularis	N	0.1	1	
FG	Euphorbia drummondii	N	0.1	5	
	Lycium ferocissimum	HTE	0.5	1	
SG	Maireana aphylla	N	8	90	
FG	Maireana pentagona	N	0.3	50	
GG	Rytidosperma caespitosum	N	2	200	
GG	Rytidosperma spp.	N	1	100	
SG	Salsola tragus	N	0.4	80	
SG	Sclerolaena diacantha	N	0.1	5	
SG	Sclerolaena muricata	N	0.5	30	
FG	Sida corrugata	N	0.1	5	
FG	Solanum esuriale	N	0.1	1	
GG	Walwhalleya proluta	N	5	100	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	01/02/2023	Dinawan		Other	JRS STC			
Zone 55	Datum GDA94	Plot ID	DEH_W_614	Plot dimensions	50x20	Orientation of middle	220	
Easting 358437	Northing 6140312	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	6
	Forbs	10
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	20.3
	Grasses etc.	85
	Forbs	1.2
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	20	0	0	30
Average of the 5 subplots	13				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Clay silt
Soil Colour	Light brown	Site Drainage	Moderate	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock			
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	01/02/2023	Dinawan	DEH_W_614	JRS STC

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	0.2	10	
GG	Austrostipa scabra	N	5	200	
	Avena fatua	E	0.1	10	
FG	Calotis cuneifolia	N	0.1	5	
FG	Calotis scabiosifolia	N	0.1	2	
FG	Chrysocephalum apiculatum	N	0.2	50	
FG	Einadia nutans	N	0.1	2	
GG	Enteropogon acicularis	N	30	1000	
FG	Euphorbia drummondii	N	0.1	5	
FG	Goodenia fascicularis	N	0.1	4	
SG	Maireana aphylla	N	20	80	
FG	Maireana pentagona	N	0.2	30	
FG	Rhodanthe corymbiflora	N	0.1	1	
GG	Rytidosperma caespitosum	N	25	800	
GG	Rytidosperma spp.	N	10	200	
SG	Salsola tragus	N	0.1	5	
FG	Sida corrugata	N	0.1	10	
FG	Solanum esuriale	N	0.1	1	
GG	Sporobolus caroli	N	5	200	
GG	Walwhalleya proluta	N	10	300	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	14/02/2023	Dinewan		Mod_Good	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_801	Plot dimensions	50x20	Orientation of middle	121
Easting 384625	Northing 6121230	IBRA region	Riverina	Photo #			
Plant Community Type		45				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	6
	Forbs	3
	Ferns	1
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.3
	Grasses etc.	55.1
	Forbs	0.3
	Ferns	0.1
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	55	40	45	35	25
Average of the 5 subplots	40				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	14/02/2023	Dinewan	DEH_W_801	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	25		
	Avena fatua	E	0.1	10	
FG	Calotis scabiosifolia	N	0.1	3	
OG	Convolvulus spp.	N	0.1	20	
GG	Enteropogon acicularis	N	3		
	Lolium rigidum	E	5		
EG	Marsilea drummondii	N	0.1	20	
GG	Rytidosperma duttonianum	N	1		
GG	Rytidosperma setaceum	N	0.1	10	
SG	Sclerolaena muricata var.	N	0.3	10	
FG	Sida trichopoda	N	0.1	30	
FG	Solanum esuriale	N	0.1	20	
GG	Sporobolus caroli	N	1		
GG	Walwhalleya proluta	N	25		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	14/02/2023	Dinawan		Intact	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_802	Plot dimensions	50x20	Orientation of middle	129
Easting 385346	Northing 6124837	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	7
	Forbs	5
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	10
	Shrubs	4.3
	Grasses etc.	26.8
	Forbs	0.7
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	10
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	85	80	90	35	60
Average of the 5 subplots	70				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	4	Soil Surface Texture	Clay loam
Soil Colour	Grey brown	Site Drainage	4	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	14/02/2023	Dinawan	DEH_W_802	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	10		
FG	Alternanthera denticulata	N	0.1	5	
SG	Atriplex leptocarpa	N	3		
GG	Austrostipa aristiglumis	N	15		
GG	Austrostipa nodosa	N	0.5	30	
GG	Austrostipa scabra	N	0.1	10	
GG	Chloris truncata	N	0.1	10	
	Lolium rigidum	E	4		
SG	Maireana decalvans	N	0.6	30	
SG	Maireana spp.	N	0.1	10	
GG	Rytidosperma setaceum	N	0.1	10	
SG	Salsola tragus	N	0.2	10	
SG	Sclerolaena muricata var.	N	0.4	20	
FG	Sida corrugata	N	0.1	30	
FG	Solanum esuriale	N	0.2	60	
GG	Sporobolus caroli	N	1		
FG	Teucrium racemosum	N	0.1	20	
FG	Vittadinia cuneata	N	0.2	20	
GG	Walwhalleya proluta	N	10		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	14/02/2023	Dinawan		Intact	Mgp and kk		
Zone 55	Datum GDA94	Plot ID	DEH_W_803	Plot dimensions	50x20	Orientation of middle	12
Easting 378265	Northing 6129337	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Weeping myall	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	9
	Forbs	9
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	20
	Shrubs	3.8
	Grasses etc.	31.5
	Forbs	1
	Ferns	0.1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	22
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	15	10	15	5
Average of the 5 subplots	12				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Red brown loam
Soil Colour	Red to brown little gilgai	Site Drainage	Nil	Distance to nearest water	Unk

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	0		
Cultivation (inc. pasture)	0		
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1		
Fire damage			
Storm damage			
Weediness			
Other			Old small powerline

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	14/02/2023	Dinawan	DEH_W_803	Mgp and kk

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	20	10	Canopy
FG	Alternanthera denticulata	N	0.1	10	Ground
SG	Atriplex leptocarpa	N	1	10	Ground
GG	Austrostipa aristiglumis	N	25	200	Ground
GG	Austrostipa nodosa	N	1	100	Ground
GG	Austrostipa scabra	N	0.2	20	
SG	Chenopodium nitrariaceum	N	0.1	1	Ground
GG	Chloris truncata	N	0.2	30	Ground
FG	Einadia nutans	N	0.1	1	Ground
SG	Enchylaena tomentosa	N	0.1	1	Ground
GG	Enteropogon acicularis	N	1	50	Ground
GG	Juncus spp.	N	0.1	30	
FG	Lepidium spp.	N	0.1	10	
FG	Leptorhynchos squamatus	N	0.1	1	Ground
	Lycium ferocissimum	HTE	0.1	1	Mid Storey
SG	Maireana decalvans	N	1	20	Ground
EG	Marsilea drummondii	N	0.1	30	Ground
FG	Oxalis perennans	N	0.1	20	Ground
SG	Rhagodia spinescens	N	0.1	1	
GG	Rytidosperma duttonianum	N	1	10	
SG	Salsola tragus	N	1	30	Ground
SG	Sclerolaena muricata	N	0.5	10	Ground
FG	Sida corrugata	N	0.1	5	Ground
FG	Solanum esuriale	N	0.1	10	Ground
GG	Sporobolus caroli	N	2	50	Ground
FG	Teucrium racemosum	N	0.2	20	
FG	Vittadinia cuneata	N	0.1	5	Ground
GG	Walwhalleya proluta	N	1	200	Ground

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	15/02/2023	Dinawan		Moderate	MGP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_804	Plot dimensions	50x20	Orientation of middle	80	
Easting 378143	Northing 6128999	IBRA region	Riverina	Photo #				
Plant Community Type		28				EEC: Yes	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	6
	Grasses etc.	4
	Forbs	5
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	20
	Shrubs	4.2
	Grasses etc.	7.7
	Forbs	2.5
	Ferns	0
	Other	0
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	5
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	65	6	70	65
Average of the 5 subplots	45.2				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Sandy clay
Soil Colour	Red	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_804	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Aristida behriana	N	0.2	20	
SG	Atriplex leptocarpa	N	0.1	5	
SG	Atriplex semibaccata	N	1		
GG	Austrostipa nodosa	N	4		
GG	Austrostipa scabra	N	3		
FG	Boerhavia dominii	N	0.2	20	
	Brassica spp.	E	1		
TG	Callitris glaucophylla	N	20		
	Conyza bonariensis	E	0.5	50	
	Echium plantagineum	E	0.1	20	
SG	Enchylaena tomentosa	N	1		
FG	Euphorbia drummondii	N	0.1	5	
	Heliotropium europaeum	E	0.1	50	
	Lactuca spp.	E	0.1	5	
	Lepidium bonariense	E	0.1	10	
	Lycium ferocissimum	HTE	0.2	2	
FG	Maireana pentagona	N	0.1	2	
SG	Rhagodia spinescens	N	1		
GG	Rytidosperma caespitosum	N	0.5	50	
SG	Salsola tragus	N	0.1	7	
SG	Sclerolaena muricata var.	N	1		
FG	Sida corrugata	N	2		
	Solanum nigrum	E	0.1	3	
FG	Vittadinia cuneata var. cuneata	N	0.1	10	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	15/02/2023	Dinawan		Moderate	MGP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_805	Plot dimensions	50x20	Orientation of middle	19	
Easting 377211	Northing 6124624	IBRA region	Riverina	Photo #				
Plant Community Type		46				EEC: Yes	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	2
	Grasses etc.	8
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.4
	Grasses etc.	37.1
	Forbs	0.6
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	15	10	15	15
Average of the 5 subplots	15				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_805	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa nodosa	N	15		
GG	Austrostipa scabra	N	5		
FG	Calotis scabiosifolia var.	N	0.1	5	
GG	Chloris truncata	N	1		
GG	Enteropogon acicularis	N	10		
	Eragrostis cilianensis	E	0.1	4	
FG	Goodenia spp.	N	0.1	10	
FG	Leiocarpa panaetioides	N	0.1	1	
	Lolium rigidum	E	5		
SG	Maireana aphylla	N	1		
FG	Maireana pentagona	N	0.1	10	
FG	Ptilotus semilanatus	N	0.1	5	
FG	Rhodanthe corymbiflora	N	0.1	4	
GG	Rytidosperma caespitosum	N	0.1	10	
GG	Rytidosperma spp.	N	1		
SG	Sclerolaena muricata var.	N	0.4	5	
GG	Sporobolus caroli	N	3		
GG	Walwhalleya proluta	N	2		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	15/02/2023	Dinawan		Moderate	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_806	Plot dimensions	50x20	Orientation of middle	225
Easting 377024	Northing 6124547	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	8
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.4
	Grasses etc.	31.4
	Forbs	0.3
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	5	10	30	50
Average of the 5 subplots	22				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Redbrown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_806	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa scabra	N	0.1	10	
FG	Centipeda cunninghamii	N	0.1	50	
GG	Eleocharis pallens	N	5		
GG	Enteropogon acicularis	N	20		
GG	Eragrostis spp.	N	0.1	1	
	Lolium rigidum	E	5		
SG	Maireana aphylla	N	0.1	2	
SG	Maireana decalvans	N	0.1	5	
FG	Maireana pentagona	N	0.1	10	
EG	Marsilea drummondii	N	0.1	200	
FG	Ptilotus semilanatus	N	0.1		
GG	Rytidosperma caespitosum	N	5		
GG	Rytidosperma setaceum	N	0.1	10	
SG	Sclerolaena muricata var.	N	0.2	4	
GG	Sporobolus caroli	N	0.1	10	
GG	Walwhalleya proluta	N	1		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	15/02/2023	Dinawan Wind		Intact	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_807	Plot dimensions	50x20	Orientation of middle	121
Easting 354260	Northing 6132250	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	11
	Grasses etc.	6
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	6.8
	Grasses etc.	16.5
	Forbs	0.3
	Ferns	0
	Other	0
High Threat Weed cover		3

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	20
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	10	5	3	5
Average of the 5 subplots	5.6				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan Wind	DEH_W_807	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	10		
TG	Alectryon oleifolius	N	5		
SG	Atriplex leptocarpa	N	0.2	20	
SG	Atriplex semibaccata	N	0.6	20	
GG	Austrostipa scabra	N	5		
SG	Chenopodium nitrariaceum	N	0.7	1	
GG	Chloris truncata	N	0.2	10	
FG	Crassula spp.	N	0.1	20	
FG	Einadia nutans	N	0.2	30	
SG	Enchylaena tomentosa	N	0.5	20	
GG	Enteropogon acicularis	N	10		
	Lycium ferocissimum	HTE	3		
SG	Maireana aphylla	N	0.5	2	
SG	Maireana decalvans	N	0.1	1	
SG	Maireana spp.	N	0.1	5	
SG	Rhagodia spinescens	N	2		
GG	Rytidosperma caespitosum	N	1		
GG	Rytidosperma setaceum	N	0.1	20	
SG	Salsola tragus	N	1		
SG	Sclerolaena birchii	N	0.1	2	
SG	Sclerolaena muricata var.	N	1		
GG	Walwhalleya proluta	N	0.2		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	15/02/2023	Dinawan		DNG	Mgp and kk		
Zone 55	Datum GDA94	Plot ID	DEH_W_808	Plot dimensions	50x20	Orientation of middle	300
Easting 354213	Northing 6132147	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Myall	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	6
	Grasses etc.	4
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	0.6
	Grasses etc.	24
	Forbs	5.5
	Ferns	0
	Other	0
High Threat Weed cover		0.3

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	1	2	5	2	10
Average of the 5 subplots	4				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Flat	Soil Surface Texture	Red compacted
Soil Colour	Red	Site Drainage	Nil	Distance to nearest water	Unk

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_808	Mgp and kk

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex leptocarpa	N	0.1	20	
GG	Austrostipa nodosa	N	2	50	
GG	Austrostipa scabra	N	1	100	
FG	Boerhavia dominii	N	0.1	5	
FG	Chrysocephalum apiculatum	N	0.1	5	
FG	Dysphania pumilio	N	0.1	5	
GG	Enteropogon acicularis	N	20	200	
FG	Euphorbia drummondii	N	0.1	1	
	Heliotropium amplexicaule	HTE	0.2	100	Ground
	Hordeum leporinum	E	0.1	5	
SG	Maireana decalvans	N	0.1	1	
SG	Salsola tragus	N	0.1	20	
SG	Sclerolaena birchii	N	0.1	5	
SG	Sclerolaena muricata	N	0.1	20	
SG	Sclerolaena stelligera	N	0.1	1	
FG	Sida corrugata	N	5	200	
FG	Vittadinia cuneata	N	0.1	1	
GG	Walwhalleya proluta	N	1	100	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	15/02/2023	Dinawan		Mod_Good	MGP KK			
Zone 55	Datum GDA94	Plot ID	DEH_W_809	Plot dimensions	50x20	Orientation of middle	10	
Easting 357646	Northing 6123845	IBRA region	Riverina	Photo #				
Plant Community Type		160				EEC: No	Confidence H	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	6
	Forbs	6
	Ferns	2
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0.4
	Shrubs	45.4
	Grasses etc.	17.1
	Forbs	1
	Ferns	1.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	10	15	5	5
Average of the 5 subplots	11				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	3	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	3	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_809	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	0.4	1	
FG	Alternanthera denticulata	N	0.1	10	
FG	Calocephalus sonderi	N	0.1	5	
FG	Centipeda minima subsp.	N	0.5	100	
SG	Chenopodium nitrariaceum	N	40		
GG	Chloris truncata	N	0.4	50	
SG	Duma florulenta	N	5		
GG	Eleocharis pallens	N	15		
SG	Enchylaena tomentosa	N	0.1	5	
GG	Enteropogon acicularis	N	0.4	20	
GG	Eragrostis australasica	N	0.2	3	
FG	Euphorbia drummondii	N	0.1	10	
	Heliotropium europaeum	E	0.1	10	
GG	Juncus spp.	N	0.1	20	
SG	Maireana decalvans	N	0.1	5	
EG	Marsilea costulifera	N	0.1	50	
EG	Marsilea drummondii	N	1	1000	
SG	Sclerolaena muricata var.	N	0.2	10	
FG	Solanum esuriale	N	0.1	10	
FG	Teucrium racemosum	N	0.1	20	
GG	Walwhalleya proluta	N	1		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	15/02/2023	Dinawan		Mod_Good	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_810	Plot dimensions	50x20	Orientation of middle	130
Easting 360172	Northing 6125591	IBRA region	Riverina	Photo #			
Plant Community Type		160				EEC: No	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	6
	Forbs	4
	Ferns	2
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	58.2
	Grasses etc.	15.4
	Forbs	3.9
	Ferns	3.3
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	2	5	5	5	5
Average of the 5 subplots	4.4				

Notes	Too wet to run tape

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_810	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Amphibromus nervosus	N	0.1	20	
FG	Centipeda minima subsp.	N	0.1	5	
SG	Chenopodium nitrariaceum	N	50		
SG	Duma florulenta	N	8		
GG	Eleocharis acuta	N	5		
GG	Eragrostis australasica	N	10		
GG	Eragrostis setifolia	N	0.1	10	
GG	Juncus spp.	N	0.1	5	
GG	Lachnagrostis filiformis	N	0.1	5	
EG	Marsilea costulifera	N	0.3	200	
EG	Marsilea drummondii	N	3	500	
FG	Ottelia ovalifolia subsp. ovalifolia	N	3		
SG	Sclerolaena muricata var.	N	0.2	10	
FG	Stellaria angustifolia	N	0.7	20	
FG	Teucrium racemosum	N	0.1	20	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinawan		Low	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_811	Plot dimensions	50x20	Orientation of middle	103
Easting 361561	Northing 6129140	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	4
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	7
	Shrubs	2.9
	Grasses etc.	15
	Forbs	1.7
	Ferns	0
	Other	0
High Threat Weed cover		0.3

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	1
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	3
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	30	10	5	10
Average of the 5 subplots	14				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	2	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinawan	DEH_W_811	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex leptocarpa	N	1		
GG	Austrostipa scabra	N	3		
FG	Boerhavia dominii	N	0.1	10	
	Brassica spp.	E	0.5	20	
TG	Callitris glaucophylla	N	7		
	Cucumis myriocarpus subsp.	E	0.1	3	
FG	Dysphania pumilio	N	0.1	10	
GG	Enteropogon acicularis	N	10		
FG	Euphorbia drummondii	N	0.1	10	
	Heliotropium europaeum	E	0.3	100	
	Lepidium bonariense	E	0.1	6	
	Lolium rigidum	E	5		
	Lycium ferocissimum	HTE	0.2	1	
SG	Maireana brevifolia	N	0.3	3	
SG	Maireana decalvans	N	0.1	10	
SG	Maireana excavata	N	0.1	6	
FG	Malva spp.	N	0.1	1	
GG	Paspalidium constrictum	N	1		
GG	Rytidosperma caespitosum	N	1		
SG	Salsola tragus	N	0.3	10	
SG	Sclerolaena birchii	N	0.1	4	
SG	Sclerolaena muricata var.	N	1		
FG	Sida corrugata	N	1		
	Solanum nigrum	E	0.1	3	
	Trifolium arvense	E	5		
FG	Vittadinia cuneata	N	0.1	5	
	Xanthium spinosum	HTE	0.1	3	
FG	Zaleya galericulata	N	0.2	5	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	15/02/2023	Dinawan		Low	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_812	Plot dimensions	50x20	Orientation of middle	40
Easting 360051	Northing 6129613	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	6
	Forbs	7
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	0.6
	Grasses etc.	5.6
	Forbs	0.8
	Ferns	0
	Other	0.1
High Threat Weed cover		0.5

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	2
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	2
No. trees with hollows	1

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	10	10	20	15
Average of the 5 subplots	12				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern	Sand hill	Slope	Slight slope and undulation	Soil Surface Texture	Soft
Soil Colour	Light brown orange	Site Drainage	Minimal	Distance to nearest water	Unk

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)	0		
Soil erosion	1	O	
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage	1	NR	
Weediness	2	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	15/02/2023	Dinawan	DEH_W_812	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Anthosachne scabra	N	0.5		
SG	Atriplex leptocarpa	N	0.1	2	
GG	Austrostipa nodosa	N	0.1	5	
FG	Boerhavia dominii	N	0.1	1	
TG	Callitris glaucophylla	N	15	1	
FG	Chrysocephalum apiculatum	N	0.1	2	
OG	Convolvulus spp.	N	0.1	5	
	Conyza bonariensis	E	0.1	5	
	Cucumis myriocarpus subsp.	E	0.1	1	
FG	Dysphania pumilio	N	0.1	3	
GG	Enteropogon acicularis	N	2		
	Heliotropium europaeum	E	0.5	100	
	Hordeum leporinum	E	0.2	20	
	Lepidium africanum	E	0.1	10	
	Lolium rigidum	E	0.1	10	
SG	Maireana brevifolia	N	0.2	1	
	Malva parviflora	E	0.1		
GG	Paspalidium constrictum	N	1		
GG	Rytidosperma caespitosum	N	1		
SG	Salsola tragus	N	0.1	5	
SG	Sclerolaena birchii	N	0.1	2	
SG	Sclerolaena muricata	N	0.1	2	
FG	Sida corrugata	N	0.2	200	
FG	Solanum esuriale	N	0.1	50	
	Solanum nigrum	E	0.1	2	
	Trifolium arvense	E	0.2	20	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	1		
	Xanthium spinosum	HTE	0.5	50	
FG	Zaleya galericulata	N	0.1	10	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinewan		Thinned	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_813	Plot dimensions	50x20	Orientation of middle	128
Easting 358538	Northing 6135349	IBRA region	Riverina	Photo #			
Plant Community Type		15				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	8
	Grasses etc.	5
	Forbs	6
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	25
	Shrubs	12.3
	Grasses etc.	10.3
	Forbs	2.5
	Ferns	0.1
	Other	0
High Threat Weed cover		0.2

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	7
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	1	5	5	25
Average of the 5 subplots	11.2				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Clay loam
Soil Colour	Grey	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	Thinned
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinewan	DEH_W_813	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex leptocarpa	N	0.2	20	
GG	Austrostipa scabra	N	0.2	20	
FG	Boerhavia dominii	N	0.1	20	
SG	Chenopodium nitrariaceum	N	4		
SG	Duma florulenta	N	2	4	
FG	Einadia nutans	N	2		
SG	Enchylaena tomentosa	N	2		
GG	Enteropogon acicularis	N	4		
TG	Eucalyptus largiflorens	N	25		
FG	Goodenia glauca	N	0.1	5	
	Lycium ferocissimum	HTE	0.1	1	
SG	Maireana brevifolia	N	0.5	6	
SG	Maireana decalvans	N	0.5	8	
EG	Marsilea drummondii	N	0.1	100	
GG	Rytidosperma caespitosum	N	3		
SG	Salsola tragus	N	0.1	5	
SG	Sclerolaena muricata var.	N	3		
FG	Sida spp.	N	0.1	1	
GG	Sporobolus caroli	N	0.1	3	
FG	Teucrium racemosum	N	0.1	10	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	3		
	Xanthium spinosum	HTE	0.1	5	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinewan		Thinned	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_814	Plot dimensions	50x20	Orientation of middle	193
Easting 357519	Northing 6136327	IBRA region	Riverina	Photo #			
Plant Community Type		15				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	8
	Grasses etc.	5
	Forbs	9
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	25
	Shrubs	55
	Grasses etc.	2.8
	Forbs	1
	Ferns	0.2
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	1
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	8
No. trees with hollows	4

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	30	15	20	10
Average of the 5 subplots	17				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1	Soil Surface Texture	Clay loam
Soil Colour	Grey	Site Drainage	1	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	NR	Thinned
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinewan	DEH_W_814	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	0.1	5	
GG	Austrostipa aristiglumis	N	0.2	5	
FG	Boerhavia dominii	N	0.1	10	
FG	Centipeda minima subsp.	N	0.1	100	
SG	Chenopodium nitrariaceum	N	35		
SG	Duma florulenta	N	4		
	Echium spp.	E	0.1	3	
FG	Einadia nutans	N	0.1	30	
GG	Eleocharis pallens	N	0.5	40	
GG	Enteropogon acicularis	N	1		
TG	Eucalyptus largiflorens	N	25		
	Heliotropium europaeum	E	0.1	10	
SG	Maireana brevifolia	N	0.5	10	
SG	Maireana decalvans	N	0.2	20	
SG	Maireana excavata	N	0.1	5	
FG	Malva spp.	N	0.1	5	
EG	Marsilea drummondii	N	0.2	400	
FG	Rumex dumosus	N	0.1	5	
SG	Sclerolaena muricata var.	N	15		
SG	Sclerolaena stelligera	N	0.1	1	
FG	Sida spp.	N	0.1	2	
FG	Solanum esuriale	N	0.2	50	
FG	Sonchus spp.	N	0.1	3	
GG	Sporobolus caroli	N	0.1	10	
FG	Teucrium racemosum	N	0.1	20	
GG	Walwhalleya proluta	N	1		
	Xanthium spinosum	HTE	0.1	3	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinewan		Thinned	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_815	Plot dimensions	50x20	Orientation of middle	13
Easting 358443	Northing 6137003	IBRA region	Riverina	Photo #			
Plant Community Type		15				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	5
	Forbs	8
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	30
	Shrubs	18.2
	Grasses etc.	15.2
	Forbs	0.9
	Ferns	0.1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	1
30 - 49 cm	1
20 - 29cm	1
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	10
No. trees with hollows	3

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	5	20	15	1
Average of the 5 subplots	10.2				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	2	Soil Surface Texture	Clay loam
Soil Colour	Grey brown	Site Drainage	2	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	Thinned
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinewan	DEH_W_815	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	20	
SG	Atriplex leptocarpa	N	0.1	10	
GG	Austrostipa aristiglumis	N	0.1	1	
FG	Boerhavia dominii	N	0.1	20	
FG	Centipeda minima subsp.	N	0.1	5	
SG	Chenopodium nitrariaceum	N	10		
SG	Duma florulenta	N	7		
FG	Einadia nutans	N	0.2	20	
GG	Enteropogon acicularis	N	2		
TG	Eucalyptus largiflorens	N	30		
FG	Goodenia glauca	N	0.1	10	
GG	Juncus spp.	N	0.1	5	
SG	Maireana decalvans	N	0.1	10	
FG	Maireana enchylaenoides	N	0.1	8	
EG	Marsilea drummondii	N	0.1	100	
GG	Paspalidium jubiflorum	N	10		
SG	Sclerolaena muricata var.	N	1		
FG	Sida corrugata	N	0.1	10	
	Sida rhombifolia	E	0.1	10	
FG	Solanum esuriale	N	0.1	20	
	Sonchus oleraceus	E	0.1	5	
GG	Walwhalleya proluta	N	3		
	Xanthium spinosum	HTE	0.1	4	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinawan		Moderate	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_816	Plot dimensions	50x20	Orientation of middle	286
Easting 356479	Northing 6139471	IBRA region	Riverina	Photo #			
Plant Community Type		46				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	7
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	7.3
	Grasses etc.	47
	Forbs	0.7
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	30	25	10	5
Average of the 5 subplots	15				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Grey	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	0		
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinawan	DEH_W_816	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa aristiglumis	N	0.2	2	
GG	Austrostipa scabra	N	0.2	10	
	Avena fatua	E	0.1	5	
GG	Enteropogon acicularis	N	10		
GG	Eragrostis australasica	N	0.4	1	
FG	Goodenia pusilliflora	N	0.1	1	
FG	Leiocarpa panaetioides	N	0.1	1	
	Lolium rigidum	E	1		
SG	Maireana aphylla	N	7		
FG	Maireana pentagona	N	0.1	5	
FG	Rhodanthe corymbiflora	N	0.1	2	
GG	Rytidosperma caespitosum	N	1		
SG	Sclerolaena muricata var.	N	0.2	5	
SG	Sclerolaena stelligera	N	0.1	5	
FG	Sida corrugata	N	0.1	5	
GG	Sporobolus caroli	N	0.2	20	
FG	Teucrium racemosum	N	0.1	5	
FG	Vittadinia cuneata	N	0.1	3	
GG	Walwhalleya proluta	N	35		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinewan		Moderate	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_817	Plot dimensions	50x20	Orientation of middle	32
Easting 362855	Northing 6137350	IBRA region	Riverina	Photo #			
Plant Community Type		46				EEC: Yes	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	5
	Grasses etc.	11
	Forbs	6
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	3.7
	Grasses etc.	61.8
	Forbs	1.8
	Ferns	0.1
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	3	20	15	5	2
Average of the 5 subplots	9				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay loam
Soil Colour	Grey	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinewan	DEH_W_817	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa bigeniculata	N	0.2	10	
GG	Austrostipa nodosa	N	10		
GG	Austrostipa scabra	N	4		
	Avena fatua	E	0.2	20	
FG	Calotis scabiosifolia	N	1		
GG	Chloris truncata	N	0.2	30	
SG	Duma florulenta	N	0.5	1	
GG	Eleocharis pallens	N	0.2	30	
GG	Enteropogon acicularis	N	15		
FG	Leucochrysum molle	N	0.4	50	
	Lolium rigidum	E	3		
SG	Maireana aphylla	N	2		
SG	Maireana decalvans	N	0.1	10	
SG	Maireana excavata	N	0.1	5	
FG	Maireana pentagona	N	0.1	10	
EG	Marsilea drummondii	N	0.1	100	
GG	Rytidosperma caespitosum	N	1		
GG	Rytidosperma duttonianum	N	1		
SG	Sclerolaena muricata var.	N	1		
FG	Solanum esuriale	N	0.1	20	
GG	Sporobolus caroli	N	0.1	20	
FG	Teucrium racemosum	N	0.1	10	
GG	Tragus australianus	N	0.1	2	
FG	Vittadinia cuneata	N	0.1	5	
GG	Walwhalleya proluta	N	30		
	Xanthium spinosum	HTE	0.1	2	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	16/02/2023	Dinawan		Sparse	MGP and KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_818	Plot dimensions	50x20	Orientation of middle	290
Easting 364002	Northing 6140585	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Weeping myall	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	7
	Grasses etc.	5
	Forbs	5
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	6.1
	Shrubs	3.9
	Grasses etc.	13.1
	Forbs	0.9
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	1
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	12
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	10	10	5	5
Average of the 5 subplots	9				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Nil	Soil Surface Texture	Red brown compacted
Soil Colour	Red to light brown	Site Drainage	Nil	Distance to nearest water	Unk

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	1	NR	
Fire damage			
Storm damage			
Weediness			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	16/02/2023	Dinawan	DEH_W_818	MGP and KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia oswaldii	N	0.1	1	
TG	Acacia pendula	N	6	1	
SG	Atriplex semibaccata	N	1		
GG	Austrostipa scabra	N	5		
FG	Einadia nutans	N	0.5	20	
SG	Enchylaena tomentosa	N	0.1		
GG	Enteropogon acicularis	N	5		
GG	Juncus spp.	N	0.1	10	
SG	Maireana decalvans	N	0.5		
EG	Marsilea drummondii	N	0.1	10	
SG	Rhagodia spinescens	N	2		
GG	Rytidosperma caespitosum	N	2		
SG	Salsola tragus	N	0.1	10	
SG	Sclerolaena muricata	N	0.1	1	
SG	Sclerolaena stelligera	N	0.1	10	
FG	Sida corrugata	N	0.1	10	
FG	Solanum coactiliferum	N	0.1		
FG	Teucrium racemosum	N	0.1	1	
FG	Vittadinia cuneata	N	0.1	1	
GG	Walwhalleya proluta	N	1		

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	17/02/2023	Dinawan		Intact	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_819	Plot dimensions	50x20	Orientation of middle	212
Easting 380768	Northing 6117093	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Yes	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	2
	Grasses etc.	9
	Forbs	10
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	20
	Shrubs	2.1
	Grasses etc.	26.4
	Forbs	1.1
	Ferns	0
	Other	0.1
High Threat Weed cover		0.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	1
Length of logs (m)	2
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	15	10	3	30	50
Average of the 5 subplots	21.6				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay
Soil Colour	Red brown	Site Drainage	0	Distance to nearest water	

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	NR	
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood/CWD removal	0		
Grazing (identify native/livestock	1	R	
Fire damage	0		
Storm damage	0		
Weediness	1		
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	17/02/2023	Dinawan	DEH_W_819	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	20		
SG	Atriplex semibaccata	N	0.1	2	
GG	Austrostipa aristiglumis	N	1		
GG	Austrostipa bigeniculata	N	10		
GG	Austrostipa nodosa	N	2		
GG	Austrostipa scabra	N	2		
FG	Calocephalus sonderi	N	0.1	1	
OG	Convolvulus spp.	N	0.1	20	
GG	Enteropogon acicularis	N	10		
FG	Euphorbia drummondii	N	0.1	10	
	Heliotropium europaeum	E	0.1	30	
GG	Juncus spp.	N	0.1	5	
FG	Maireana pentagona	N	0.1	10	
FG	Oxalis perennans	N	0.1	3	
FG	Ptilotus semilanatus	N	0.1	10	
GG	Rytidosperma caespitosum	N	0.2	20	
GG	Rytidosperma setaceum	N	0.1	10	
SG	Sclerolaena muricata var.	N	2		
FG	Sida corrugata	N	0.2	70	
FG	Solanum coactiliferum	N	0.1	2	
FG	Solanum esuriale	N	0.1	10	
FG	Teucrium racemosum	N	0.1	20	
FG	Vittadinia cuneata	N	0.1	4	
GG	Walwhalleya proluta	N	1		
	Xanthium spinosum	HTE	0.1	3	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	17/02/2023	Dinewan		Sparse	MGP KK		
Zone 55	Datum GDA94	Plot ID	DEH_W_820	Plot dimensions	50x20	Orientation of middle	260
Easting 381861	Northing 6117368	IBRA region	Riverina	Photo #			
Plant Community Type		26				EEC: Myall	Confidence H

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	2
	Grasses etc.	7
	Forbs	4
	Ferns	0
	Other	1
Sum of Cover of native vascular plans by growth form group	Trees	0.5
	Shrubs	0.7
	Grasses etc.	10.3
	Forbs	0.4
	Ferns	0
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	1
Length of logs (m)	3
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	2	5	2	5	5
Average of the 5 subplots	3.8				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	Nil	Soil Surface Texture	Compacted red clay loam
Soil Colour	Red	Site Drainage	Nil	Distance to nearest water	Unk

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	1	O	
Cultivation (inc. pasture)			
Soil erosion	1	R	
Firewood/CWD removal			
Grazing (identify native/livestock	1	R	
Fire damage			
Storm damage			
Weediness	1	R	
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	17/02/2023	Dinewan	DEH_W_820	MGP KK

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	0.5	4	
GG	Austrostipa bigeniculata	N	0.1	5	
GG	Austrostipa nodosa	N	0.5	50	
GG	Austrostipa scabra	N	5		
FG	Calocephalus sonderi	N	0.1	1	
GG	Chloris truncata	N	0.5	50	
OG	Convolvulus spp.	N	0.1	5	
GG	Juncus spp.	N	0.2	40	
SG	Maireana excavata	N	0.5	50	
FG	Maireana pentagona	N	0.1	5	
FG	Ptilotus semilanatus	N	0.1	2	
GG	Rytidosperma caespitosum	N	2		
GG	Rytidosperma duttonianum	N	2		
SG	Sclerolaena muricata	N	0.2		
FG	Sida corrugata	N	0.1	20	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	20/11/2023	Dinawan		Intact	NL & DM			
Zone 55	Datum GDA94	Plot ID	DEH_W_900	Plot dimensions	50x20	Orientation of middle	40	
Easting 359266	Northing 6141778	IBRA region	Riverina	Photo #				
Plant Community Type		26				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	7
	Grasses etc.	7
	Forbs	8
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	7
	Shrubs	22.5
	Grasses etc.	34.1
	Forbs	1.7
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	1
5 - 9 cm	1
< 5 cm	0
Length of logs (m)	1
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	5	15	10	20	10
Average of the 5 subplots	12				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay loam
Soil Colour	Red brown	Site Drainage	Moderate	Distance to nearest water	300 metres

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	20/11/2023	Dinawan	DEH_W_900	NL & DM

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
TG	Acacia pendula	N	7	3	
SG	Atriplex leptocarpa	N	0.1	10	
SG	Atriplex semibaccata	N	0.1	1	
GG	Austrostipa scabra	N	1	200	
	Avena spp.	E	0.1	1	
FG	Calotis hispidula	N	0.5	100	
FG	Calotis scabiosifolia	N	0.2	100	
GG	Chloris truncata	N	0.1	1	
FG	Einadia nutans	N	0.1	10	
SG	Enchylaena tomentosa	N	0.1	1	
GG	Enteropogon acicularis	N	2	100	
FG	Leiocarpa brevicompta	N	0.1	1	
FG	Leiocarpa panaetioides	N	0.1	10	
	Lolium rigidum	E	0.5	200	
SG	Maireana aphylla	N	15	100	
FG	Maireana pentagona	N	0.1	1	
SG	Rhagodia spinescens	N	7	20	
GG	Rytidosperma caespitosum	N	3	300	
GG	Rytidosperma setaceum	N	4	700	
SG	Salsola tragus	N	0.1	1	
SG	Sclerolaena muricata var.	N	0.1	1	
FG	Sida cunninghamii	N	0.5	100	
GG	Sporobolus caroli	N	4	600	
FG	Vittadinia cuneata	N	0.1	1	
	Vulpia bromoides	E	0.1	50	
GG	Walwhalleya proluta	N	20	1000	

BAM Plot Data Sheet								Site Sheet no: 1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	20/11/2023	Dinawan		Moderate	DM & NL			
Zone 55	Datum GDA94	Plot ID	DEH_W_901	Plot dimensions	50x20	Orientation of middle	320	
Easting 355957	Northing 6139996	IBRA region	Riverina	Photo #				
Plant Community Type		160				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	5
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	5.2
	Grasses etc.	25.7
	Forbs	0.3
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	0	5	0	0
Average of the 5 subplots	1				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay loam
Soil Colour	Brown	Site Drainage	Poor	Distance to nearest water	1.3 km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	20/11/2023	Dinawan	DEH_W_901	DM & NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	1	
FG	Brachyscome spp.	N	0.1	1	
SG	Chenopodium nitrariaceum	N	5	20	
SG	Duma florulenta	N	0.1	1	
GG	Eleocharis pallens	N	15	500	
GG	Enteropogon acicularis	N	0.1	1	
GG	Eragrostis australasica	N	0.5	40	
GG	Juncus spp.	N	0.1	1	
FG	Leiocarpa brevicompta	N	0.1	1	
	Lolium rigidum	E	0.2	100	
SG	Maireana aphylla	N	0.1	1	
EG	Marsilea drummondii	N	0.1	1	
	Vulpia bromoides	E	0.1	1	
GG	Walwhalleya proluta	N	10	300	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2023	Dinawan		Mod_Good	DM & NL		
Zone 55	Datum GDA94	Plot ID	DEH_W_902	Plot dimensions	50x20	Orientation of middle	270
Easting 355131	Northing 6139356	IBRA region	Riverina	Photo #			
Plant Community Type		160				EEC: None	Confidence L

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	4
	Forbs	4
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	17.1
	Grasses etc.	53.1
	Forbs	0.4
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	0	5	0	5	0
Average of the 5 subplots	2				

Notes	Unsure of PCT. Mapped as 26. Unlikely to be 26 though.

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Clay loam
Soil Colour	Brown	Site Drainage	Moderate	Distance to nearest water	2.1km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2023	Dinawan	DEH_W_902	DM & NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.1	1	
	Avena spp.	E	0.1	1	
SG	Chenopodium nitrariaceum	N	10	10	
SG	Duma florulenta	N	7	30	
GG	Enteropogon acicularis	N	1	100	
GG	Eragrostis australasica	N	2	30	
FG	Euphorbia drummondii	N	0.1	1	
GG	Juncus spp.	N	0.1	1	
FG	Leiocarpa spp.	N	0.1	1	
	Lolium rigidum	E	1	100	
EG	Marsilea drummondii	N	0.1	100	
SG	Sclerolaena muricata var. villosa	N	0.1	1	
FG	Solanum esuriale	N	0.1	1	
GG	Walwhalleya proluta	N	50	2000	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2023	Dinawan		Low	DM & NL		
Zone 55	Datum GDA94	Plot ID	DEH_W_903	Plot dimensions	50x20	Orientation of middle	230
Easting 358131	Northing 6130642	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: None	Confidence L

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	1
	Grasses etc.	3
	Forbs	4
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0.1
	Shrubs	0.1
	Grasses etc.	31.5
	Forbs	0.9
	Ferns	0
	Other	0
High Threat Weed cover		0.4

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	10	10	5	10	15
Average of the 5 subplots	10				

Notes	White cypress western rosewood sparse canopy, Nida Goosefoot. PCT mapping hasnt been done

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Sandy loam
Soil Colour	Yellow brown	Site Drainage	Moderate	Distance to nearest water	1.1km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2023	Dinawan	DEH_W_903	DM & NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa scabra	N	1	100	
	Avena spp.	E	2	100	
FG	Boerhavia dominii	N	0.1	1	
FG	Boerhavia repleta	N	0.1	1	
TG	Callitris glaucophylla	N	0.1	1	
	Echium plantagineum	E	0.1	1	
GG	Enteropogon acicularis	N	30	1000	
	Hordeum spp.	E	0.1	1	
	Lepidium africanum	E	0.1	1	
	Lolium rigidum	E	0.1	1	
	Lycium ferocissimum	HTE	0.4	3	
	Medicago truncatula	E	5	500	
GG	Rytidosperma caespitosum	N	0.5	100	
SG	Sclerolaena muricata var.	N	0.1	1	
FG	Sida corrugata	N	0.5	100	
FG	Solanum esuriale	N	0.2	100	
	Sonchus oleraceus	E	0.1	100	
	Trifolium arvense	E	15	1000	
	Vulpia bromoides	E	15	1000	
	Vulpia myuros	E	5	700	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	21/11/2023	Dinawan		Moderate	NL & DM			
Zone 55	Datum GDA94	Plot ID	DEH_W_904	Plot dimensions	50x20	Orientation of middle	10	
Easting 358641	Northing 6125950	IBRA region	Riverina	Photo #				
Plant Community Type		10				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	4
	Forbs	5
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	15
	Shrubs	1.8
	Grasses etc.	5.7
	Forbs	2.6
	Ferns	0
	Other	0
High Threat Weed cover		1.1

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	0
50 - 79 cm	0
30 - 49 cm	2
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	3
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	40	30	30	30	20
Average of the 5 subplots	30				

Notes	

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	1 degree WSW aspect	Soil Surface Texture	Sandy loam
Soil Colour	Red brown	Site Drainage	Moderate	Distance to nearest water	1.6km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2023	Dinawan	DEH_W_904	NL & DM

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
SG	Atriplex semibaccata	N	0.5	20	
GG	Austrostipa nodosa	N	0.1	10	
GG	Austrostipa scabra	N	0.5	100	
FG	Boerhavia dominii	N	0.1	10	
TG	Callitris glaucophylla	N	15	1	
	Echium plantagineum	E	0.1	10	
FG	Einadia nutans	N	0.2	3	
GG	Enteropogon acicularis	N	5	300	
	Heliotropium europaeum	E	0.2	100	
	Hordeum spp.	E	7	1000	
	Lolium rigidum	E	4	800	
	Lycium ferocissimum	HTE	1	10	
	Malva parviflora	E	0.1	1	
	Marrubium vulgare	E	1	10	
	Medicago truncatula	E	0.1	1	
FG	Oxalis perennans	N	0.1	10	
SG	Rhagodia spinescens	N	0.1	1	
SG	Salsola tragus	N	0.1	1	
SG	Sclerolaena birchii	N	0.1	4	
SG	Sclerolaena muricata var.	N	1	8	
FG	Sida corrugata	N	2	300	
	Sisymbrium spp.	E	0.1	1	
FG	Solanum esuriale	N	0.2	100	
GG	Sporobolus caroli	N	0.1	1	
	Tribulus terrestris	E	0.1	1	
	Trifolium arvense	E	1	300	
	Vulpia bromoides	E	5	1000	
	Xanthium spinosum	HTE	0.1	1	

BAM Plot Data Sheet							Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders		
Date	21/11/2023	Dinawan		Low	DM & NL		
Zone 55	Datum GDA94	Plot ID	DEH_W_905	Plot dimensions	50x20	Orientation of middle	260
Easting 357939	Northing 6126527	IBRA region	Riverina	Photo #			
Plant Community Type		28				EEC: None	Confidence M

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	3
	Grasses etc.	4
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	0
	Shrubs	1.2
	Grasses etc.	9.2
	Forbs	12.9
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	# Tree Stems Count
DBH	
80+ cm	0
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	0
No. trees with hollows	0

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	20	10	10	30	10
Average of the 5 subplots	16				

Notes	Pine and myall

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Sandy loam
Soil Colour	Red brown	Site Drainage	Moderate	Distance to nearest water	1.2km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)	2	O	
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2023	Dinawan	DEH_W_905	DM & NL

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
GG	Austrostipa nodosa	N	0.2	30	
GG	Austrostipa scabra	N	1	100	
	Avena spp.	E	8	1000	
FG	Boerhavia dominii	N	0.5	200	
	Echium plantagineum	E	0.1	1	
GG	Enteropogon acicularis	N	6	300	
FG	Euphorbia drummondii	N	0.1	1	
	Heliotropium europaeum	E	0.5	200	
	Hordeum spp.	E	20	2000	
FG	Maireana enchylaenoides	N	0.1	1	
	Medicago truncatula	E	0.1	30	
SG	Rhagodia spinescens	N	0.1	1	
GG	Rytidosperma setaceum	N	2	200	
SG	Salsola tragus	N	0.1	5	
SG	Sclerolaena birchii	N	1	30	
FG	Sida corrugata	N	10	500	
FG	Sida cunninghamii	N	0.2	30	
FG	Solanum esuriale	N	2	500	
	Sonchus oleraceus	E	0.1	1	
	Trifolium arvense	E	4	200	
	Vulpia bromoides	E	15	1000	

BAM Plot Data Sheet								Site Sheet no:1 of 2
		Survey Name		Veg Zone ID	Recorders			
Date	21/11/2023	Dinawan		Moderate	NL & DM			
Zone 55	Datum GDA94	Plot ID	DEH_W_906	Plot dimensions	50x20	Orientation of middle	60	
Easting 357292	Northing 6127374	IBRA region	Riverina	Photo #				
Plant Community Type		10				EEC: None	Confidence M	

BAM Attribute (400m2 plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	5
	Grasses etc.	3
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plans by growth form group	Trees	10
	Shrubs	31.2
	Grasses etc.	13.1
	Forbs	0.7
	Ferns	0.1
	Other	0
High Threat Weed cover		0

BAM Attribute (1000m2 plot)	
DBH	# Tree Stems Count
80+ cm	1
50 - 79 cm	0
30 - 49 cm	0
20 - 29cm	0
10 - 19 cm	0
5 - 9 cm	0
< 5 cm	0
Length of logs (m)	20
No. trees with hollows	2

BAM Attibute (1 x 1m plots)	Litter cover (%)				
Subplot score (% in each)	50	15	10	20	25
Average of the 5 subplots	24				

Notes	Confirm PCT. River rRed woodland wetland. Nitre goosefoot dominating understory with Lignum

Physiography + site features that may help in determining PCT and Management Zone

Landform Pattern		Slope	0	Soil Surface Texture	Sandy loam
Soil Colour	Dull brown	Site Drainage	Moderate	Distance to nearest water	1.9km

Plot Disturbance	Severity code	Age code	Observational evidence
Clearing inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood/CWD removal			
Grazing (identify native/livestock	2	R	
Fire damage			
Storm damage			
Weediness			
Other			

400 m2 plot: Sheet 2 of 2		**Survey Name**	**Plot ID**	**Recorders**
Date	21/11/2023	Dinawan	DEH_W_906	NL & DM

GF Code	Genus species	N,E or HTE	Cover	Abund	Stratum
FG	Alternanthera denticulata	N	0.5	100	
SG	Atriplex leptocarpa	N	0.1	1	
SG	Atriplex semibaccata	N	1	100	
GG	Carex inversa	N	8	700	
SG	Chenopodium nitrariaceum	N	25	50	
SG	Duma florulenta	N	5	40	
	Echium plantagineum	E	0.5	50	
FG	Einadia nutans	N	0.1	8	
TG	Eucalyptus camaldulensis	N	10	2	
	Hordeum spp.	E	4	500	
GG	Juncus flavidus	N	5	700	
	Lepidium africanum	E	0.2	100	
	Lolium rigidum	E	0.1	1	
	Marrubium vulgare	E	0.1	1	
EG	Marsilea drummondii	N	0.1	100	
FG	Rumex brownii	N	0.1	10	
SG	Salsola tragus	N	0.1	1	
	Sisymbrium spp.	E	1	500	
	Sonchus oleraceus	E	0.1	1	
	Trifolium arvense	E	0.5	100	
GG	Tripogon loliiformis	N	0.1	1	
	Vulpia bromoides	E	3	400	
	Vulpia myuros	E	0.1	40	

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Appendix 4. Fauna

Table A 5: Fauna species recorded at the subject land

Common name	Scientific name
Mammals	
Red Kangaroo	*Macropus rufus*
Eastern Grey Kangaroo	*Macropus giganteus*
House Mouse	*Mus musculus*
Brown Hare	*Lepus capensis*
Rabbit	*Oryctolagus cuniculus*
Fox	*Vulpes vulpes*
Cat	*Felis catus*
Birds	
Noisy Miner	*Manorina melanocephala*
Crested Pigeon	*Ocyphaps lophotes*
Grey Butcherbird	*Cracticus torquatus*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Pied Butcherbird	*Cracticus nigrogularis*
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Nankeen Kestrel	*Falco cenchroides cenchroides*
Black-shouldered Kite	*Elanus axillaris*
Wedge-tailed Eagle	*Aquila audax*
Blue Bonnet	*Northiella haematogaster*
Emu	*Dromaius novaehollandiae*
Australasian Pipit	*Anthus novaeseelandiae*
White-winged Fairy-wren	*Malurus leucopterus*
Black Kite	*Milvus migrans*
Magpie-lark	*Grallina cyanoleuca*
Galah	*Eolophus roseicapilla*
Red-rumped Parrot	*Psephotus haematonotus*
White-necked Heron	*Ardea pacifica*
White-faced Heron	*Egretta novaehollandiae*
Welcome Swallow	*Hirundo neoxena*
Black Swan	*Cygnus atratus*
Banded Lapwing	*Vanellus tricolor*

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Common name	Scientific name
Apostlebird	*Struthidea cinerea*
Crimson Chat	*Ephthianura tricolor*
Tree Martin	*Petrochelidon nigricans*
Glossy Ibis	*Plegadis falcinellus*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Superb Fairy-wren	*Malurus cyaneus*
Southern Whiteface	*Aphelocephala leucopsis*
Chestnut-rumped Thornbill	*Acanthiza uropygialis*
Striated Pardalote	*Pardalotus striatus*
Red-capped Robin	*Petroica goodenovii*
Yellow Thornbill	*Acanthiza nana*
Brown Falcon	*Falco berigora*
Pacific Black Duck	*Anas superciliosa*
Yellow-throated Miner	*Manorina flavigula*
Grey-crowned Babbler	*Pomatostomus temporalis*
Willie Wagtail	*Rhipidura leucophrys*
Brown Songlark	*Cincloramphus cruralis*
Black-faced Woodswallow	*Artamus cinereus*
Australian Wood Duck	*Chenonetta jubata*
Zebra Finch	*Taeniopygia guttata*
Straw-necked Ibis	*Threskiornis spinicollis*
Common Starling	*Sturnus vulgaris*
Black Falcon	*Falco subniger*
White-winged Chough	*Corcorax melanorhamphos*
Australian Ringneck	*Barnardius zonarius*
Yellow-throated Scrubwren	*Sericornis citreogularis*
Singing Honeyeater	*Gavicalis virescens*
Brown Goshawk	*Accipiter fasciatus*
Common Bronzewing	*Phaps chalcoptera*
White-fronted Chat	*Epthianura albifrons*
Plumed Whistling-Duck	*Dendrocygna eytoni*
Black-tailed Native-hen	*Tribonyx ventralis*
Masked Lapwing	*Vanellus miles*
Stubble Quail	*Coturnix pectoralis*
Little Raven	*Corvus mellori*
White-plumed Honeyeater	*Lichenostomus penicillatus*

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Common name	Scientific name
House Sparrow	*Passer domesticus*
Hoary-headed Grebe	*Poliocephalus poliocephalus*
Sacred Kingfisher	*Todiramphus sanctus*
Little Grassbird	*Poodytes gramineus*
Rufous Songlark	*Cincloramphus mathewsi*
Rainbow Bee-eater	*Merops ornatus*
Horsfield's Bronze-Cuckoo	*Chalcites basalis*
Grey Teal	*Anas gracilis*
Pink-eared Duck	*Malacorhynchus membranaceus*
Eurasian Skylark	*Alauda arvensis*
Australasian Grebe	*Tachybaptus novaehollandiae*
Australian King Parrot	*Alisterus scapularis*
Mulga Parrot	*Psephotus varius*
Rufous Whistler	*Pachycephala rufiventris*
Striated Thornbill	*Acanthiza lineata*
Black-fronted Dotterel	*Elesyornis melanops*
Chestnut Teal	*Anas castanea*
Gull-billed Tern	*Gelochelidon nilotica*
Whistling Kite	*Haliastur sphenurus*
Superb Parrot	*Polytelis swainsonii*
Yellow-plumed Honeyeater	*Lichenostomus ornatus*
Restless Flycatcher	*Myiagra inquieta*
Brown Thornbill	*Acanthiza pusilla*
Peaceful Dove	*Geopelia striata*
Weebill	*Smicrornis brevirostris*
Pallid Cuckoo	*Cuculus pallidus*
Intermediate Egret	*Ardea intermedia*
Spotted Harrier	*Circus assimilis*
Ground Cuckoo-shrike	*Coracina maxima*
Eastern Rosella	*Platycercus eximius*
Fuscous Honeyeater	*Lichenostomus fuscus*
Little Egret	*Egretta garzetta*
Red Wattlebird	*Anthochaera carunculata*
Pied Cormorant	*Phalacrocorax varius*
Swamp Harrier	*Circus approximans*
Australian Hobby	*Falco longipennis*

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Common name	Scientific name
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*
Great Egret	*Ardea alba*
Buff-rumped Thornbill	*Acanthiza reguloides*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Grey Fantail	*Rhipidura fuliginosa*
Jacky Winter	*Microeca fascinans*
Grey Shrike-thrush	*Colluricincla harmonica*
White-winged Triller	*Lalage sueurii*
White-fronted Honeyeater	*Phylidonyris albifrons*
Pied Currawong	*Strepera graculina*
Redthroat	*Pyrrholaemus brunneus*
Singing Bushlark	*Mirafra javanica*
Blue-faced Honeyeater	*Entomyzon cyanotis*
Crimson Rosella	*Platycercus elegans*
Western Gerygone	*Gerygone fusca*
Rainbow Lorikeet	*Trichoglossus haematodus*
Black Honeyeater	*Certhionyx niger*
Australian White Ibis	*Threskiornis moluccus*
Masked Woodswallow	*Artamus personatus*
Fairy Martin	*Petrochelidon ariel*
Striped Honeyeater	*Plectorhyncha lanceolata*
Cockatiel	*Nymphicus hollandicus*
Sulphur-crested Cockatoo	*Cacatua galerita*
Laughing Kookaburra	*Dacelo novaeguineae*
Brown-headed Honeyeater	*Melithreptus brevirostris*
Yellow-billed Spoonbill	*Platalea flavipes*
Little Corella	*Cacatua sanguinea*
Little Pied Cormorant	*Microcarbo melanoleucos*
Mistletoebird	*Dicaeum hirundinaceum*
Common Myna	*Acridotheres tristis*
Australian Pelican	*Pelecanus conspicillatus*
Nankeen Kestrel	*Falco cenchroides*
Galah	*Eolophus roseicapillus*
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*
White-browed Woodswallow	*Artamus superciliosus*
Australian Magpie	*Cracticus tibicen*

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Common name	Scientific name
Grey-crowned Babbler eastern subspecies	*Pomatostomus temporalis temporalis*
Common Myna	*Sturnus tristis*
Little Grassbird	*Megalurus gramineus*
Hardhead	*Aythya australis*
Black-winged Stilt	*Himantopus himantopus*
Budgerigar	*Melopsittacus undulatus*
Purple Swamphen	*Porphyrio porphyrio*
Black-fronted Dotterel	*Elseyornis melanops*
Painted Honeyeater	*Grantiella picta*
Australian Spotted Crake	*Porzana fluminea*
Diamond Firetail	*Stagonopleura guttata*
Mallee Ringneck	*Barnardius zonarius barnardi*
Australian White Ibis	*Threskiornis molucca*
Royal Spoonbill	*Platalea regia*
Pallid Cuckoo	*Cacomantis pallidus*
Fork-tailed Swift	*Apus pacificus*
Reptiles	
Lace Monitor	*Varanus varius*
Gould's Goanna	*Varanus gouldii*
Eastern Blue-tongue lizard	*Tiliqua scincoides*
Shingle-back	*Tiliqua rugosa*
Central Bearded Dragon	*Pogona vitticeps*
Bearded Dragon	*Pogona barbata*
Patternless Delma	*Delma inornata*
Eastern Brown Snake	*Pseudonaja textilis*
Frogs	
Spotted Grass Frog	*Limnodynastes tasmaniensis*
Eastern Sign-bearing Froglet	*Crinia parinsignifera*
Sudell's Frog	*Neobatrachus sudelli*
Southern Bell Frog	*Litoria raniformis*
Eastern Banjo Frog	*Limnodynastes dumerilii*
Peron's Tree Frog	*Litoria peronii*
Crucifix Frog	*Notaden bennettii*
Fish	
Carp	*Cyprinus carpio*
Mosquito Fish	*Gambusia holbrooki*

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Table A 5: Bird species recorded at BUS points

Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Apostlebird ***Struthidea cinerea***	Not Listed			Y		Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y		Y		Y	Y
Australasian Grebe ***Tachybaptus novaehollandiae***	Not Listed	Y	Y						Y									Y										
Australasian Pipit ***Anthus novaeseelandiae***	Not Listed	Y	Y			Y			Y		Y	Y		Y		Y		Y	Y	Y	Y	Y		Y		Y	Y	Y
Australian Hobby ***Falco longipennis***	Not Listed																	Y					Y	Y				
Australian King Parrot ***Alisterus scapularis***	Not Listed			Y																								
Australian Magpie ***Gymnorhina tibicen***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Australian Pelican ***Pelecanus conspicillatus***	Not Listed	Y																										
Australian Raven ***Corvus coronoides***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Australian Ringneck ***Barnardius zonarius***	Not Listed	Y		Y		Y	Y		Y	Y	Y				Y		Y	Y		Y		Y	Y		Y	Y	Y	Y
Australian White Ibis ***Threskiornis molucca***	Not Listed	Y																										
Australian Wood Duck ***Chenonetta jubata***	Not Listed	Y		Y		Y				Y	Y			Y				Y					Y	Y		Y		
Banded Lapwing ***Vanellus tricolor***	Not Listed																									Y		
Black Falcon ***Falco subniger***	Vulnerable, BC Act								Y	Y	Y	Y					Y				Y				Y			
Black Honeyeater ***Certhionyx niger***	Not Listed								Y			Y																
Black Kite ***Milvus migrans***	Not Listed	Y	Y	Y		Y			Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y			Y	Y	Y
Black Swan ***Cygnus atratus***	Not Listed	Y																								Y		
Black-faced Cuckoo-shrike ***Coracina novaehollandiae***	Not Listed	Y		Y	Y	Y	Y		Y		Y	Y		Y		Y	Y	Y		Y	Y	Y	Y	Y	Y			
Black-faced Woodswallow ***Artamus cinereus***	Not Listed	Y											Y		Y		Y			Y								
Black-fronted Dotterel ***Elseyornis melanops***	Not Listed	Y																Y										

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Black-shouldered Kite ***Elanus axillaris***	Not Listed	Y	Y		Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y
Black-tailed Native-hen ***Tribonyx ventralis***	Not Listed	Y							Y									Y									Y	
Blue Bonnet ***Northiella haematogaster***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Blue-faced Honeyeater ***Entomyzon cyanotis***	Not Listed					Y				Y												Y						
Brown Falcon ***Falco berigora***	Not Listed	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y	Y	Y
Brown Goshawk ***Accipiter fasciatus***	Not Listed	Y								Y																		
Brown Songlark ***Cincloramphus cruralis***	Not Listed		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y		Y		Y
Brown Thornbill ***Acanthiza pusilla***	Not Listed			Y														Y		Y				Y				
Brown-headed Honeyeater ***Melithreptus brevirostris***	Not Listed																	Y										
Buff-rumped Thornbill ***Acanthiza reguloides***	Not Listed	Y																Y		Y								
Chestnut Teal ***Anas castanea***	Not Listed	Y																										
Chestnut-rumped Thornbill ***Acanthiza uropygialis***	Not Listed			Y														Y						Y				
Cockatiel ***Nymphicus hollandicus***	Not Listed									Y																		
Common Bronzewing ***Phaps chalcoptera***	Not Listed								Y									Y										
Common Myna ***Acridotheres tristis***	Not Listed																						Y					
Common Starling ***Sturnus vulgaris***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Crested Pigeon ***Ocyphaps lophotes***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Crimson Chat ***Ephthianura tricolor***	Not Listed												Y			Y												
Crimson Rosella ***Platycercus elegans***	Not Listed				Y																							
Eastern Rosella ***Platycercus eximius***	Not Listed					Y	Y			Y								Y					Y	Y			Y	

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Emu *Dromaius novaehollandiae*	Not Listed								Y									Y	Y				Y					
Eurasian Skylark *Alauda arvensis*	Not Listed											Y	Y	Y					Y									Y
Fairy Martin *Petrochelidon ariel*	Not Listed																	Y										
Fuscous Honeyeater *Ptilotula fusca*	Not Listed																							Y				
Galah *Eolophus roseicapilla*	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Glossy Ibis *Plegadis falcinellus*	Not Listed					Y																						
Great Egret *Ardea alba*	Not Listed	Y																										
Grey Butcherbird *Cracticus torquatus*	Not Listed	Y		Y	Y	Y	Y				Y			Y	Y					Y		Y	Y					
Grey Fantail *Rhipidura albiscapa*	Not Listed																	Y		Y			Y	Y				
Grey Shrike-thrush *Colluricincla harmonica*	Not Listed																							Y				
Grey Teal *Anas gracilis*	Not Listed	Y				Y					Y		Y	Y		Y		Y										Y
Grey-crowned Babbler *Pomatostomus temporalis temporalis*	Vulnerable, BC Act			Y	Y	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y		Y		Y	Y
Ground Cuckoo-shrike *Coracina maxima*	Not Listed																					Y						
Gull-billed Tern *Gelochelidon nilotica*	Not Listed	Y																										
Hoary-headed Grebe *Poliocephalus poliocephalus*	Not Listed	Y																										
Horsfield's Bronze-Cuckoo *Chalcites basalis*	Not Listed			Y		Y									Y	Y	Y							Y	Y			
House Sparrow *Passer domesticus*	Not Listed	Y																						Y				
Intermediate Egret *Ardea intermedia*	Not Listed												Y															
Jacky Winter *Microeca fascinans*	Not Listed	Y		Y											Y								Y					
Laughing Kookaburra *Dacelo novaeguineae*	Not Listed					Y																						

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Little Black Cormorant ***Phalacrocorax sulcirostris***	Not Listed	Y							Y																			
Little Corella ***Cacatua sanguinea***	Not Listed																											Y
Little Egret ***Egretta garzetta***	Not Listed	Y																Y										
Little Grassbird ***Poodytes gramineus***	Not Listed								Y							Y			Y								Y	
Little Pied Cormorant ***Microcarbo melanoleucos***	Not Listed																									Y		
Little Raven ***Corvus mellori***	Not Listed	Y		Y	Y	Y	Y		Y	Y	Y		Y		Y				Y	Y	Y	Y		Y	Y	Y	Y	
Magpie-lark ***Grallina cyanoleuca***	Not Listed	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
Masked Lapwing ***Vanellus miles***	Not Listed	Y									Y	Y											Y				Y	
Masked Woodswallow Artamus personatus	Not Listed										Y									Y								
Mistletoebird ***Dicaeum hirundinaceum***	Not Listed									Y																		
Mulga Parrot ***Psephotus varius***	Not Listed																						Y				Y	
Nankeen Kestrel ***Falco cenchroides***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Noisy Miner ***Manorina melanocephala***	Not Listed	Y		Y	Y	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Pacific Black Duck ***Anas superciliosa***	Not Listed	Y	Y						Y				Y			Y	Y					Y		Y		Y	Y	
Pallid Cuckoo ***Cuculus pallidus***	Not Listed			Y	Y																							
Peaceful Dove ***Geopelia striata***	Not Listed		Y	Y		Y	Y		Y	Y	Y	Y					Y	Y		Y			Y	Y				
Pied Butcherbird ***Cracticus nigrogularis***	Not Listed	Y	Y	Y	Y	Y	Y			Y	Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y
Pied Cormorant ***Phalacrocorax varius***	Not Listed	Y																								Y		
Pied Currawong ***Strepera graculina***	Not Listed														Y										Y			
Pink-eared Duck ***Malacorhynchus membranaceus***	Not Listed	Y																										

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Plumed Whistling-Duck ***Dendrocygna eytoni***	Not Listed	Y	Y						Y									Y	Y				Y			Y	Y	
Rainbow Bee-eater ***Merops ornatus***	Not Listed			Y				Y			Y	Y				Y		Y		Y		Y	Y	Y				Y
Rainbow Lorikeet ***Trichoglossus haematodus***	Not Listed																			Y								
Red Wattlebird ***Anthochaera carunculata***	Not Listed						Y																Y					
Red-capped Robin ***Petroica goodenovii***	Not Listed			Y														Y							Y			
Red-rumped ***Parrot Psephotus haematonotus***	Not Listed	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Redthroat ***Pyrrholaemus brunneus***	Vulnerable, BC Act																					Y						
Restless Flycatcher ***Myiagra inquieta***	Not Listed																						Y					
Rufous Songlark ***Cincloramphus mathewsi***	Not Listed			Y				Y				Y						Y								Y		Y
Rufous Whistler ***Pachycephala rufiventris***	Not Listed				Y						Y							Y					Y		Y			
Sacred Kingfisher ***Todiramphus sanctus***	Not Listed																	Y					Y	Y				
Singing Bushlark ***Mirafra javanica***	Not Listed													Y														Y
Singing Honeyeater ***Gavicalis virescens***	Not Listed	Y		Y		Y	1		Y	Y		Y			Y			Y					Y		Y		Y	
Southern Whiteface ***Aphelocephala leucopsis***	Vulnerable, EPBC Act, Vulnerable BC Act	Y	Y	Y	Y	Y		Y				Y				Y		Y		Y	Y		Y	Y				
Spiny-cheeked Honeyeater ***Acanthagenys rufogularis***	Not Listed											Y			Y								Y					
Spotted Harrier ***Circus assimilis***	Vulnerable BC Act												Y							Y				Y		Y		Y
Straw-necked Ibis ***Threskiornis spinicollis***	Not Listed	Y				Y			Y		Y		Y	Y		Y		Y								Y	Y	
Striated Pardalote ***Pardalotus striatus***	Not Listed			Y	Y	Y					Y					Y		Y					Y	Y				

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
Striated Thornbill ***Acanthiza lineata***	Not Listed																						Y					
Striped Honeyeater ***Plectorhyncha lanceolata***	Not Listed																						Y					
Stubble Quail ***Coturnix pectoralis***	Not Listed		Y					Y						Y				Y										Y
Sulphur-crested Cockatoo ***Cacatua galerita***	Not Listed						Y																					
Superb Fairy-wren ***Malurus cyaneus***	Not Listed	Y	Y	Y				Y	Y		Y	Y			Y			Y		Y			Y	Y			Y	
Superb Parrot ***Polytelis swainsonii***	Vulnerable, EPBC Act and BC Act					Y	Y					Y						Y				Y						
Swamp Harrier ***Circus approximans***	Not Listed	Y																										
Tree Martin ***Petrochelidon nigricans***	Not Listed	Y	Y								Y	Y				Y		Y			Y	Y	Y	Y				
Wedge-tailed Eagle ***Aquila audax***	Not Listed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weebill ***Smicrornis brevirostris***	Not Listed																	Y					Y	Y				
Welcome Swallow ***Hirundo neoxena***	Not Listed	Y	Y			Y	Y		Y		Y	Y	Y	Y		Y				Y			Y	Y		Y	Y	Y
Western Gerygone ***Gerygone fusca***	Not Listed				Y						Y							Y		Y			Y					
Whistling Kite ***Haliastur sphenurus***	Not Listed	Y									Y		Y	Y	Y	Y	Y								Y			Y
White-faced Heron ***Egretta novaehollandiae***	Not Listed	Y			Y	Y			Y	Y	Y		Y					Y	Y		Y			Y		Y	Y	
White-fronted Chat ***Epthianura albifrons***	Vulnerable, BC Act	Y							Y				Y			Y					Y					Y		
White-fronted Honeyeater ***Phylidonyris albifrons***	Not Listed																						Y					
White-necked Heron ***Ardea pacifica***	Not Listed	Y	Y						Y		Y		Y					Y					Y	Y		Y		Y
White-plumed Honeyeater ***Ptilotula penicillata***	Not Listed	Y			Y																	Y	Y	Y				
White-winged Chough ***Corcorax melanorhamphos***	Not Listed			Y	Y	Y	Y			Y	Y				Y			Y					Y	Y			Y	

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Species	Status	CTL 1	CTL 10	CTL 11	CTL12	CTL 2	CTL 3	CTL 4	CTL 6	CTL 7	CTL 8	CTL 9	IMP 1	IMP 10	IMP 11	IMP 13	IMP 15	IMP 16	IMP 2	IMP 20	IMP 21	IMP 22	IMP 3/18	IMP 4	IMP 5/19	IMP 6	IMP 7	IMP 9
White-winged Fairy-wren *Malurus leucopterus*	Not Listed	Y	Y		Y						Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y		Y		Y	Y
White-winged Triller *Lalage sueurii*	Not Listed			Y	Y																		Y					
Willie Wagtail *Rhipidura leucophrys*	Not Listed	Y	Y	Y		Y			Y	Y		Y	Y	Y		Y		Y	Y	Y	Y		Y	Y	Y		Y	Y
Yellow Thornbill *Acanthiza nana*	Not Listed								Y	Y								Y					Y	Y				
Yellow-billed Spoonbill *Platalea flavipes*	Not Listed																									Y		
Yellow-plumed Honeyeater *Lichenostomus ornatus*	Not Listed																						Y					
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	Not Listed			Y		Y						Y						Y		Y			Y	Y				
Yellow-throated Miner *Manorina flavigula*	Not Listed	Y				Y	Y		Y	Y	Y	Y			Y		Y			Y	Y	Y	Y	Y	Y		Y	
Yellow-throated Scrubwren *Sericornis citreogularis*	Not Listed									Y																		
Zebra Finch *Taeniopygia guttata*	Not Listed	Y	Y										Y			Y			Y	Y	Y			Y		Y		

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Appendix 5. SAII

Appendix 5.1. Plains Wanderer *Pedionomus torquatus*

Information required (BAM Section 9.1.2)	Response
1. Impacts to the species and the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAII.	
-	Plains Wanderer *Pedionomus torquatus* is listed under Principle 1 in TBDC. Listed has having a population reduction of >80% in 10 years or three generations. Surveys for Plains Wanderer were conducted in November 2022 (habitat assessment), and nocturnal surveys in March and April 2023, all well as opportunistically through all survey periods. Detailed habitat assessment was undertaken, as well nocturnal surveys and acoustic detection. No records were detected. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible, see Section 7. Specifically, due to cryptic nature of this species and critically endangered listing, avoidance of suitable habitat and mapped important areas were incorporated early into project designs. Due to the dynamic nature of natural and derived grasslands, other areas of the subject land may provide habitat for Plains Wanderer at certain times pending fluctuating long term environmental conditions. Approximately 11.8 ha of important mapped area occurs within the development corridor, and 645 ha within the subject land. Buffers of 100m and 300m were employed on important mapped areas as a no go for turbine placement, and high constraint for civil construction. This resulted in large scale avoidance of SAII habitat. Impacts to 4.02 ha that are linear in nature have been calculated to occur directly to important mapped areas, and approximately 14.97 ha of impact occur within a 100m of an important mapped area. Of the 4.02 ha of direct impact to important mapped areas, 3.72 ha occur as a result of Stage 2 impacts, whilst 0.30 ha occurs as a result of Stage 1. Additionally, 0.99 ha or 25% of the total areas impacted are based on Mapped Important Areas that comprise polygons mapped across existing formed council roads. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
2a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	
i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	It is estimated that species population has fallen from between approximately 1,000- 3000 individuals to approximately 700 individuals over the last twenty years (WSP, 2022), and potentially as low as 300 (LLS, 2020). Approximately 300 - 700 individuals are thought to occur within the Riverina.
ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in	This decline in population estimates of Plains Wanderer are tied to habitat condition, which has been compromised by persisting dry conditions and land management practices throughout its range over the last 20 years (WSP, 2022). Additionally, to the loss and degradation of sparse, lowland native grasslands, caused by the conversion of native grasslands to dense introduced pasture or croplands (DoE, 2016). The vast majority (>99%) of records of Plains Wanderer in NSW now come from an area of the western Riverina bounded by Hay and Narrandera on the Murrumbidgee River in the north, the Cobb Highway in the west, the Billabong Creek in the south, and Urana in the

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Information required (BAM Section 9.1.2)	Response
geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites	east. Recent analysis of monitoring data collected between 2001 and 2014 from across sites in the Riverina region indicate that there was an overall decline in numbers of 93% over this time period (DoE 2016).
2b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:	
i. an estimate of the species' current population size in NSW, and	The current estimate is between 300 to 700 individuals in NSW and between 1000 to 3000 in Australia (NSW and Victoria)
ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and	Current detail in regard to Plains Wanderer population estimates are centered on the area of mapped habitat distribution in the Riverina area of NSW and monitoring of sites. (WSP,2022).
iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	It is difficult to pinpoint the exact cause of rapid decline, but likely a combination of effects of sustained drought, clearing or conversion of native vegetation, particularly grasslands on grey soils where tussock forming grass remain optimal and more stable, as well increase predation by species such as foxes. However, when conditions are considered favorable, this species is capable of recovering.
2c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:	
i. extent of occurrence	It is difficult to determine the current extent as data is limited but as of 2011, the estimated extent of occurrence of the species was 930 000 km square (DoE 2016). Likewise, the current area of occupancy, but as of 2011, the estimated area of occupancy was 330 km square (DoE 2016). Due to the dynamic nature of natural and derived grasslands to which habitat for the Plains Wanderer is critical, the area of occupancy maybe constantly changing.
ii. area of occupancy	
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species	The Riverina region is considered a population stronghold (DoE 2016).

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Information required (BAM Section 9.1.2)	Response
occurrences), and	
iv. whether the species' population is likely to undergo extreme fluctuations	It is likely that the population of the Plains Wanderer will undergo extreme fluctuations with a decrease in numbers following significant drought events, as well sustained periods of above average rainfall, as result of lower breeding success. However, during repeated average years, and following on from form drought events, Plains Wanderers have been shown to recover, however these events have been somewhat inconsistent in the last 20 years.
2d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	
i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site	Plains Wanderer breed in solitary pairs in a territory defended by the larger female, though they can be serially polyandrous. They are capable of breeding in their first year. The male does most of the incubation during the 23 day incubation period and is also primarily responsible for attending the young (DoE 2016). The species is considered to not have reproductive characteristics that limit its reproductive capacity. Other than the dynamic nature of the grasslands habitat and condition states the Plains Wanderer relies upon, it does not have abiotic factors or traits considered critical. Key threatening process applicable to this species are: • Clearing on native vegetation, particularly grasslands • Predation by foxes. • Invasion of exotic perennial grasses
ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or	
iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)	
3. data deficient	
Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record	Plains Wanderer are not listed in TBDC as a data deficient species. Due to the dynamic nature of natural and derived grasslands to which habitat for the Plains Wanderer is critical, areas of optimal habitat is considered uncertain.

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Information required (BAM Section 9.1.2)	Response
this in the BDAR	
4a. the impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the development site (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and **ii. an estimate of the number of individuals (mature and immature) to be impacted by the project and as a percentage of the total NSW population, or** **iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the project**	The Plains-wanderer mapped important area are based on 2001 Plains-wanderer primary habitat mapping completed for NPWS across 2.28 million hectares. The mapping identified 52,783 ha of primary habitat or 2.3% of the mapping area. Primary habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Since the project's completion in 2001, the mapping has been updated from ground-truthing during regular Plains-wanderer surveys conducted by NSW DCCEEW staff. The NSW Draft Recovery Plan for the species states that in 2001/2002 most primary habitat had the carrying capacity of 1 pair of birds per 18 ha (NSW NPWS 2002). Surveys undertaken within the subject land did not detect any individuals. However, it is difficult to accurately estimate numbers within the broader locality. Estimated numbers in Oolambeyan National Park as at 2021 was 5 individuals, whilst an additional 3 individuals were recorded at Bundure Travelling Stock Route (TSR) to the south of the subject land. Anecdotal evidence from the landowner indicated individuals are semi regularly seen historically on the Goolgumbla property. It is not anticipated the project will impact upon Plains Wanderer individuals. Future occupancy may be reduced, however due to variability and dynamic nature of grasslands that provides habitat for this species, this is difficult to quantify. Patches of potential habitat within the subject land primarily being low grasslands such as Riverina grasslands communities PCT 46 are estimated at 5,699 ha, but also grasslands derived from Weeping Myall communities contribute up to 6,746 ha. Approximately 11.8 ha of important mapped area occurs within the development corridor, and 645 ha within the subject land. Outside of important mapped areas, the project will result in the removal of linear areas up to 114 ha that may contain suitable habitat during dynamic grassland changes. The majority of these impacts occur during stage 2 of the project, accounting for 99.24 ha of impact or 87% of the potential habitat loss. No individuals are expected to be directly impacted by the project. The project is not expected to result in substantial indirect impacts to the species such as through increased habitat fragmentation. Plains-wanderers are known to be mainly sedentary, particularly when habitat is suitable, however they may move greater distances in response to changes in environment and habitat availability (Marchant and Higgins, 1993) (DoE 2016). The project will directly impact upon linear areas of suitable habitats, and in some cases create localised fragmentation of habitat via construction of roads and access tracks through areas of habitat. However, no permanent barriers excluding the species from adjacent areas of suitable habitat, or preventing movements between separated areas of habitat, will be created. Furthermore there are large areas of potentially (or dynamically) suitable habitat within the subject land that are not impacted by the project, which will persist into the future. Mitigation measures are listed in Section 9, which includes specific measures for Plains Wanderer Indicative stewardship sites being developed also contain mapped important areas and other areas of potential habitat to be conserved and managed

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Information required (BAM Section 9.1.2)	Response
4b. impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the project in hectares, and a percentage of the total AOO, or EOO within NSW	This species was not recorded in detailed surveys undertaken in November 2022, March 2023 and April 2023 and therefore considered unlikely to be occupying areas within the development corridor, or at least not in any substantial numbers within the subject land. Due to the dynamic nature of the grasslands critical to this species, areas within the subject land may be suitable for this species in future, however, the most optimal areas of habitat have been avoided within the development footprint as far as practicable. Potentially suitable (but sub-optimal) areas within the subject land and development footprint include; <u>Subject Land</u> • Important mapped areas 645 ha • Riverine plains grasslands 5,699 (PCT 46 and PCT 45) • Riverplain derived grasslands 6,746 (PCT 26 DNG) <u>Development corridor</u> • Important mapped areas 11.8 ha • Riverine plains grasslands 677.14 (PCT 46 and PCT 45) • Riverplain derived grasslands 2,282.95 (PCT 26 DNG) • 100m buffer of mapped important habitat 47.33 ha <u>Development Footprint</u> • Important mapped areas 4.02 ha • Riverine plains grasslands 114.42 ha (PCT 46 and PCT 45) • Riverine derived grasslands 395.93 (PCT 26 DNG) • 100m buffer of mapped important habitat 14.97 ha It is not anticipated that any direct impacts will occur to this species currently. The species national Extent of Occurrence is estimated as 930 000 km2 (93 million hectares), and national Area of Occupancy as 33,000 ha (Cth DCCEEW 2015). Extensive area of habitat will remain within the subject land and broader locality. Important mapped areas of habitat, and similar within the development footprint have been prioritised for avoidance. Mitigation measures such as coordinated fox control and grasslands management will likely provide more optimal habitat within the subject land and have effects more broadly in the landscape.
ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted	
iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	
iv. to determine changes	

Information required (BAM Section 9.1.2)	Response
in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR	

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Appendix 5.2. Austral Pillwort *Pilularia novae-hollandiae*

Information required (BAM Section 9.1.2)	Response
1. Impacts to the species and the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAII.	
-	Surveys for *Pilularia novae-hollandiae* were interrupted by flooding events in November 2022. Further surveys were undertaken in November 2023, however some spatial gaps still occur and overall survey is lower in some areas of habitat then required. Therefore this species is assumed present within areas of potentially suitable habitat. This species will be subject to further survey in November 2024. Assumed present where survey shortfall occurs • PCT 15 moderate 6.20 ha • PCT 15 thinned 1.61 ha • PCT 28 moderate 0.98 ha In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the subject land considered potential habitat including within seasonally damp situations such as shallow depression and on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers seasonally moist grey gilgaied soils in depressions on the floodplains within PCTS such as PCT 10, PCT 13, PCT 15, PCT 17, PCT 24, PCT 45 and PCT 46, which occur within the subject land, as well as areas of PCT 26, where it occurs with slight variations in microrelief on more gilgaied grey clay soils. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
2a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	
i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	*Pilularia novae-hollandiae* is not listed under Principle 1 in TBDC. The rate of population decline in NSW is currently unknown. An improved understanding of the species biology and ecology are required to inform conservation and recovery of the species.
ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants,	

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Information required (BAM Section 9.1.2)	Response
competitors or parasites	
2b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:	
i. an estimate of the species' current population size in NSW, and	*Pilularia novae-hollandiae* is not listed under Principle 2 in TBDC. Although the current extent is unknown, it has a wide distribution throughout NSW. Most of the records are quite dated, with limited new information, however, recent records were confirmed during surveys for the ProjectEnergy Connect project, that observed an approximate extent of 1.85 ha within nine-shallow muddy gilgai depressions approximately 64 Km to the north west of the subject land (WSP, 2022). The subpopulation size at the Lake Cowal SoS management site for *Pilularia novae-hollandiae* is unknown although managed habitat area is listed as 144 ha (Environment Energy and Science 2021). Likewise, the subpopulation size at the Oolambeyan National Park SoS management site is unknown with managed habitat area identified as 1.55 ha (EES, 2023).
ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and	The rate of population decline in NSW is currently unknown.
iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	
2c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:	
i. extent of occurrence	*Pilularia novae-hollandiae* is listed under Principle 3 in TBDC. Difficulties in understanding the population status of this species occur due to the ephemeral nature of the species life cycle and preferred habitat of shallow ephemeral pools and in mud in swamps and depressions. Survey difficulties also inhibit population understanding as the species is grass like in appearance, obscure and considered possibly overlooked elsewhere in its probable distribution range (EES, 2023). The species is widespread, but not common, within seasonally dry depressions and margins of marshes; Generally, grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. This species is considered ephemeral appearing when soils are moistened by rain (EES, 2023) It is likely that the population of this species will undergo extreme fluctuations within
ii. area of occupancy	
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	
iv. whether the species'	

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Information required (BAM Section 9.1.2)	Response
population is likely to undergo extreme fluctuations	increased numbers during significant sustained rainfall/flooding events, and conversely, a decline in numbers during drought. This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. Although not complete and with presence currently assumed, no evidence of this species has been recorded to date.
2d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	
i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site	*Pilularia novae-hollandiae* not listed under Principle 4 in TBDC. Given the ephemeral nature of the species life cycle it is considered likely to undergo extreme population fluctuations particularly during drought and prolonged dry periods where the species dies back and remains underground as a rhizome (underground stem) or as sporocarps (fruiting body) often buried in mud. During favourable wet conditions dispersal vectors of sporocarps are considered probably waterfowl as many of the recorded location of the species are from artificial pools and in recently inundated areas (Jones 1998). This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. Germination and growth seem to be highly dependent upon wetter years, although the exact relationship between flooding and the species is not well known. Key threatening process applicable to this species are: • Alternations of hydrology (natural flow regimes of rivers, streams and floodplains) • Clearing on native vegetation • Invasion of exotic perennial grasses.
ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or	
iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)	
3. data deficient	
Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR	*Pilularia novae-hollandiae* is not listed in TBDC as a data deficient species.

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Information required (BAM Section 9.1.2)	Response
4a. the impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the development site (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and **ii. an estimate of the number of individuals (mature and immature) to be impacted by the project and as a percentage of the total NSW population, or** **iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the project**	Surveys for *Pilularia novae-hollandiae* were interrupted by flooding events in November 2022. Further surveys were undertaken in November 2023, however some spatial gaps still occur and overall survey is lower in some areas of habitat then required. Therefore this species is assumed present within some areas of potentially suitable habitat. This species will also be subject to further survey in November 2024. Potentially suitable areas may occur within PCTs and zones within the development corridor and development footprint including: <u>Development corridor</u> • PCT 10 – 9.35 ha • PCT 13 – 48.88 ha • PCT 15 – 41.38 ha • PCT 17 – 18.06 ha • PCT 24 – 2.52 ha • PCT 26 – 2,282.95 ha • PCT 28 – 25.36 ha • PCT 45 – 57.00 ha • PCT 46 – 620.14 ha <u>Development Footprint</u> • PCT 10 – 0.33 ha • PCT 13 – 13.97 ha • PCT 15 – 7.8 ha • PCT 17 – 2.93 ha • PCT 24 – 0.23 ha • PCT 26 – 395.93 ha • PCT 28 – 0.98 ha • PCT 45 – 8.83 ha • PCT 46 – 105.59 ha This species has been assumed present to date in PCT 15 and PCT 28, the latter in areas adjacent to PCT 10 and on prior streams. Further surveys will be conducted in November 2023. Should this species be identified upon completion of the required survey, it would be subject to avoid measures as far practicable. Within subject land, it is estimated there is the following amount of habitat that will contain areas of suitable microhabitats (flooded gilgai depressions) for *Pilularia novae-hollandiae*. • Riverine plain grasslands – 5,699 ha (Development footprint impacts equate to 2 %) • Riverine derived grasslands – 6,746 ha (Development footprint impacts equate to 6 %) • Inland riverine forests – 87 ha (Development footprint impacts equate to 0.37 %) • Inland floodplain woodlands– 1,685 ha (Development footprint impacts equate to 3 %) • Inland floodplain swamps – 315.67 ha (Development footprint impacts equate to 1%)
4b. impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the project in hectares, and a	It is not anticipated that impacts on the on the geographic range would occur for the project as a result from the clearing of native vegetation, increased weed invasion, or changes in hydrology with result from the project. Detailed mitigation measures will be implemented as per Section 9.

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Information required (BAM Section 9.1.2)	Response
percentage of the total AOO, or EOO within NSW	This BDAR does not provide any new information that demonstrates that the principle identifying that the species is at risk of an SAII is not accurate.
ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted	
iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	
iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds,	

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Information required (BAM Section 9.1.2)	Response
estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR	

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Appendix 5.3. Claypan Daisy *Brachyscome muelleroides*

Information required (BAM Section 9.1.2)	Response
1. Impacts to the species and the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAII.	
-	*Brachyscome muelleroides* has been surveyed throughout the development footprint in September 2022 and September 2023 and has not been recorded. These surveys were not substantially impeded by flooding events in Spring 2022, which were more prevalent in the latter part of Spring 2022. Further survey will be undertaken in September and November 2024. However, overall, the amount of survey undertaken is representative to the size and requirements of each vegetation zone where habitat for this species is present. This species was not recorded. In terms of avoidance, detailed constraints assessments modelling of biodiversity vales was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the subject land considered potential habitat including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers seasonally moist grey gilgaied soils on the floodplains with PCTS such as PCT 45 and PCT 46, which occur within the subject land. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
2a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	
i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	*Brachyscome muelleroides* is not listed under Principle 1 in TBDC. Little is known of the former distribution and abundance for this species. Changes to land use and resultant habitat modification from agricultural activities and altered hydrological regimes are thought to be a contributing cause to the species decline (Lucas, 2010).
ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites	

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Information required (BAM Section 9.1.2)	Response
2b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:	
i. an estimate of the species' current population size in NSW, and	*Brachyscome muelleroides* is not listed under Principle 2 in TBDC. The species is restricted to the mid Murray and Murrumbidgee Rivers region in NSW and Victoria. Current distribution and abundance are not currently well known, and subject to seasonal fluctuations and effects of drought. Only five sites have precise locality details, and four of these are on Morundah Station near Urana in NSW, which has almost all of the currently recorded plants (about 20,000).
ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and	Little is known about the current location and status of *Brachyscome muelleroides*. The species has been recorded from about 20 locations since 1900, only about 13 locations since 1930 and only eight locations since 1990. The most important site appears to be Morundah Station in NSW, a Commonwealth Department of Defence property leased for grazing, which has almost all currently recorded plants. One proposed recovery action is to survey for and monitor populations to gain more accurate information on distribution and abundance of *Brachyscome muelleroides* (Lucas, 2010)
iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	
2c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:	
i. extent of occurrence	*Brachyscome muelleroides* is listed under Principle 3 in TBDC. The extent of occurrence for *Brachyscome muelleroides* is <100 km square. The area of occupancy for *Brachyscome muelleroides* is <10 km square, about 20, 000 plants from the main population, but historical records have this species "plentiful" or abundant" at other areas. The subject lands on the western limit of the extent of occurrence and is generally considered from east of Narrandera (NSW) and Locksley (Vic), through to Wagga Wagga (NSW) in the east. This species has a highly restricted distribution. Only a single significant known population exists at Morundah Station near Urana NSW, with a few scattered and isolated patches near Rand, NSW. Of what is known, its preferred habitat is on grey cracking clay and gilgaied soils, often occurring with Marsilea species, soils on the floodplains of the Murray and Murrumbidgee Rivers. Associated PCTs such as PCT 45 and PCT 46, occur on this soil type and have largely been avoided as well as subjected to detailed survey. No records were found during surveys in September 2022 and September 2023 within the subject land. It is likely that the population of this species will undergo extreme fluctuations within increased numbers during significant sustained rainfall/flooding events, and conversely, a
ii. area of occupancy	
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	
iv. whether the species' population is likely to undergo extreme fluctuations	

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Information required (BAM Section 9.1.2)	Response
	decline in numbers during drought. This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. No evidence of this species was recording during September 2023 or November 2023, and following an above average rainfall year in 2022.
2d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	
i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site	*Brachyscome muelleroides* not listed under Principle 4 in TBDC. Information is currently lacking around the processes for recruitment for this species. It is thought that this species may require periodic flooding of its habitat to maintain the wet conditions suitable for seed set and germination. This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. Germination and growth seem to be highly dependent upon wetter years, although the exact relationship between flooding and the species is not known. It appears that sufficient autumn rainfall that results in localised soil waterlogging, or periodic flooding, are required to initiate seed germination and plant growth (Lucas 2010).
ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or	Despite targeted surveys taking place in September 2022, September 2023 and November 2023, this species was not recorded in suitable habitat. Key threatening process applicable to this species are: • Alternations of hydrology (natural flow regimes of rivers, streams and floodplains) • Clearing on native vegetation • Invasion of exotic perennial grasses.
iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)	
3. data deficient	
Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR	*Brachyscome muelleroides* is not listed in TBDC as a data deficient species.

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Information required (BAM Section 9.1.2)	Response
4a. the impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the development site (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	This species was not recorded in detailed surveys undertaken in September 2022, September 2023 and November 2023, therefore considered unlikely to be present. Suitable area within the development corridor and development footprint include: <u>Development corridor</u> • PCT 45 Moderate 57 ha • PCT 46 Moderate 620.14 ha <u>Development Footprint</u> • PCT 45 Moderate 8.83 ha • PCT 46 Moderate 105.59 ha It is not anticipated that impacts will occur to this species, as it has not been recorded during detailed surveys in September 2022, September 2023 or November 2023. These surveys were not substantially impeded by flooding events in Spring 2022, which were more prevalent in the latter part of Spring 2022. Within subject land, it is estimated there is the following amount of habitat that will contain suitable microhabitats for *Brachyscome muelleroides*. • Riverine plain grasslands – 5,699 ha (Development footprint impacts equate to 2 %)
ii. an estimate of the number of individuals (mature and immature) to be impacted by the project and as a percentage of the total NSW population, or	
iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the project	
4b. impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the project in hectares, and a percentage of the total AOO, or EOO within NSW	This species is listed in TBDC as occurring in the Wagga Wagga, Narranderra, Tocumwal and Walbundrie areas. Also occurs in north-central Victoria (only along the Murray from Tocumwal to the Ovens River) (BioNet 2023). The main population, ~20,000 plants, occurs near Urana at Morundah Station. It is not anticipated that impacts on the geographic range would occur for the project as a result from the clearing of native vegetation, increased weed invasion, or changes in hydrology with result from the project. Detailed mitigation measures will be implemented as per Section 9. This BDAR does not provide any new information that demonstrates that the principle identifying that the species is at risk of an SAII is not accurate.
ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat;	

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Information required (BAM Section 9.1.2)	Response
OR impact will affect some habitat, but no individuals of the species will be directly impacted	
iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases, or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g., seed dispersal) and pollination distance for the species	
iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects,	

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Information required (BAM Section 9.1.2)	Response
likelihood of disturbance; and disease, pathogens, and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR	

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Appendix 5.4. Bindweed *Convolvulus tedmoorei*

Information required (BAM Section 9.1.2)	Response
1. Impacts to the species and the action and measures taken to avoid the direct and indirect impact on the species at risk of an SAII.	
-	*Convolvulus tedmoorei* has been surveyed for throughout the development footprint in September 2022 and September 2023 and has not been recorded. These surveys were not substantially impeded by flooding events in Spring 2022, which were more prevalent in the latter part of Spring 2022. Further survey will be undertaken in November 2024 in targeted areas of habitat within the development corridor. Small areas of assumed presence are currently included within this BDAR of 3.13 ha in total. In terms of avoidance, detailed constraints assessments modelling of biodiversity vales was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas of grey clay soils as far as practicable. This has resulted in multiple revisions of the development footprint as demonstrated in Section 7. This species prefers grey clay soils on the floodplains of the Darling and Murrumbidgee Rivers with PCTs such as PCT 17, PCT 24, PCT 26, PCT 45 and PCT 46, which all occur within the development corridor. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
2a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	
i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	*Convolvulus tedmoorei* is not listed under Principle 1 in TBDC. Changes to land use and resultant habitat modification from agricultural activities are thought to be a contributing cause to the species decline (OEH 2023).
ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors, or parasites	
2b. evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:	
i. an estimate of the species' current	*Convolvulus tedmoorei* is listed under Principle 2 in TBDC. *Convolvulus tedmoorei* is listed in TBDC as '<50 individuals or <250 individuals where threats

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Information required (BAM Section 9.1.2)	Response
population size in NSW, and	are known. The species is endemic to NSW with only two known collections, with the closest being to the >50km north-west of Coleambally, near Darlington Point. All other records are located in the Broken Hill locality. There is an inadequate understanding of the ecology and distribution to the species currently.
ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and	It is currently unknown what the estimated number of individuals may be or is difficult to estimate any decline in species population size.
iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	
2c. evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:	
i. extent of occurrence	*Convolvulus tedmoorei* is not listed under Principle 3 in TBDC. The extent of the occurrence of this species is unknown. The occupancy of this species is unknown. This species has a highly restricted distribution. Of what is known it preferred habitat is on grey clay soils on the floodplains of the Darling and Murrumbidgee Rivers. Associated PCTs such as PCT 17, PCT 24, PCT 45 and PCT 46, all occur within the development corridor on this soil type and have largely been avoided. The majority of PCT 26 occurs on red/brown soils, however does contain slight variation with microrelief on more gilgaied grey clay soils, and where this species may occur. No records were found during surveys in September 2022 and September 2023. It is considered unlikely that the population of this species will undergo extreme fluctuations. This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. No information is currently available to suggest this was the case.
ii. area of occupancy	
iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	
iv. whether the species' population is likely to undergo extreme fluctuations	
2d. evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	
i. known reproductive characteristics severely limit the ability to increase the existing	*Convolvulus tedmoorei* is not listed under Principle 4 in TBDC. Information is currently lacking around the processes for recruitment for this species. This species was not recorded in detailed surveys undertaken in September 2022 and September 2023.

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Information required (BAM Section 9.1.2)	Response
population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site	It is thought that this species may require periodic flooding of its habitat to maintain the wet conditions suitable for seed set and germination. However, some species of *Convolvulus tedmoorei* from western NSW possess a thick taproot that aids their persistence during dry periods, and some can produce hard-coated seed that can lie dormant in the soil for extended periods (OEH, 2022). This may have been evident following above average rainfall conditions and periodic flooding in 2022, and the subsequent season in 2023. No information is currently available to suggest this was the case. Key threatening process applicable to this species are: • Clearing on native vegetation • Alternations of hydrology (natural flow regimes of rivers, streams and floodplains) • Invasion of exotic perennial grasses.
ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or	
iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)	
3. data deficient	
Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR	*Convolvulus tedmoorei* is not listed in TBDC as a data deficient species.
4a. the impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the development site (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	This species was not recorded in detailed surveys undertaken in September 2022 and September 2023 and therefore considered unlikely to be present. Suitable areas within the development corridor and development footprint include: <u>Development corridor</u> • PCT 17 – 18.06 ha • PCT 24 – 2.52 ha • PCT 26 – 2,282.95 ha • PCT 45 - 57 ha • PCT 46 – 620.14 ha <u>Development Footprint</u>

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Information required (BAM Section 9.1.2)	Response
ii. an estimate of the number of individuals (mature and immature) to be impacted by the project and as a percentage of the total NSW population, or	• PCT 17 – 2.93 ha • PCT 24 – 0.23 ha • PCT 26 – 395.93 ha • PCT 45 – 8.83 ha • PCT 46 – 105.59 ha It is not anticipated that impacts will occur to this species, as it has not been recorded during detailed surveys in September 2022 or September 2023. These surveys were not substantially impeded by flooding events in Spring 2022, which were more prevalent in the latter part of Spring 2022.
iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the project	Within the subject land, it is estimated there is the following amount of habitat that will contain suitable microhabitats for *Convolvulus tedmoorei.* • Riverine plain grasslands – 5,699 ha (Development footprint impacts equate to 2 %) • Riverine derived grasslands – 6,746 ha (Development footprint impacts equate to 6 %) • Inland floodplain swamps– 1,685 ha (Development footprint impacts equate to 3 %)
4b. impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the project in hectares, and a percentage of the total AOO, or EOO within NSW	This species is listed in TBDC as occurring on two areas on the Murrumbidgee and Darling River floodplains. *Convolvulus tedmoorei* is a predicted species in the Murrumbidgee IBRA subregion with the species knowledge restricted to two historic records from the Darlington Point area from 1969 (BioNet 2023). It is not anticipated that impacts on the on the geographic range would occur for the project as a result from the clearing of native vegetation, increased weed invasion, or changes in hydrology with result from the project. Detailed mitigation measures will be implemented as per Section 9. This BDAR does not provide any new information that demonstrates that the principle identifying that the species is at risk of an SAII is not accurate.
ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted	
iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources	

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Information required (BAM Section 9.1.2)	Response
such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	
iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR	

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Appendix 6. EPBC Act Significant Impact Criteria assessments

Important population

An important population is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

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

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Appendix 6.1. Painted Honeyeater *Grantiella picta*

Species background

Painted Honeyeater is listed as vulnerable under the EPBC Act. It has a specialised diet consisting mainly of mistletoe fruits, but also includes nectar (from flowering mistletoe, eucalypts and possibly banksias) and arthropods (DAWE 2021a). Painted Honeyeater is endemic to mainland Australia, found on the inland slopes of the Great Dividing Range from the Grampians, Victoria to Roma, Queensland. The species exhibits dispersive, seasonal north-south movements governed principally by the fruiting of mistletoe (Barea L.P & Watson D.M 2007). Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory.

The species inhabits mistletoes in eucalypt forests, woodlands, riparian woodlands of Black Box and River Red Gum, preferring a higher number of mature trees as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips. The key threat to the species is habitat loss in both breeding and non-breeding habitats. Degraded private lands used for agriculture or grazing provide small opportunities for Painted Honeyeaters to persist in fragmented landscapes, but with many landowners considering mistletoes as a pest their ongoing removal threatens the survival of the species.

Occurrence in study area

Painted Honeyeater was recorded foraging within the subject land in high condition Weeping Myall vegetation, with areas where sighting occurred now excluded from the development corridor. Associated PCTs within the development corridor include PCTs 10, 13, 15, 17, 26, and 28, however suitable habitat is likely to constitute PCT 26 Intact only, given the species requires connected woodland with forging mistletoe. Historic records for the species occur north of the subject land, as well as to the southwest around Deniliquin.

SIC assessment for Painted Honeyeater

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. There is a low likelihood that the project would lead to a long-term decrease in the size of an important population of the Painted Honeyeater. Important populations of Painted Honeyeater have not been defined in the Commonwealth Conservation Advice (Commonwealth of Australia 2015). There are no recognised subpopulations and due to its dispersive movements it is considered to comprise a single population (Garnett, Szabo, & Dutson 2011). The number of individuals is estimated to be <10,000 and the population is thought to be in decline (DAWE 2021a). As it is considered a single population, individuals occurring within the study area would be part of an 'important population' for the purpose of the SIC assessment. Factors likely to contribute to a long-term decrease in the size of an important population of the Painted Honeyeater primarily relate to habitat loss, land clearance, and decreased abundance of mistletoe that is a vital foraging and breeding resource for the species. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained. An additional 44,000 ha within 50 km of the subject land will also be retained. Direct impacts to 133.14 ha of intact Weeping Myall woodland would occur as result of the project. Although these areas

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SIC assessment for vulnerable species
represent potential habitat for Painted Honeyeater, they occur as mostly smaller patches which are considered less suitable, or the fringing areas of larger patches of habitat, and as such are of lesser quality for Painted Honeyeater. Larger connected areas of intact Weeping Myall will remain. Painted Honeyeaters were recorded within the subject land, with the areas where the group were observed has now been removed from the development corridor. This has been taken into account when assessing the relative importance of the areas being removed for Painted Honeyeaters, in line with the recommendations in the National Recovery Plan (DAWE 2021a). Given that Painted Honeyeater prefers large remnants of vegetation, and selects nest sites in habitats where mistletoe prevalence and parasitism rates are high, and that large areas of suitable habitat will be retained within both the development corridor and subject land, with movement for this species not substantially fragmented, it is considered unlikely that the project would lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of an important population.
No. The area of occupancy for Painted Honeyeater is thought to have declined but is not defined in the National Recovery Plan (DAWE 2021a). The project would result in direct impacts to 133.14 ha of intact Weeping Myall woodland representing potential habitat for Painted Honeyeater. However, the areas being removed are mostly smaller patches which are considered less suitable, or the fringing areas of larger patches of habitat, the majority of which would be retained. While the species was recorded twice within the subject land, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained. An additional 44,000 ha within 50 km of the subject land will also be retained. While prescribed impacts of the project include collision risk, this species is not likely to be significantly impacted as it flies at canopy height and was not recorded within the RSA or unlikely to fly within RSA. Based on the size and quality of the areas proposed for removal, and their context in the broader landscape and areas to be retained, the project would not result in a significant reduction to the area of occupancy for the species.
Fragment an existing important population into two or more populations.
No. Due to its complex movement patterns typified by migration and local nomadism, the Painted Honeyeater has what is effectively a single national population. The species is highly mobile and individuals can move freely through areas of unsuitable and marginal habitat to seek out and exploit favourable habitat patches. The project would result in direct impacts to 133.14 ha of potential habitat for Painted Honeyeater, and therefore will result in some localised fragmentation, but is considered unlikely to result in any barriers to movement for the species such that it would fragment the local population. While the construction of wind turbines will generate prescribed impacts to the flight pathways for some bird species, it is not likely to fragment the local population of Painted Honeyeater given the species flies at canopy height. The areas of vegetation being removed are smaller patches or the fringing areas of larger patches, and as such would not impact on the connectivity of habitat within the broader landscape for this species.
Adversely affect habitat critical to the survival of a species.
No. Habitat critical to the survival of the species identified in the National Recovery Plan includes: • Known or likely breeding habitat in Boree/Weeping Myall, Brigalow woodlands, box-gum woodlands and box-ironbark forests on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. • All preferred foraging species within known and likely foraging habitat particularly mistletoes of the genus *Amyema* growing on forest and woodland eucalypts and acacias.

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SIC assessment for vulnerable species

- All Key Biodiversity Areas for Painted Honeyeater.
- Suitable habitat in future climate niches as information becomes available.

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes avoidance of large, intact patches of Weeping Myall, likely to constitute critical habitat for Painted Honeyeater. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained. An additional 44,000 ha within 50 km of the subject land will also be retained. As this is consistent with the definition of critical habitat for the species, this represents a large area of retention in comparison to the vegetation being impacted by the project.

Direct impacts to 133.14 ha of intact Weeping Myall areas vegetation is predicted, which would also meet the definition of critical habitat for Painted Honeyeater. However, the areas of Weeping Myall being removed are mostly smaller patches which are considered less suitable for the species, or the fringing areas of larger patches of habitat. On two instances, sightings of the species occurred within the subject land, with these areas now removed from development corridor. It is possible the species utilises the subject land on occasion.

This has been taken into account when assessing the relative importance of the areas being removed for Painted Honeyeaters, in line with the recommendations in the National Recovery Plan (DAWE 2021a). In the broader landscape context, records are concentrated north of the subject land, and to the south-west around Deniliquin. Although the habitat being removed does meet the definition of critical habitat, its relative importance in the landscape is likely to be less than the areas being retained in both the subject land itself and within the broader landscape context.

The National Recovery Plan lists Key Biodiversity Areas (KBAs) relevant to the Painted Honeyeater, which do not include the subject land or nearby surrounds.

There is no current information on habitat associated with future climate niches.

Overall, the project will have direct impacts on 133.14 ha of habitat that meets the definition of critical habitat in the National Recovery Plan for Painted Honeyeater. However, as described in the National Recovery Plan, the habitat being impacted has been assessed in the broader landscape context to determine its relative importance for Painted Honeyeater. Given that the habitat being impacted is largely smaller patches, or the fringes of larger patches, that do not contain abundant Mistletoe, combined with the large areas of habitat to be retained both within and directly adjacent to the subject land, and the mobility of the species, it is overall considered unlikely that the project would result in a significant adverse impact to critical habitat for the Painted Honeyeater. The overall retention of 737.95 ha of suitable vegetation within the development corridor, and 6,552.25 ha within the broader subject land that that consists of higher quality and more connected potential habitat, is likely to outweigh the removal of 133.14 ha.

Disrupt the breeding cycle of an important population.

No. The project is expected to result in the removal of 133.14 ha of potential habitat. This habitat is associated with smaller patches of Weeping Myall or the fringes of larger patches, and is considered less suitable for Painted Honeyeater. The species selects nest sites in habitats where mistletoe prevalence and parasitism rates are high, which was not observed in the areas of habitat being removed, suggestion these areas are unlikely to represent preferred breeding habitat. The 133.14 of Weeping Myall woodland being removed constitutes a small proportion of available breeding habitat throughout the species' range. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained. An additional 44,000 ha within 50 km of the subject land will also be retained.

The removal of 133.14 ha of potential habitat, when considered in relation to the areas to be retained, would not be expected to disrupt the breeding cycle of the population. In addition, prescribed impacts arising from the construction and operation of the wind turbines are not considered to be significant, given the species flyways are below the turbine height.

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SIC assessment for vulnerable species

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. The project is expected to result in the removal of 133.14 ha of potential habitat. This habitat is associated with smaller patches of woodland or the fringes of larger patches, and is considered less suitable for Painted Honeyeater. This habitat is not considered to be quality Painted Honeyeater habitat and it is unlikely that removal of this habitat would result in species decline. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained and would remain available for the highly mobile Painted Honeyeater to continue to forage and breed within the locality.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control.
It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.

Introduce disease that may cause the species to decline.

No. There are no known diseases causing potential species decline to the Painted Honeyeater, or diseases to its preferred food source, mistletoe. The project would be unlikely to result in any increased risk of disease transmission to Painted Honeyeater such that the species would be at risk of decline.
The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.

Interfere substantially with the recovery of the species.

No. Habitat loss and degradation is a key threat to the species. The project would result in direct impacts to 133.14 ha of intact Weeping Myall areas. The National Recovery Plan also states that protection of Painted Honeyeater breeding and foraging habitats at the local, regional and landscape scale is also an important objective. Within the development corridor, 737.95 ha of suitable vegetation would be retained, and within the broader subject land, 6,552.25 ha would be retained. It is considered unlikely that the amount of potential clearing would interfere substantially with the recovery of the species, particularly in the context of the higher quality areas of potential habitat that is being retained.

Conclusion.

Based on the assessment above, it is concluded that Painted Honeyeater is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population.
- Will not disrupt the breeding cycle of an important population, the local population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not interfere will the recovery of the species.

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Appendix 6.2. Superb Parrot *Polytelis swainsonii*

Species background

Superb Parrot is listed as vulnerable under the EPBC Act. Superb Parrots are absent from large areas of the Riverina and northern Victoria, confined to the Barmah forest area with the core distribution being west of the Great Dividing Range in NSW from Canberra, Goulburn and as far west as Nyngan and Swan Hill. There are only three main breeding areas: an area of the south-west slopes bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young (NSW); along the Murrumbidgee River, between Wagga Wagga and Toganmain Station, and farther north at Goolgowi (NSW); and along the Murray and Edward Rivers, from east of Barmah and Millewa State Forest to south of Taylors Bridge (NSW and Victoria). The species occurs in box-gum and acacia woodlands and riverine woodlands. They mostly feed on the ground on fruits and seeds from a variety of plants but also feed extensively in shrubs and trees. In the Riverina area, the Superb Parot nests in loose colonies in large, living or dead trees with many hollow branches, typically near watercourses. The same nest hollows are used in successive years, often by the same pair (DSE 2011).

It was formerly considered that there were two separate populations of the Superb Parrot, one in southern NSW and northern Victoria, and the other further north in NSW (Forshaw & Cooper 1981), but it is now apparent that only a single population exists (Forshaw & Cooper 2002; Garnett & Crowley 2000; Higgins 1999; Webster & Ahern 1992).

Major threats to the Superb Parrot are loss and degradation of habitat, competition for nest hollows, road kills, illegal removal of wild birds, Psittacine beak and feather disease (PBFD) and climate change.

Occurrence in study area

Superb parrot was recorded foraging onsite. Associated PCTs within the subject land include; 10, 13, 15, 17, 26 and 28, however suitable habitat is likely to constitute PCTs 10, 13, 15 and PCT 26 Intact only. There was no evidence of breeding observed within the subject land, and potential hollows were found to be preferentially in use by common species such as Blue Bonnets and Galahs. Sightings of these individuals were predominantly along road corridors and within Intact Weeping Myall vegetation, and on the odd occasion, flying at height above White Cypress Pine communities towards more intact Weeping Myall areas.

SIC assessment for Superb Parrot

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. There are no recognised subpopulations for the Superb Parrot and the species is considered to comprise a single population. Recent estimates suggest the population consists of approximately 20,000 mature individuals, and is considered to be in decline (DSE 2011). Individuals occurring within the study area would therefore be considered to be part of an 'important population' for the purpose of this SIC assessment. The main cause of population decline for Superb Parrot is habitat loss, particularly breeding habitat and nest sites in large hollow-bearing trees. Core breeding habitat is associated with the Barmah-Millewa River Red Gum Forest and Murrumbidgee Red Gum forest Key Biodiversity Areas (KBA), as well as the South-west Slopes of NSW KBA. Impacts to these critical habitat locations are a primary threat to the species (DSE 2011). The subject land contains suitable foraging habitat for the Superb Parrot in the form of woodlands and grasslands where seed, nectar and fruits are available for foraging. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided

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SIC assessment for vulnerable species

as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants. Within the development corridor, 830.58 ha of suitable vegetation would be retained, as well as approximately 8,130.82 ha within the subject land.

Direct impacts will include the removal of 158.17 ha of PCTs 10, 13, 15, 17 and PCT 26 Intact which contain mature woody vegetation that constitute potential habitat for the Superb Parrot. The habitat being removed occurs as smaller patches and the edges of larger patches. Higher quality areas along water courses, road corridors and larger remnants have been largely avoided.

Superb Parrot is a hollow-nesting species, and the project would result in the removal of 15 hollow-bearing trees, out of 67 recorded within the subject land, all of which contain medium to large hollows considered potential habitat for the species. However, these are considered unlikely breeding habitat for the Superb Parrot, which is known to prefer riparian forests that include River Red Gums for breeding, particularly in the Barmah Forest in Victoria and the Millewa and Moira forests in NSW, as well as stretches of the Murrumbidgee River near Wagga Wagga and Darlington Point in NSW (DSE 2011). No evidence of breeding was recorded during surveys for Superb Parrot, though other common species were observed occupying hollows. It is likely that this species is present within the subject land for foraging only, moving to larger riparian areas containing patches or River Red Gums for breeding.

The project would also result in impacts to a further ~500ha of native grassland vegetation, which does represent potential foraging habitat for the Superb Parrot. These areas may be utilised on a seasonal and transient basis by the species but are unlikely to be relied upon for its persistence in the landscape given the vast areas of similar or better quality habitat in the surrounding landscape. Prescribed impacts resulting from the project include the operation of WTGs. Superb parrot was recorded within the RSA, and flies at a height that puts it at a higher risk of collision. While large areas of suitable habitat will be retained within the development corridor and subject land, and remain available for Superb Parrot to utilise, a number of annual flights of the Superb Parrot is at risk of collision. Given this, and that the species was recorded numerous times within the subject land, and within RSA, therefore it is unlikely the project could lead to the long-term decrease in the size of an important population.

Reduce the area of occupancy of an important population.

Yes. The Superb Parrot is highly mobile, and their exact movements are not fully understood. An ongoing decline has been documented across their range, which is projected to further contract and undergo a south-eastern shift in response to climate change. The area of occupancy for the species has not been defined however, actions that remove critical habitat are considered likely to reduce the area of occupancy (DSE 2011). Critical habitat primarily refers to breeding habitat (tree hollows in riparian areas), and suitable foraging habitat in proximity to breeding areas.

The project would not include the removal of areas of critical breeding habitat for the Superb Parrot. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Within the development corridor, 830.58 ha of suitable vegetation would be retained, as well as approximately 8,130.82 ha within the subject land.

Direct impacts would occur to 158.17 ha of PCTs 10, 13, 15 and 26 in intact condition. In addition ~500 ha of grasslands including derived native grasslands will be impacted. These areas may be used on a seasonal or transient basis by the Superb Parrot but are unlikely to be relied upon for its persistence in the landscape and are not considered critical habitat.

Prescribed impacts resulting from the project include the operation of WTGs. Superb parrot was recorded within the RSA, and flies at a height that puts it at a higher risk of collision. While larger areas of suitable habitat will be retained within the development corridor and subject land, and remain available for Superb parrot to utilise. A number of annual flights of the Superb Parrot is at risk of collision as well as the potential, albeit low likelihood, of macro avoidance of habitat within the subject land.

As such, there is potential that the project would reduce the area of occupancy of an important population of Superb Parrot during the operational phase of the project through potential collisions or macro avoidance of habitat.

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SIC assessment for vulnerable species

Fragment an existing important population into two or more populations.

No. The Superb Parrot is a mobile species, capable of undertaking large movements as it migrates seasonally between breeding and non-breeding areas (DSE 2011). Individuals can also move through the landscape matrix to exploit favourable habitat patches and seasonal resources. Higher quality feeding habitats in the form of woodland areas with nectar, fruit and seed resources and adjacent grassland areas have largely been avoided and buffered during the design process. There would be direct impacts to 158.17 ha of PCT 10, 13, 15 and 26 in intact condition. While clearance would only occur in sporadic and linear areas for the WTG and access, the operational phase of the project has the capacity to act as a barrier to movement, due to the moderate collision risk and macro avoidance. However, it is not considered likely the Project may fragment an existing important population into two or more populations.

Adversely affect habitat critical to the survival of a species.

No. Key Biodiversity Areas (KBAs) defined in the National Recovery Plan are considered critical for supporting the long-term persistence of the species. Other critical habitat is associated with areas containing riparian woodlands, with suitable large, hollow-bearing trees for nesting and breeding. The project is not within a KBA and does not involve the removal of riparian woodlands that could be considered breeding habitat critical to the survival of the species.

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. There will be direct impacts to 158.17 ha of PCT 10, 13, 15, 17 and 26 (intact) that is considered potential habitat for Superb Parrot. This habitat occurs as small patches and the edges of larger patches, and is likely of lesser quality than larger, intact remnants and is therefore not consistent with habitat critical to the survival of the species. In addition, the project will result in prescribed impacts to the species such as high collision risk from operational WTGs.

A total of 15 hollow-bearing trees are being removed as part of the project. No breeding has been recorded in these hollows either historically or during the current survey. There is a low likelihood that these trees represent critical habitat to the species' survival, particularly in the broader landscape context where it is likely individuals would target hollow-bearing trees in riparian vegetation containing dense River Red Gums for nesting.

Within the development corridor, 830.58 ha of suitable vegetation would be retained, as well as approximately 8,130.82 ha within the subject land. These larger, intact patches are likely to be more critical to the survival of the species than those being removed.

As described in the National Recovery Plan, where habitat cannot be avoided it should be offset. Under the BAM, foraging habitat for Superb Parrot impacted by the project would generate ecosystem and species credits that would be retired prior to construction.

Disrupt the breeding cycle of an important population.

No. No known breeding habitat will be impacted by the project. A total of 15 hollow-bearing trees are being removed however, these are considered unlikely to be utilised by Superb Parrot as they are not associated with riparian habitats. Majority of riparian vegetation has been avoided and buffered as part of the detailed design of the project. Despite this, prescribed impacts arising from the operational phase of the project include a moderate collision risk for Superb Parrot. While potential breeding habitat within the subject land is suboptimal, the collision risk associated with the operation of the WTGs may result in a barrier to movement for the local population, resulting in fatality of breeding pairs. However, the reduction in small numbers of breeding individuals is unlikely to effect the overall breeding cycle of the Superb Parrot.

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SIC assessment for vulnerable species

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Yes. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Additionally, no known breeding site will be impacted. The project would also result in the removal of up to ~500 ha of native vegetation likely to constitute potential foraging habitat for Superb Parrot. While large areas of similar habitat exist in the landscape, and will be retained as part of the Project, the collision risk resulting from the operation of WTGs following construction has the potential to act as a barrier to the movement of Superb Parrot and therefore isolate individuals within the local population. Therefore, there is potential that the project would isolate the availability of habitat to the extent that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control.
It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.

Introduce disease that may cause the species to decline.

No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.

Interfere substantially with the recovery of the species.

No. Habitat loss is a key threat to the Superb Parrot, particularly removal of critical breeding resources associated with large, hollow-bearing trees in riparian areas. The project would result in direct impacts of 158.17 ha of PCTs 10, 13, 15, 17 and 26 (intact), however this vegetation is not considered suitable breeding habitat for Superb Parrot, or habitat critical to the survival of the species. Within the development corridor, 830.58 ha of suitable vegetation would be retained, as well as approximately 8130.82 ha within the subject land. Wind turbine strike as a result of operational wind farms is also listed within the National Recovery Plan as a key threat to the species (DAWE 2021b). While there is unlikely to be an impact to breeding habitat and most high quality foraging habitat would be retained, the operation of WTGs within the subject land has the potential to result in the creation of a barrier to movement for the species, and habitat avoidance in proximity to WTGs. Therefore, the Project has the potential to interfere with the recovery of the Superb Parrot.

Conclusion.

Based on the assessment above, it is concluded that Superb Parrot has the potential to be significantly impacted by the project. This conclusion was made on the basis that the project:

- May lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population. This results from removal of habitat and risk of collisions.
- May isolate or decrease the availability or quality of habitat to the extent the species declines.
- May interfere will the recovery of the species.

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Appendix 6.3. Southern Whiteface *Aphelocephala leucopsis*

Species background

Southern Whiteface is listed as vulnerable under the EPBC Act. The species is a small and stocky, thornbill-like bird with a brown dorsum, dark brown wings, a white belly and a black tail with narrow white tip. The species has characteristic facial markings, consisting of a white band across the forehead, with a darker streak along the top edge (Cth DCCEEW 2023a). The species lives in a wide range of open woodland and shrublands where there is an understorey of grasses and/or shrubs. Southern Whitefaces forage almost exclusively on the ground, favouring habitat with low tree densities and an herbaceous understorey litter cover. The species' diet consists of insects, spiders, and seeds. These birds usually forage in small groups, consisting of between two and eight individuals, but may be seen in larger flocks of up to 70, including mixed species feeding flocks (Cth DCCEEW 2023a).

The species occurs across most of mainland Australia, south of the tropics. While there are currently an estimated 477,000 mature individuals in the wild, the population has declined by an estimated 30 to 50% every ten years since 1999 (Cth DCCEEW 2023a). Habitat critical to the survival of Southern Whiteface includes areas of relatively undisturbed open woodland and shrublands with an understorey of shrubs and/or grasses, habitat with low tree density and an herbaceous understorey litter cover which provides essential foraging habitat, and living and dead trees with hollows and crevices which are essential for roosting and nesting. Habitat loss and fragmentation are considered the most likely causes of the species' current decline, through drought and extreme weather events also play a role.

Occurrence in study area

Southern Whiteface has been recorded within and adjacent to the subject land. Suitable habitat for this species is available in woodland, scattered trees and open farmland associated with PCTs 13, 15, and 26.

SIC assessment for Southern Whiteface

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. Important populations have not been defined in the Commonwealth Conservation Advice and a national recovery plan has not been prepared. The population is estimated to be 477,000 mature individuals in the wild, consisting of two subspecies: the south-east southern whiteface (410,000) and the south-west southern whiteface (67,000). Habitat loss and fragmentation is the likely cause of species decline, as a result of intensive agriculture and increasing drought. The subject land contains suitable habitat for the Southern Whiteface, which prefers open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. The species favours habitat with low tree densities an herbaceous understorey with litter cover. Several observations were made of Southern Whiteface within the subject land. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this subspecies, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants. There is a low likelihood that the project would lead to the long-term decrease in the size of the population of the Southern Whiteface.

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SIC assessment for vulnerable species

Reduce the area of occupancy of an important population.

No. No important populations have been identified for the Southern Whiteface. The extent of occurrence for the species is estimated to be 4,910,000 km^2, however the area of occupancy is contracting and is estimated to be 70,000 km^2. Reduced area of occupancy for the species is associated with the complete removal of habitat for intensive agriculture. Suitable habitat for this species occurs primarily in areas of open woodlands.
Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, including intact woodland areas that are the most likely habitat for this subspecies, were avoided as much as possible. The project is considered unlikely to significantly impact the area of occupancy of the Southern Whiteface.

Fragment an existing important population into two or more populations.

No. Southern Whitefaces are considered sedentary, but may move into wetter areas outside of their normal range during wetter years. It is unlikely that the project would result in fragmentation for the species. The operation phase of the project is considered compatible with continued occupation by Southern Whiteface, which would be able to utilise retained habitats within the subject land. Areas of habitat being removed are associated with small remnants and the fringes of larger remnants, which is unlikely to result in any barriers to movement. The species is able to move through open areas as well as lightly timbered woodlands, and it is unlikely that the project would result in a barrier to movement for the species.

Adversely affect habitat critical to the survival of a species.

No. The Conservation Advice for the Southern Whiteface defines habitat critical to its survival as:
Relatively undisturbed open woodlands and shrublands with an understorey of grasses or shrubs, or both;
Habitat with low tree densities and an herbaceous understory litter cover which provides essential foraging habitat;
Living and dead trees with hollows and crevices which are essential for roosting and nesting.

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible.
Trees with small hollows or crevices are important resources for Southern Whiteface breeding. The project would result in the removal of 15 hollow-bearing trees. Overall however, the majority of hollow-bearing trees have been avoided and would be retained, in addition to intact woodland areas that would contain suitable breeding resources for the Southern Whiteface. These trees are unlikely to be critical to the species' survival in the broader landscape context where large areas of suitable habitat will be retained.

Disrupt the breeding cycle of an important population.

No. There is a low likelihood that the project would result in any disruption to the breeding cycle. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible.
It is considered unlikely that the areas subject to removal would result in disruption of the breeding cycle to the Southern Whiteface.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible

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SIC assessment for vulnerable species
The project includes the removal of up to 21.77 ha of Black Box woodland, and 133.14 ha of intact Weeping Myall woodland representing habitat for this species, as well as 15 hollow-bearing trees. Impacts as a result of the project are considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. Within the subject land, 1,685 ha of suitable habitat would be retained. Furthermore the species occurs across the majority of southern Australia and as such localised impacts associated with the project will not impact habitat to the extent that the species as whole is likely to decline. In addition, mitigation methods implemented as part of a Biodiversity Management Plan for the project will ensure that indirect impacts including weed establishment and pests are minimised for the duration of the works and upon operation.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control. It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.
Introduce disease that may cause the species to decline.
No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.
Interfere substantially with the recovery of the species.
No. There is currently no National Recovery Plan for the Southern Whiteface, however conservation and management priorities within the approved conservation advice for the species primarily relate to reducing clearing of critical habitat (particularly for agriculture), revegetation to expand and connect areas of existing habitat and minimising habitat degradation caused by livestock. The project includes the removal of up to 21.77 ha of Black Box woodland, and 133.14 ha of intact Weeping Myall woodland representing habitat for this species, as well as 15 hollow-bearing trees. Within the subject land, at least 1,685 ha of suitable habitat would be retained. The operation phase of the project is considered compatible with persistence of Southern Whiteface in the landscape, and would not present a barrier to movement. The project is not likely to interfere substantially with the recovery of the species.
Conclusion.
Based on the assessment above, it is concluded that Southern Whiteface is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population. • Will not disrupt the breeding cycle of an important population, the local population or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not interfere will the recovery of the species.

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Appendix 6.4. Diamond Firetail *Stagonopleua guttata*

Species background

The Diamond Firetail is listed as vulnerable under the EPBC Act. It is a large, striking finch with a bright red bill, and red eyes and rump. Diamond firetails occur on the south-east mainland of Australia from south-east Queensland to Eyre Peninsula, South Australia, and about 300 km inland from the sea. Diamond firetails occur in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover. Diamond firetails usually occur in flocks of between 5 to 40, and occasionally more. The species appears to be sedentary, though some populations move locally. Their flight is described as low and direct in long lines with slight undulations. Birds roost in dense shrubs or in smaller nests built especially for roosting (Cth DCCEEW 2023b).

Diamond Firetails are distributed across the south-east mainland of Australia, from south-east Queensland to south-east South Australia. While there are currently an estimated 136,000 mature individuals in the wild, the species' population has declined by approximately 30 to 50% within the last 10 years (Cth DCCEEW 2023b). The biggest contributor to this decline is the clearance of quality nesting and breeding habitat, though habitat degradation also plays a role.

Occurrence in study area

Diamond Firetail were recorded during detailed surveys. The species is thought to be sedentary, though some populations move locally.

SIC assessment for Diamond Firetail

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. There is a low likelihood that the project would lead to a long-term decrease in the size of an important population of the Diamond Firetail. There are currently estimated to be 136,000 mature individuals in the wild, however the reliability of these estimates is low (Cth DCCEEW 2023b) . No important populations have been identified for Diamond Firetail within the approved conservation advice for these species. The main threat causing local declines of Diamond Firetail populations is native vegetation clearance for large scale agriculture that has resulted in a decrease in the size and quality of important nesting and breeding habitats (Cth DCCEEW 2023b). Overgrazing and the replacement of native perennial grasses with exotic annual grasses has also led to food shortages during autumn and winter. The subject land contains habitat suitable for the Diamond Firetail, which prefers open forests and lightly timbered habitats, including farmland and grassland with scattered trees. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this subspecies, were avoided as much as possible. The operation phase of the project is also considered compatible with the foraging activity of Diamond Firetail, which would still be able to exploit seasonal grassland resources within the subject land following construction. Given the expansive areas of native vegetation in the broader landscape, and the large patches of suitable habitat within the subject land to be retained, the project is not expected to lead to long-term decreases in the size of the population of Diamond Firetail.

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SIC assessment for vulnerable species

Reduce the area of occupancy of an important population.

No. No important populations have been identified for Diamond Firetail. The extent of occurrence is estimated at 1,500,000 km^2 and the area of occupancy is estimated at 25,000 km^2.
Suitable habitat for this species occurs throughout the subject land in grasslands, lightly timbered and intact woodland remnants. Activity is likely to be concentrated in more remnant vegetation where suitable shrubs occur for shelter and roosting, however, contain low tree densities..
Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, including intact woodland areas that are the most likely habitat for species, were avoided as much as possible. Higher quality areas along water courses and larger remnants have been largely avoided and buffered. The habitat being removed occurs as smaller patches and the edges of larger patches. This would constitute a minor reduction in the potential area of occupancy available to the species that is unlikely to represent a significant impact.
The operation phase of the project is considered compatible with the foraging activity of Diamond Firetail, which would still be able to utilise grassland habitats within the subject land. The project is therefore considered unlikely to significantly impact the area of occupancy for the Diamond Firetail.

Fragment an existing important population into two or more populations.

No. Diamond Firetail is thought to be mostly sedentary, though some populations do undergo local movements. It is unlikely that the project would result in fragmentation for the species. Areas of suitable habitat being removed include smaller patches of woodland vegetation and the fringes of larger patches, which is unlikely to result in any barriers to movement. The operation phase of the project is considered compatible with the foraging activity of Diamond Firetail, which would still be able to utilise grassland habitats within the subject land. The species is able to move through open areas as well as lightly timbered woodlands, and it is unlikely that the project would result in a barrier to movement for the species.

Adversely affect habitat critical to the survival of a species.

No. The Conservation Advice for the Diamond Firetail defines habitat critical to its survival as:

- Eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats;
- low tree density, few large logs and little litter cover by high grass cover for foraging, roosting and breeding;
- drooping she-oak within the Mt Lofty Ranges.

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible.
The operation phase of the project is considered compatible with ongoing occupation of the area by Diamond Firetail, which would be able to utilise grassland habitats following construction and within retained patches of vegetation.

Disrupt the breeding cycle of an important population.

No. Suitable foraging and breeding habitat for this species occurs throughout the subject land in grasslands, lightly timbered and intact woodland remnants. Activity is likely to be concentrated in more intact remnants where suitable shrubs occur for shelter, roosting and breeding. Breeding habitat is also associated with the stick nests of raptors, which were present, would be located in tall trees in the landscape.
There is a low likelihood that the project would result in any disruption to the breeding cycle. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants, representing the most suitable breeding habitat for Diamond Firetail. As large areas of similar habitat exist in the landscape, and would be retained as part of the project, it is unlikely that the areas subject to removal would result in disruption of the breeding cycle of Diamond Firetail.

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SIC assessment for vulnerable species
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Additionally, no known breeding site will be impacted. Once operational, the subject land would continue to provide potential habitat for this species in the form of open grasslands that may provide foraging resources or movement corridors through the landscape. Impacts as a result of the project are considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. In addition, mitigation methods implemented as part of a Biodiversity Management Plan for the project will be implemented to ensure that indirect impacts including weed establishment are minimised for the duration of the works.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control. It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.
Introduce disease that may cause the species to decline.
No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.
Interfere substantially with the recovery of the species.
No. There is currently no National Recovery Plan Diamond Firetail, however recovery actions are outlined within the approved conservation advice for the species. Those relating to the project include: • Retain and protect woodland, open forest, grassland and mallee habitat from clearing, fragmentation and disturbance (areas of 200 ha or greater within woody vegetation are particularly significant). • Protect and maintain areas of high-quality habitat, which includes open forest, woodland, mallee and grasslands with a diverse ground layer dominated by a mixture of grass species which seed at different times of year (providing a year-round food supply) and provides scattered shrubs for shelter. • Retain mistletoe and scattered patches of dense shrubs for nesting habitat, particularly in areas close to water. While the project will result in the removal of myall woodland, derived grasslands and small areas or riverine woodland habitats, the area of habitat to be removed by the project is surrounded by contiguous areas of suitable foraging and breeding habitat, with similar or higher quality resources. The project is unlikely to pose a barrier to movement of the species within the broader locality. Given these factors it is considered unlikely that the project will interfere with the recovery of these species.
Conclusion.
Considering the above factors, it is unlikely that the project will impose a significant impact Diamond Firetail as: • Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population. • Will not disrupt the breeding cycle of an important population, the local population or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.

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SIC assessment for vulnerable species

- Will not interfere will the recovery of the species.

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Appendix 6.5. Eastern Major Mitchell's Cockatoo *Lophochroa leadbeateri*

Eastern Major Mitchell's Cockatoo is listed as endangered under the EPBC Act. The eastern Major Mitchell's cockatoo lives in arid and semi-arid woodlands dominated by Mulga (*Acacia aneura*), Mallee and box eucalypts, Slender Cypress Pine (*Callitris gracilis*) or Belah (*Casuarina cristata*). Within these vegetation types, the subspecies main requirements are fresh surface water, and trees with suitable nesting hollows. The main threat causing the decline of the subspecies is habitat loss and degradation. A major aspect of habitat loss is the loss of large hollow-bearing trees which provide nest sites.

The subspecies occur in the Murray-Darling, Eyre and Bulloo River basins, from Isisford and Roma in the north, through western New South Wales to north-west Victoria and west to eastern South Australia.

Eastern Major Mitchell's Cockatoo has specific preference of nesting hollows close to wooded areas, using these areas for travel between feeding area and nesting or roosting sites. Fragmented landscapes, the vegetated corridors tend to be the preference for travel as well as roadside remnant vegetation patches (DCCEEW, 2023).

Eastern Major Mitchell's Cockatoo typically prefer hollows with the following characteristics (Cth DCCEEW 2023g):

- Average hollow entrance diameter of 13.3 x 27.7 cm (range 8-30 x 9-80 cm, horizontal x vertical diameter).
- Average hollow depth of 53.9 cm (range 19 – 180 cm).
- Average nest chamber floor diameter of 18 cm (range 9-34 cm).
- Average nest tree diameter at breast height of 72.5 cm (range 34-149 cm).

Occurrence in study area

Surveys for eastern Major Mitchell's Cockatoo were undertaken as part of the diurnal bird surveys and BBUS. The species was not recorded during these surveys, but has been recorded approximately 13 kilometres from the subject land. Foraging and breeding habitat is represented by large hollows and woodland communities within PCT's 13, 15, 26 and 45.

SIC assessment for Major Mitchell's Cockatoo

SIC assessment for Major Mitchell's Cockatoo
Lead to the long-term decrease in the size of a population.
No. There is a low likelihood that the project would lead to a long-term decrease in the size of the population of the eastern Major Mitchell's Cockatoo. The subspecies *Lophochroa leadbeateri leadbeateri* is commonly known as the Eastern Major Mitchell's Cockatoo. It is considered to exist as a single population, with no sub-populations identified in the Conservation Advice for the species (Cth DCCEEW 2023c). The population has undergone a severe reduction, and was estimated at around 15,000 mature individuals in 2011. The main threat causing decline of the subspecies is habitat loss and degradation, particularly the removal of large hollow-bearing trees which are used for nesting. Eastern Major Mitchell's Cockatoo requires large areas of intact woodland vegetation and corridors for movement across the landscape, with specific requirements for nesting tree species and hollow characteristics. Impacts that result in a decline of these requirements are considered likely to contribute to a decrease in the size of the population.

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SIC assessment for Major Mitchell's Cockatoo

The subject land contains habitat considered suitable for the subspecies. Large hollows occur in woodland communities within the site. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this subspecies, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants.
This species was not recorded during detailed BUS across a two year period. Hollow bearing trees will be removed as part of the project, limited to 15. Turbine collision is possible, but overall risk is considered low.
Habitat being removed is linear in nature, occurs generally within smaller patches and the edges of larger patches. Higher quality areas along water courses and larger remnants have been largely avoided and buffered.
Eastern Major Mitchell's Cockatoo is a hollow-nesting species, and the project would result in the removal of 15 hollow-bearing trees, out of 67 recorded within the subject land. Of these, only seven contain large hollows considered potential habitat for the species. No evidence of breeding was recorded during surveys for Major Mitchell's Cockatoo, and no historic records occur within the subject land of breeding by this species. It is considered unlikely that the species is utilising these hollows for breeding.
It is considered unlikely the project will lead to the long-term decrease in the size of the population of this subspecies.

Reduce the area of occupancy of the species

No. The species area of occupancy is estimated to be 225,000 km2 and is considered to have undergone a decline due to the ongoing loss and degradation of breeding habitat (Cth DCCEEW 2023c). Uncleared rangeland comprises much of its range, and it is thought that 20 – 30% of this range is still occupied.
The eastern Major Mitchell's Cockatoo prefers to feed in or close to wooded areas, and utilise wooded corridors for movement through fragmented landscapes. Wooded areas are therefore likely to be key habitat for the species.
Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, including intact woodland areas that are the most likely habitat for this subspecies, were avoided as much as possible. The project would remove relatively small areas of habitat within this expanse. The project would result in the removal of 15 hollow-bearing trees, out of 67 recorded within the subject land. Of these, only seven contain large hollows considered potential habitat for the species. Impacts to foraging habitat will occur, and although the subject land contains suitable foraging habitat, as this species was not detected across two years of BBUS survey, it is like unlikely habitats within the subject land are utilised frequently by this species. It is unlikely the project will result in a substantial reduced area of occupancy for this species.

Fragment an existing population into two or more populations.

No. Eastern Major Mitchell's Cockatoo are highly mobile and individuals can move through areas of less suitable and marginal habitat to seek out and exploit favourable habitat patches. The subspecies prefer to feed in or close to wooded areas, and use wooded areas for travel between feeding areas and nesting or roosting sites (Cth DCCEEW 2023c). Vegetation corridors will not be subject to large scale direct impacts by the project, and the level of habitat fragmentation, in relation to Eastern Major Mitchell's Cockatoo will generally be minimal. These habitats have largely been avoided and buffered during the design process and allows for movement throughout the subject land. The project is considered unlikely to result in fragmentation of the population, with suitable movement corridors being retained within the subject land and within the broader landscape context.

Adversely affect habitat critical to the survival of a species.

No. Eastern Major Mitchell's Cockatoos inhabit a wide range of plant communities, mostly in arid and semi-arid woodlands, always within easy reach of surface water. Habitat critical to the survival of the eastern Major Mitchell's cockatoo consist of:

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SIC assessment for Major Mitchell's Cockatoo

- Arid and semi-arid woodlands dominated by mulga (*Acacia aneura*), mallee and box eucalypts, slender cypress pine (*Callitris gracilis*) or belah (*Casuarina cristata*).
- Known habitat containing suitable attributes, including potential habitat for the subspecies, especially where there are large mature trees with suitable hollows; and
- Surrounding matrix of these areas for the role of providing movement corridors for dispersal across the landscape.

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this subspecies, were avoided as much as possible. Areas of intact woodland have predominantly been avoided during the design process. There will be direct linear impacts to 21.77 ha of Black Box woodland, and 133.14 ha of Weeping Myall (intact) woodland, that could be considered potential habitat for the eastern Major Mitchell's Cockatoo.

A total of 15 hollow-bearing trees are being removed as part of the project, with seven of these containing hollows of a suitable size for the eastern Major Mitchell's Cockatoo. No breeding has been recorded in these hollows either historically or during the current survey. There is a low likelihood that these trees represent critical habitat to the species' survival, particularly in the broader landscape context where it is likely individuals would target large, intact remnants for breeding.

Within the subject land, as this species was not recorded across two years of BBUS, and given the retention of a high percentage of the species' breeding and foraging habitat, the project is not expected to adversely affect habitat critical to the survival of the Eastern Major Mitchell's Cockatoos

Disrupt the breeding cycle of a population.

No. No known breeding habitat will be impacted by the project. A total of 15 hollow-bearing trees are being removed as part of the project, with seven of these containing hollows of a suitable size for the eastern Major Mitchell's Cockatoo. No breeding has been recorded in these hollows either historically or during the current survey. Given the large amount of suitable habitat being retained, it is considered unlikely that the project would result in any disruption to the breeding cycle of the population.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Additionally, no known breeding site will be impacted. Therefore, the magnitude of the impact is small in the context of other causes of habitat loss operating across the species' range and in isolation is unlikely to impact the species to the extent that it would cause a decline in the population.

Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat.

No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control.
It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.

Introduce disease that may cause the species to decline.

No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction

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SIC assessment for Major Mitchell's Cockatoo
of pathogens as a result of the construction and operation of the project.
Interfere substantially with the recovery of the species.
No. The main threat causing the decline of the subspecies is habitat loss and degradation. A major aspect of habitat loss is the loss of large hollow-bearing trees which provide nest sites. Actions that remove habitat critical to the survival of the subspecies would interfere with the recovery of the subspecies (Cth DCCEEW 2023c). The project would not be removing habitat critical to the survival of the subspecies, as no breeding habitat has been identified. High-quality woodland vegetation has largely been avoided, and this habitat is considered more likely to be critical to the subspecies' survival than that which is being removed.
Conclusion.
Based on the assessment above, it is concluded that Eastern Major Mitchell's Cockatoo is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population. • Will not disrupt the breeding cycle of a population, or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not interfere will the recovery of the species.

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Appendix 6.6. Australian Painted Snipe *Rostratula australis*

Species background

Australian Painted Snipe is listed as endangered under the EPBC Act. This species is a small, freshwater wader with a long bill that droops slightly at the tip. This species occurs in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, dams and marshy areas where there is a cover of grasses, lignum, samphire, low scrub or open timber. Australian Painted Snipe nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. The species forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.

Australian Painted Snipe is a highly mobile species, their dispersive movements have been attributed to local conditions; with movements to flooded areas and from drying to permanent wetlands, away from areas affected by drought. Distribution includes scattered records across Australia. In NSW, many records are from the Murray-Darling Basin, with other important areas including the Hawkesbury River and the Clarence and lower Hunter Valleys.

Occurrence in the study area

Surveys for Australian Painted Snipe were undertaken as part of the diurnal bird surveys and BBUS. The species was not recorded during these surveys, despite periods of above average rainfall and flooding events increasing the quantity and availability of water within the subject land and surrounding landscape, but has been recorded approximately 25 kilometers from the subject land over 15 years ago. Suitable habitat for this species is broadly available within farm dams, and freshwater Lignum wetlands and shrublands within PCT 24, PCT 17, PCT 13 and PCT 15.

SIC assessment for Australian Painted Snipe

SIC assessment for Australian Painted Snipe
Lead to the long-term decrease in the size of a population of a species.
No. There is a low likelihood that the project would lead to a long-term decrease in the size of the population of the Australian Painted Snipe. The Australian Painted Snipe is a highly cryptic and poorly known species. The species forms a single, homogenous breeding population across most of Australia. The main threat considered likely to decrease the size of the Painted Snipe population is the loss and degradation of wetlands through drainage and the diversion of water for agriculture and reservoirs (Cth DCCEEW 2022a). No Painted Snipe were recorded within the subject land. Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain. It is possible that these areas may be exploited by the Australian Painted Snipe on a seasonal or transient basis in response to suitable conditions. These habitats are not considered optimal habitat for the Australian Painted Snipe, however this species is known to fly to and from nomadically based on environmental conditions, influenced by factors such as habitat availability, water levels, and food resources as well as for breeding events between September and March. Swamps, and flooded grasslands may provide suitable habitat on the rare occasion during rare flooding events. Australian Painted Snipes typically fly at relatively low elevations, especially during their migration and foraging activities. They are not considered high-altitude migratory birds like some species of waterbirds and/or raptors. Instead, they tend to fly close to the ground, skimming over wetlands and vegetation as they move between feeding and breeding sites. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity

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SIC assessment for Australian Painted Snipe

value, and therefore most likely habitats for Australian Painted Snipe were avoided as much as possible. Suitable aquatic habitat and low-lying areas with potential for seasonal inundation throughout the subject land have been buffered and excluded by design from development, resulting in retention of larger Lignum swamps, farm dams and the Coleambally Outfall Drain.

Direct impacts to potential habitat for Australian Painted Snipe will be limited to small areas around Coleambally Outfall Drain and suboptimal ephemeral habitat within PCT 24, PCT 17, PCT 13 and PCT 15. associated with the removal of small areas of ephemeral lignum swamp and fringing areas. The project would retain larger and more intact wetland areas and would not result in barriers or obstructions to movement in the landscape for the species.

The project does not include any impacts that would result in the drainage and diversion of water or removal of large areas of key habitat.

The direct impacts that would occur to potential Painted Snipe habitat are considered negligible. The species is highly mobile, and capable of exploiting seasonally available resources across a large geographic area. As such, it is considered unlikely that Painted Snipe would be reliant on the marginal quality habitat being impacted as a result of the project for its persistence in the landscape. The project is therefore considered unlikely to lead to a long-term decrease in the size of an important population of the species.

Reduce the area of occupancy of a population.

No. The species is widespread and is not considered to have a restricted geographic distribution however, within its geographic range records are sparse and scattered, with movements of the species considered unpredictable. The area of occupancy is therefore much less than the extent of occurrence, 2000 km^2 compared with 7,100,000 km^2 (DSEWPC 2013).

Suitable habitat within its range is relatively restricted, and associated with shallow terrestrial freshwater (occasionally brackish) wetlands including temporary or permanent lakes, swamps and claypans as well as periodically inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. The species is highly mobile, and capable of travelling large distances to exploit these resources as they become available across the landscape in response to prevailing weather conditions.

There is a low likelihood that the project would reduce the area of occupancy for the Australian Painted Snipe. Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain that are most likely to represent suitable Painted Snipe habitat. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Suitable wetland habitat and low-lying areas have been largely excluded from the development by design, with direct impacts limited to small areas of potentially suitable habitat around Coleambally Outfall Drain and suboptimal ephemeral habitat within PCT 24, PCT 17, PCT 13 and PCT 15. Impacts to potentially suitable habitat surrounding the Coleambally Outfall Drain., are short-term and temporary, and would not affect the long-term suitability of these sites for use by Australian Painted Snipe.

The potential for the Australian Painted Snipe to flyover the subject land in search of suitable habitat cannot be discounted, however, a significant flyway is not anticipated. The operation of the project would not preclude this species from occurring in the landscape during high rainfall events. distribution of presumably higher quality habitat does not place the subject land in a location that is likely to be utilised for passage by the Australian Painted Snipe. This is supported by lack of detection of the species during BUS. Generally, assessment has found the risk the project poses for collision or barrier effect is low to negligible. The project is considered unlikely to result in a significant reduction to the area of occupancy for the Australian Painted Snipe.

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SIC assessment for Australian Painted Snipe

Fragment an existing population into two or more populations.

No. The project is considered unlikely to lead to fragmentation of the population. The species is highly mobile and capable of travelling large distances to exploit suitable resources. The nature of the project would not preclude Australian Painted Snipe from occupying the area during favourable conditions. The project is unlikely to incur major disturbance to higher condition mapped NSW wetlands or localised riparian corridors within the subject land and will not incur a disturbance to the key riparian corridors likely to be used by this species within the broader landscape between areas of habitat.
Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Suitable wetlands, including ephemeral water bodies and the Coleambally Outfall Drain would be retained as part of the project.

Adversely affect habitat critical to the survival of a species.

No. Habitat critical to the survival of this species as outlined by the National Recovery Plan is difficult to define into a single description due to variability of habitat used across its range (e.g., coastal and inland). Australian Painted Snipe are a highly mobile species, capable of undertaking large-scale movements to exploit ephemeral resources. The species is known to rely on wetlands for both breeding and foraging, and these habitats within its range can be considered as critical to the survival of the species. The habitat present within the subject land is not considered to constitute critical habitat for this species. The project would result in direct impacts to small areas around Coleambally outfall drain within existing crossings as well areas of marginal ephemeral habitat within PCT 24, PCT 17, PCT 13 and PCT 15. Although these habitats are wetland habitats and therefore potentially utilised by Australian Painted Snipe, they are considered low quality within the broader landscape context, where larger wetlands occur that would likely be preferred by Painted Snipe due to having increased foraging, breeding and sheltering opportunities.
Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Given the availability of higher quality habitat within the broader landscape, the impacts of the project on a small amount of potential habitat for Painted Snipe are considered minimal, and unlikely to affect the survival of the species.

Disrupt the breeding cycle of a population.

No. The Australian Painted Snipe breeds in response to seasonal rainfall patterns and wetland conditions, relying on wetlands and inundated areas for breeding and foraging (Cth DCCEEW 2022a). There is a low likelihood that the project would disrupt the breeding cycle of an important population. The project is unlikely to incur major disturbance to localised riparian corridors within the subject land and will not incur a disturbance to the key riparian corridors likely to be used by this species within the broader landscape between areas of key habitat is unlikely to result in any disruption to the breeding cycle, given the availability of other wetland areas and the broader landscape and the high mobility of the species. The project would not lead to the permanent degradation or removal of habitat such that the recruitment, survival or dispersal rates of an important population would be lowered enough to have a significant impact on the species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. The project is unlikely to modify remaining potential habitat that may be available to the species during flooding events such that the species is likely to decline. Australian Painted Snipe is a highly mobile species, and is capable of undertaking large spatial movements to exploit seasonally available resources. Removal of a minor amount of

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SIC assessment for Australian Painted Snipe
suboptimal habitat is unlikely to represent a significant loss of habitat for the species.
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat.
No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control. It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.
Introduce disease that may cause the species to decline.
No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.
Interfere substantially with the recovery of the species.
No. The project would not interfere with the recovery plan objectives, which are to sustain a positive population trend by minimising threats to the species, protecting its habitat and generating new knowledge. The project would remove a small amount of marginal quality potential habitat, but has avoided through design higher quality areas that may be utilised by the Painted Snipe.
Conclusion.
Based on the assessment above, it is concluded that Australian Painted Snipe is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population. • Will not disrupt the breeding cycle of a population, or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not interfere will the recovery of the species.

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Appendix 6.7. Australasian Bittern *Botaurus poiciloptilus*

Species background

The Australasian Bittern is listed as endangered under the EPBC Act. It is a large, stocky, thick-necked, heron-like bird and has a prominent black-brown stripe running down the side of the neck, the eyebrow is pale, and the chin and upper throat are white. In Australia, the Australasian Bittern occurs from south-east Queensland to south-east South Australia as far as the Adelaide Region, southern Eyre Peninsula, Tasmania and in the southwest of Western Australia (DEE 2019).

This species occurs in freshwater wetlands, and rarely, estuaries or tidal wetlands. Wetlands with tall, dense vegetation with aquatic habitat in up to 0.3 metres deep of water are utilised for foraging. Nesting occurs adjacent to relatively deep, densely vegetated freshwater swamps and pools, building a nest in vegetation generally up to 2.5 metres tall, with nests built up to around 0.3 metres above the water level (DEE 2019). Rice fields are also known to be frequently utilised by this species (DEE 2019).

The Australasian Bittern has primarily been impacted by the loss of wetland habitat through the diversion of water away from wetlands; drainage of swamps; and clearing for urban and agricultural development. Habitat degradation due to factors such as reduced water quality, invasion by weeds, impacts from grazing animals and reduced water flows due to a changing climate are also impacting on Australasian Bittern survival and breeding success. Predation by introduced species may also be limiting survival but more research is required to determine the relative importance of this threat.

Occurrence in study area

Australian Bittern has not been recorded within the subject land, but is known to move through the site during migration. Suitable habitat is present, represented by Lignum woodland and wetland PCT 13, but this is considered marginal habitat and unlikely to be used regularly or relied upon by the species. Habitat is also available associated with the Coleambally Outfall Drain and surrounding areas.

There is no optimal habitat for the Australasian Bittern within the subject land. The species is known to fly to and from breeding grounds in and around Leeton and Griffith in NSW, through to Victoria. It is very unlikely that this species would occur within the subject land, other than rare transient use or during increased seasonal flooding events and on short term, temporary basis.

SIC assessment for Australasian Bittern

SIC assessment for Endangered species
Lead to the long-term decrease in the size of a population.
No. There is a low likelihood that the project would lead to a long-term decrease in the size of an important population of the Australasian Bittern. It is estimated that there are 1300 mature Australasian Bittern individuals in Australia. These can be divided into two subpopulations, the south-eastern and the south-western subpopulations. The rice fields of the Riverina, including the Murrumbidgee and Coleambally Irrigation Areas support the largest known population of Australasian Bittern, and up to 59% of the national population (Cth DCCEEW 2022b). It is thought that the population has been in decline for over 30 years, associated with the loss of key breeding habitats. Current threats to the species are primarily associated with hydrological changes and habitat removal or modification, that would further reduce the availability and quality of breeding and foraging habitat for the species. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity

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SIC assessment for Endangered species

value, and therefore most likely habitats for Australasian Bittern, were avoided as much as possible. Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain. Suitable aquatic habitat and low-lying areas with potential for seasonal inundation throughout the subject land have been buffered and excluded by design from development. Although it may utilise these habitats within the subject land on a seasonal or transient basis in response to flooding events, it is unlikely that the species relies upon these habitats to complete its lifecycle.

This species is known to fly to and from breeding grounds in and around Leeton and Griffith in NSW, through to Victoria Potential flight heights for Australasian Bitterns can vary depending on several factors, including habitat type, weather conditions, and behavioural patterns. Generally, Bitterns are known to fly at relatively low altitudes, often skimming over wetland vegetation such as reeds and grasses. This low-level flight behaviour is believed to be an adaptation to their hunting strategy, as they primarily prey on small fish, frogs, and invertebrates found in shallow water within wetland habitats. Bitterns are likely to fly lower to minimise energy expenditure and maintain stability due to their bulky heavy set build. However, prolonged flights over open areas and open habitats may occur on occasion, and they may occasionally ascend to slightly higher altitudes, particularly during certain behaviours such as territorial displays, courtship flights, or nomadic movements. It is not well known, and although possible, it is considered an unlikely event that Bitterns would fly within the RSA of this project, that being within 80-280m above ground level. Recent research shows they can ascend to higher altitudes, and although based on a small sample size of three individuals, recent GPS movement tracking of Australasian Bitterns in New Zealand has shown the species can fly within RSA height, with one individual spending 61% of its time at heights of 20–200 metres. Satellite tracking of the species in Australia has also shown the species flying at heights of 3–100 metres above ground (AOC, 2023). No recorded collisions with wind turbines for this species in NSW have been recorded. This species has a low risk of being effected by macro avoidance of large areas of turbines. No Australasian Bittern populations were detected or are known to occur within the subject land and none were detected across two years and eight seasons of BBUS.

There is a low likelihood that the project would result in the long-term decrease in the size of the population of Australasian Bittern.

Reduce the area of occupancy of the species.

No. The area of occupancy for Australasian Bittern is thought to have declined by 70 percent between 1977 and 2008 as a result of habitat loss, particularly breeding grounds (Cth DCCEEW 2022b). Changing water regimes and the loss or modification of wetland habitats is considered an ongoing threatening process for the Australasian Bittern. The area of occupancy was estimated at 1200 km2, with low reliability (NSW DCCEEW 2010) or estimated to be between 600 km^2 and 800 km^2 (DEE 2019), but this has likely further declined as a result of subsequent wetland loss.

Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain. These areas are considered most likely to represent suitable habitat for Australasian Bittern.

This species is known to fly to and from breeding grounds in and around Leeton and Griffith in NSW, through to Victoria. Prolonged flights over open areas and open habitats may occur on occasion, and they may occasionally ascend to slightly higher altitudes, particularly during certain behaviours such as territorial displays, courtship flights, or nomadic movements. It is not well known, and although possible, it is considered an unlikely event that Bitterns would fly within the RSA of this project, that being within 80-280m above ground level. The species will continue to be able to forage and breed in retained habitat within and outside of the project area. It is considered unlikely that these minor impacts to potential habitat for this species would cause any meaningful reduction to the area of occupancy for the species, particularly given that areas of higher quality habitat would be retained as a result of the project.

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SIC assessment for Endangered species

Fragment an existing population into two or more populations.

No. The project is considered unlikely to lead to fragmentation of an existing population into two or more populations. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible The project is unlikely to incur major disturbance to mapped major wetlands or localised riparian corridors within the subject land and will not incur a disturbance to the key riparian corridors likely to be used by this species within the broader landscape between areas of key habitat.

The species is highly mobile and capable of travelling large distances to exploit suitable resources. The nature of the project would not preclude the species from occupying the area during favourable conditions, and will not act as a significant barrier or increase fragmentation between two or more potential populations.

Adversely affect habitat critical to the survival of a species.

No. Given that the Australasian Bittern is presumed to have undergone a severe reduction in numbers, based on historic habitat loss and degradation across the core part of its range, all natural habitat (including constructed wetlands with suitable habitat) in which the Australasian Bittern is known or likely to occur should be considered critical to the survival of the species (DEE 2019).

The Australasian Bittern prefers wetlands with dense vegetation from 0.5-3.5 metres in height, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds as well as rice crops (Cth DCCEEW 2022b).

The National Recovery Plan for the species defines critical habitat as any natural wetland habitat where the species is known or likely to occur (breeding or foraging habitat) within its known range. Critical habitat for the Australasian Bittern is therefore likely to occur within the subject land. Although it has not been recorded, there are nearby records associated with the Coleambally Irrigation Channel (Herring, M. 2023), and the Coleambally Irrigation Area further north. Tracking data also shows individuals undertaking migratory movements through the subject land, so it is reasonable to assume that suitable wetlands areas may be utilised by the species, presumably on a short-term and transient basis enroute to more suitable areas further north.

The majority of these potentially suitable areas, would be retained as a result of the project. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitats for the Australasian Bittern, were avoided as much as possible. Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain. Suitable aquatic habitat and low-lying areas with potential for seasonal inundation throughout the subject land have been buffered and excluded by design from development, resulting in retention of larger lignum swamps, farm dams and the Coleambally Outfall Drain. These areas are considered marginal for Australasian Bittern, as they do not have dense vegetative cover or suitable water depth to be considered optimal habitat for the species. It is however possible that they are exploited on a seasonal or transient basis in response to flooding events, or on a temporary basis during migratory movements.

Given that areas of higher quality habitat will be retained, and direct impacts would be associated with marginal potential habitat for the Australasian Bittern, it is considered unlikely the project will adversely affect habitat critical to the survival of the species.

Disrupt the breeding cycle of a population.

No. The Australasian Bittern breeds from October to February in solitary pairs. However, sometimes several nests may be placed in close proximity to each other (Marchant & Higgins 1993). The species nests adjacent to relatively deep, densely

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SIC assessment for Endangered species

vegetated freshwater swamps and pools, building its nests under dense cover over shallow water (Marchant & Higgins 1990). The species prefers to nest in vegetation that is up to 2.5 m tall and the nests are placed about 30 cm above the water level (Marchant & Higgins 1990). The nest is a shallow structure of dry or green reeds, within a clump of reeds in water or a swamp and is built on a platform of bent-over reeds.

Despite occurring in a range of wetland types, breeding is known to occur in a much smaller sub-set of locations (Cth DCCEEW 2022b). Breeding has been confirmed in areas of the Riverina, predominantly the Coleambally Irrigation Area where irrigated rice crops provide optimal habitat for Australasian Bitterns.

Areas within the subject land are not considered suitable breeding habitat for the Australasian Bittern, which do not meet the requirements for breeding habitat. No breeding of Australasian Bittern has been recorded in the subject land, despite tracking efforts of individual birds travelling to and from the Coleambally Irrigation Area as part of the Bitterns in Rice Project (Herring, M. 2023). It is considered unlikely that Australasian Bittern utilise habitats within the subject land for breeding, and removal of a small amount of potential non-breeding habitat is unlikely to result in a disruption to the breeding cycle of Australasian Bittern.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. The project is unlikely to modify remaining potential habitat that may be available to the species during flooding events such that the species is likely to decline. Australasian Bittern is a highly mobile species, and is capable of undertaking large spatial movements to exploit seasonally available resources. Removal of a minor amount of suboptimal habitat is unlikely to represent a significant loss of habitat for the species, or contribute to its decline. Higher quality areas of habitat have been retained as a result of the project, and importantly remain more broadly within the landscape, and the nature of the project would not preclude the species from occupying habitats within the subject land during favourable conditions.

Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat.

No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control.

It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.

Invasive weeds species are not known to directly harm populations of Australasian Bittern, but do have potential to reduce quality of habitat in wetland areas. The risk of introduction of weed species will be mitigated by the implementation of good soil transportation practices throughout works that will be detailed in the Construction Environment Management Plan (CEMP).

Introduce disease that may cause the species to decline.

No. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.

Interfere substantially with the recovery of the species.

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A national recovery plan currently exists for Australasian Bittern. Actions outlined within the plan to aid in the recovery of the species relating to the project include:

- Identify subpopulations of high conservation priority.
- Identify key locations that require habitat protection and improvement.
- Protect areas of 'habitat critical for survival' that are not currently managed for nature conservation.
- Develop and implement a range of voluntary incentives for protecting Australasian Bittern habitat on private land.
- Undertake wetland restoration activities, to create suitable habitats for Australasian Bittern.
- Monitor habitat subject to restoration and enhancement.

The project would result in direct impacts to small areas of marginal wetland vegetation. In the broader landscape context, and based on tracking information of the species, the Coleambally Irrigation Area is considered to be a key location for breeding in the region and a key conservation priority. It is unlikely the project will result in substantial interference with the recovery actions listed for the species.

Conclusion

Based on the assessment above, it is concluded that Australasian Bittern is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population.
- Will not disrupt the breeding cycle of a population, or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not interfere will the recovery of the species.

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Appendix 6.8. Plains-wanderer *Pedionomus torquatus*

Distribution

Plains-wanderer *Pedionomus torquatus* (EPBC Act, Critically Endangered) occurs in semi-arid and arid NSW, with the core occurrence of records located between Narrandera in the east, Deniliquin in the south, Balranald in the west and Hilston in the north. Records are located is population clusters throughout western NSW including Mossgiel, Mungo National Park, Nearie Lake Nature Reserve and as far as Sturt National Park in north-west NSW (DoE 2016)

Habitat requirements

Preferred habitat is generally characterised as containing approximately 50 % bare ground, 10 % fallen litter, and 40 % grasses, herbs, and forbs, usually on hard red-brown loams (DPIE 2020). Grass tussocks are mostly shorter than five centimetres, with some patches of vegetation up to around 30 centimetres important for providing concealment. Inter-tussock space with bare earth and sparse litter is an important habitat component. Plains-wanderers do not use habitat that is too dense with limited space between tussocks, actively avoid areas of dense grass, and their presence is negatively correlated with increased grass height (DoE 2016, DPIE 2020). Open grassland structure is necessary to allow the birds to forage efficiently and to detect and avoid predators.

It should be noted that Plains-wanderer has also been recorded as occurring in low, sparse chenopod shrublands (Harrington et al, 1988), however, it is unknown as to whether the species can persist in these habitats over extended timeframes (DoE 2016).

Survey observation

Plains-wanderer Mapped Important Areas of habitat (NSW DCCEEW 20243) occur throughout the subject land. Surveys for Plains-wanderer focused on identifying grasslands outside of NSW DCCEEW Mapped Important Areas that nonetheless contained similar structural characteristics to these areas. At the time of surveys (March/April 2023), the grasslands observed, including the nearby Mapped Important Areas, contained habitat structure that was generally too dense as described in the *National Recovery Plan for the Plains-wanderer (Pedionomus torquatus)* (DoE 2016), the *Saving Our Species Plains-wanderer Habitat Management Guide* (DPIE 2020b), and more recent research by Nugent et al. (2022 *Multi-scale habitat selection by a cryptic, critically endangered grassland bird—The Plains-wanderer (Pedionomus torquatus): Implications for habitat management and conservation*. The habitat survey took into account the extended period of above-average rainfall as well as the likely light to moderate grazing regime prior to survey when assessing habitat suitability.

The grassland (and low open chenopod shrublands) within the subject land was found to be, almost uniformly, less than 25% bare ground with significant amounts of litter occupying the inter-tussock space and grass tussocks spaced closely together, much more so than the preferred inter-tussock space of 10-20 centimetres (DPIE 2020b).

Based on the dynamic nature of Riverina grasslands, presence of suitable habitat within the subject land, as well as expected suitable habitat and known records in the surrounding landscape, a population of Plains-wanderer is likely to exist. Based on the results of the habitat assessment, grazing levels within the subject land were of low density, based on biomass available, and grass cover being relatively high during the prolonged wet period over the 2021, 2022 and 2023 seasons. Given the density of the grasslands at the time of survey, most of the subject land, including Mapped Important Areas and the additional habitat area

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mapped by Biosis, would be unlikely to be utilised at the current time by the local population of the species. However, the habitat assessment applied a precautionary approach and considered that even though the majority of Mapped Important Areas grasslands were too dense in their current condition, additional areas were considered suitable habitat if they were similar in structure and composition to the Mapped Important Areas grasslands, as these areas were assessed based on their potential to support Plains-wanderers under different conditions than the conditions observed at the time of survey, namely if the site were subjected to increased grazing or a period of prolonged drought. The subject land has potential to support a local population of the species during periods of drought or more average years.

Approximately 645 hectares of Mapped Important Areas occur within the subject land, and 11.8 hectares within the development corridor. Other areas of potential habitat mapped by Biosis within the development corridor is 114.42 hectares.

Targeted surveys for this species were undertaken in March and April 2023.

SIC assessment for Plains-wanderer

SIC assessment for endangered species
Lead to the long-term decrease in the size of a population of a species.
No. A population of Plains-wanderer is considered reasonable likely to occur within the subject land based on recent records of the species in close proximity to the subject land, and the presence of suitable habitat within the subject land that is broadly connected to known habitats present within Oolambeyan National Park. The subject land supports areas of habitat, that whilst currently occurring in a form that is sub-optimal for Plains-wanderer (generally too dense), would nonetheless support the species following environmental conditions that result in reduced density of grass tussocks. Plains-wanderer primary habitat mapping completed by NPWS in 2001 across 2.28 million hectares, identified 52,783 ha of primary habitat NPWS 2002, which formed the basis of BAM Mapped Important Areas, approximately 645 ha of which occurs with the subject land. Carrying capacity was assessed by NPWS (2002) as at the time (2001 / 2002) as 1 pair of birds per 18 ha (NPWS 2002). However, within the Riverina the Plains-wanderer population is estimated to have undergone a reduction in numbers of approximately 75% during the 2002 drought, after which time there was only minor, staged increases in numbers between 2004 to 2010 (Parker & Baker-Gabb, 2013). Further population declines in the Riverina population of Plains-wanderer subsequently occurred following the increased rainfalls experienced from late 2010 to 2012 (Parker & Baker-Gabb, 2013). More recent analysis of monitoring data collected between 2001 and 2014 indicates that there was an overall decline in numbers of 93% across sites in the Riverina region over this time period (Cth DCCEEW 2015). Based on approximately 759 ha of suitable habitat within the subject land, up to an estimated 4 pairs of birds may potentially occur within the subject land. The project is expected to impact upon approximately 4.02 ha of Mapped Important Habitat for Plains-wanderer, or a total of 114.42 ha of potential habitat when additional Biosis mapped habitat is considered. These impacts equate to 0.6% of the total Mapped Important Habitat, to up to 9% of the total mapped habitat within the development corridor. Based on the potential for the subject land to support up to 4 pairs of birds within approximately 759 ha of potential habitat, impacts to up to 8% of this habitat cannot be said to be likely to impact upon sufficient habitat such that the local population is impacted. However given the largely sedentary nature of the species and the low overall population numbers, in the unlikely event that proposed impacts were to occur directly to an area currently utilised by the species, it could be possible that a decrease to the size of the local population could occur.
Reduce the area of occupancy of a population.
Yes. As outlined above, based on approximately 795 ha of suitable habitat within the subject land, up to an estimated 4 pairs of birds may potentially occur within the subject land. Home ranges of individual birds is up to 21 ha in the Riverina (12 ha on average), with pairs' home ranges equating to approximately 18 hectares due to around half of a pairs home

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SIC assessment for endangered species

ranges overlapping individual home ranges overlapping (CoA 2015). Based on the largest estimate of each individual bird requiring 21 ha of non-overlapping habitat, the maximum area of occupancy of the potential population that could occur within the subject land would be 210 ha, or 26 % of the mapped suitable habitat. Based on these figures it is possible that impacts to 4.02 of mapped important mapped areas and 114 ha of potential habitat by the project would reduce the area of occupancy of a population. However given, the largely sedentary nature of the species and the low overall population numbers, in the unlikely event that proposed impacts were to occur directly to an area currently utilised by the species, it could be possible that a reduction in the population's area of occupancy could occur.

Fragment an existing population into two or more populations.

No. The project is not expected to result in substantial fragmentation impacts to the population of Plains-wanderers potential occurring within the subject land. Plains-wanderers are known to be mainly sedentary, particularly when habitat is suitable, however they may move greater distances in response to changes in environment and habitat availability (Marchant and Higgins, 1993) (CoA 2015). The project will directly impact upon areas of suitable habits, and in some cases create localised fragmentation of habitat via construction of roads and access tracks through areas of habitat. However, no permanent barriers excluding the species from adjacent areas of suitable habitat, or preventing movements between separated areas of habitat, will be created. Furthermore there are large areas of suitable habitat within the subject land that are not impacted by the project, which will persist into the future, including approximately 629 ha of Mapped Important Areas, of which a large portion occurs within indicative stewardship sites associated with the project and estimated 5,699 ha of potential riverine grassland areas within the subject land more broadly.

Adversely affect habitat critical to the survival of a species.

Yes. The National Recovery Plan for Plains-wanderer (DoE 2016) states habitat critical to the survival of this species includes:

- Any regions where the species is likely to occur, and
- Any newly discovered locations that extend the likely range of the species.

The subject land occurs in a "region where the species occurs", supports habitat considered suitable to support the species, occurs proximal to recent records of the species, and has the potential to support up to 4 pairs of birds. As such, mapped habitats within the subject land are considered habitat critical to the survival of the species.
Given the sedentary nature of the species, and overall low population umbers, impacts to 4.02 ha of important mapped areas and 114 ha of potential habitat is considered likely to adversely affect habitat critical to the survival of a species.

Disrupt the breeding cycle of a population.

No. Plains-wanderers breed in solitary pairs that require an area of approximately 18 hectares due to around half of a pairs home ranges overlapping individual home ranges overlapping (CoA 2015). It is possible that up to 4 pairs of birds could utilise habitats with the subject land based on current population estimates. Whilst it is unlikely that impacts associated with the project would occur to areas currently being utilised for breeding, given the sedentary nature of the species and overall low population umbers, if impacts were to occur directly to a breeding pair, this may be considered a disruption to the breeding cycle of the overall population.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Yes. Estimated total population numbers of Plains-wanderers within NSW are between 200 and <1000 individuals (Cth DCCEEW 2015). As outlined above, the project is considered likely to impact upon habitat considered critical to the survival of the species, and has the potential to impact the size and reduce the area of occupancy of a population of the species. If any of these impacts were to occur to the between 1 and 4 pairs of birds potentially utilising the habitat present within the subject land, this would equate to an impact to 1% and 5% of the lower estimate, and 0.2% and 1% of the upper estimate, of the total population of the species. In the worst case scenario impact of loss of habitat associated with the project resulting in impacts to 4 pairs of birds, or 5% of the total population of the species, the project would be

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SIC assessment for endangered species

considered likely to impact habitat to a level where the species is likely to decline. The potential for this worst case scenario impact to occur is very low, however it illustrates that due to the low overall population numbers of the species some potential for substantial impacts at the species level remain.

Result in invasive species that are harmful to a species becoming established in the species' habitat.

No. The subject land is already located within a highly modified environment, dominated in land used for agricultural activities, with invasive species harmful to Plains-wanderer, such as Foxes, already well established. As a part of the Biodiversity Management Plan, a Weed and Pest Management component will be strictly implemented to prevent the increase in invasive species as a result of the project

Introduce disease that may cause the species to decline.

No. The project is not likely to introduce any diseases this species is susceptible to. In addition to this the project will implement several controls and management plans including a Biodiversity Management Plan and a Weed and Pest Management Plan. Considering the nature of the project and the management plans which will be implemented it is considered unlikely the project would introduce disease that may cause the species to decline.

Interfere substantially with the recovery of the species.

No. The National Recovery Plan for this species outlines the following objectives:

- Reverse the long-term population trend of decline and increase the numbers of Plains-wanderers to a level where there is a viable, wild breeding population, even in poor breeding years, and
- Enhance the condition of habitat across the Plains-wanders' range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation.

The project will not interfere substantially with these recovery objectives.

Conclusion.

The project is considered to have the potential to result in a significant impact to Plains-wanderer**.** This assessment has found that the project:

- Is likely to adversely affect habitat critical to the survival of the species and reduce the area of occupancy of a population.
- Has some potential to impact the species' habitat to the extent that the species is likely to decline.
- Is unlikely to lead to the long-term decrease in a population of this species or disrupt the breeding cycle of this species. However there is a possibility these impacts could occur.
- Will not fragment an existing population into two or more populations, result in invasive species becoming established in the species' habitat, introduce disease that may cause the species to decline, or interfere with the recovery of the species.

Based on it being possible that a number of key Significant Impact Criteria could occur as a result of the project, the conclusion of a potential significant impact to Plains-wanderer is considered warranted.

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Appendix 6.9. Corben's Long-eared Bat – *Nyctophilus corbeni*

Distribution

This species occurs across NSW, with a primary band of records leading north-east through inland areas from Wentworth across to Moree (NSW DCCEEW 2024b). Potential occurrence is noted throughout most of inland, semi-arid and arid NSW (DCCEEW 2024).

Habitat Requirements

This species occurs in a wide range of habitats including inland woodland with box, ironbark, cypress pine, Buloke, brigalow, Belah, Smooth-barked Apple, River Red Gum, Black Box and various types of mallee (Threatened Species Scientific Committee 2015). The species is noted as being more abundant in extensive stands of vegetation in comparison to small or fragmented woodland patches, suggesting a large home range. Old growth vegetation is likely a critical component to this species habitat requirements (Threatened Species Scientific Committee 2015). Corben's Long-eared Bat is not considered to be at risk of turbine strike due it its flight characteristics being generally below RSA height, with a slower, more manoeuvrable flight, below canopies and in and around vegetation.

Survey observation

No threatened species were positively identified during the bat utilisation survey effort completed by nature Advisory, however, three species complexes were identified. One of the three species complexes has the potential of being Corben's Long-eared Bat *Nyctophilus corbeni*. This species has been assessed within the BDAR as having the potential to occur and as such, is subject to assessment below.

SIC assessment for Corben's Long-eared Bat

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. The subject land occurs within the known distribution of this species. A call complex was identified during the bat utilisation survey effort which has the potential of being Corben's Long-eared Bat *Nyctophilus corbeni.* Species complexes occur, as not all microbat species are able to be consistently or reliably identified using echolocation detection alone. Where this occurs, groupings are compiled of possible species and labelled as a species complex**.** Habitat for Corben's Long-eared Bat is primarily within extensive, albeit patchy occurrences of White Cypress Pine Open Woodland (PCT 28), and areas of Black Box Woodland (PCTs 13 and 16) scattered throughout the subject land. Due to most of the WTGs being located >200m away from watercourses, the majority of this habitat is not proposed to be directly impacted. However, a small number of WTGs are adjacent to this habitat and also require clearing for access tracks for construction and operation purposes. In regard to collision risk, this is considered low to negligible, as this species is highly manoeuvrable and able to change direction often and quickly (Churchill 2008) as well as prefer to fly very close to vegetation, usually at canopy height, where they weave between gaps in the canopy (Churchill 2008). Mitigation measures including two-staged clearing procedures will be undertaken for removal of any hollow-bearing trees or those with fissures. In the event this species is identified. Works would cease and further assessment would be undertaken. Considering the above, the project is unlikely to lead to a long-term decrease in an important population of Corben's Long Eared Bat
Reduce the area of occupancy of an important population.

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SIC assessment for vulnerable species
No. The species is known to be more abundant in extensive stands of vegetation, in comparison to smaller woodland patches, suggesting its home range is probably large. Based on this large home range, it can be assumed that if a population of the species occurs within the subject land it would likely utilise habitats across the majority of the site and within the surrounding locality. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants of Black Box dominated woodland and higher quality patches of White Cypress Pine communities. The project is not expected to reduce the area of occupancy of the population, especially given the species is likely to be able to persist during operation of the project.
Fragment an existing important population into two or more populations.
No. The project is not anticipated to increase fragmentation within the population's distribution. The project will result in linear removal of some areas of suitable habitat, and the removal of 15 hollow bearing trees, however a larger percentage of habitat will be retained. Further to this, the proposed operational impacts are limited to widely spaced wind turbines and relatively low usage access tracks and is therefore, in conjunction with this bats particular and preferred flight and foraging behaviours, it is unlikely to significantly prevent dispersal of this mobile species, into contiguous areas of habitat within and outside of the subject land.
Adversely affect habitat critical to the survival of a species.
No. Habitat critical to the survival of Corben's Long-eared Bat has not been defined in an approved national recovery plan for the species or in the approved conservation advice for the species. While habitat within the subject land includes potential for foraging, breeding, roosting and dispersal, it is not considered to be habitat that is critical for the species' survival nationally.
Disrupt the breeding cycle of an important population.
No. There is little information available on the species' reproductive biology, but breeding is thought to be seasonal with maternity colonies of 10-20 individuals roosting in dead trees including cypress. Mitigation measures including stop works procedure will be undertaken for removal of any hollow bearing trees that could support this species, in the event this species is identified. Works would cease and further assessment would be undertaken. Given the large amount of suitable habitat being retained, it is considered unlikely that the project would result in any disruption to the breeding cycle of the population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. Habitat reduction is considered unlikely to cause the species to decline. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes larger patches of native woodland vegetation, and higher quality, intact remnants of Black Box dominated woodland and higher quality patches of White Cypress Pine communities. Furthermore, the quality of retained habitats will not be decreased as the risk of collision and/or barrier effect from WTGs is negligible.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control. It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.
Introduce disease that may cause the species to decline.

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SIC assessment for vulnerable species
No. The project is not likely to introduce any diseases this species is susceptible to. In addition to this the project will implement several controls and management plans including a BBAMP, Biodiversity Management Plan and a Weed and Pest Management Plan. Considering the nature of the project and the management plans which will be implemented it is considered unlikely the project would introduce disease that may cause microbat species to decline.
Interfere substantially with the recovery of the species.
No. An approved national recovery plan has not been prepared for Corben's Long-eared Bat, however the Threatened Species Scientific Committee (TSSC) has prepared Conservation Advice for the species which outlines recovery actions. Habitat loss and fragmentation are listed as known key threats to the species in the Conservation Advice.
Conclusion.
Based on the assessment above, it is concluded that Corben's Long-eared Bat is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population. • Will not disrupt the breeding cycle of a population, or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not interfere will the recovery of the species**.**

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Appendix 6.10. Southern Bell Frog *Litoria raniformis*

Species background

Southern Bell Frog (also known as the Growling Grass Frog) is listed as vulnerable under the EPBC Act. The species has declined in both distribution and abundance in NSW, but has persisted in irrigated rice-growing areas along the Murrumbidgee and Murray Rivers (Pyke & Muir 2008), including the Coleambally Irrigation Area and the Lowbidgee floodplain which occur in close proximity to the subject land. In the semi-arid part of its range, the species typically requires large, continuous areas containing both permanent and ephemeral waterbodies that undergo regular flooding. Waterbodies containing diverse aquatic vegetation are needed for floating, calling and foraging, surrounded by habitat that contains suitable refugia (DSE 2012). In the study area, suitable habitat is associated with permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys.

Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. The species has been known to breed anytime from early spring through to late summer/early autumn (Sept to April) following a rise in water levels.

The main threats to Southern Bell Frog include habitat loss, degradation and modification, fragmentation and isolation of populations, and introduced predators and disease (DEWHA 2009).

Occurrence in study area

The Coleambally Irrigation Area occurs north of the subject land, and is listed as a Priority Management Site under the NSW Saving Our Species strategy (SOS). It comprises a series of wetlands (primarily on private land), interspersed with irrigated crops, primarily rice. Irrigated rice crops are thought to be key breeding habitat for the species within the Coleambally Irrigation Area, so much so that they are considered unlikely to breed in waterbodies other than rice fields, including supply channels, drainage channels or other water bodies (Pyke & Muir 2008). Permanent wetlands are more likely to be occupied by the species and to provide important core breeding habitat. Seasonally flooded sites are also likely to be used during high-rainfall years (DEWHA 2009). In the semi-arid zone, individuals are unlikely to move further than 5 kilometres between water bodies in the absence of major flood events. Within the subject land, there is habitat connectivity (terrestrial and aquatic) between waterbodies on site, and between waterbodies at neighbouring sites, including the Coleambally Irrigation Area via the Coleambally Irrigation Channel that runs through the eastern portion of the subject land.

Surveys for Southern Bell Frog within the subject land occurred following above average rainfall and flooding events in 2022, 2023 and 2024. As a result, Southern Bell Frog was recorded in high numbers throughout the subject land, reflecting the species' ability to occupy marginal habitats to exploit seasonal conditions and disperse terrestrially through the landscape in wet years (DEWHA 2009).

Outside high rainfall events and flood years, areas that provide permanent water sources occur within the Coleambally Outfall Drain, as well as farm dams and the larger areas of lignum swamp. The site also contains numerous topographic depressions that may be utilised seasonally depending on local rainfall. Coleambally Outfall Drain is not considered to be optimal habitat as it lacks diverse aquatic flora required for breeding. It is likely to act as a dispersal pathway however, likely bringing frogs down from the priority sites associated with the Coleambally Irrigation Area. It was noted that where more permanent water was found and *Gambusia holbrooki* were present, the Southern Bell Frog was not recorded or observed to be present. Where more

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permanent water was found, such as irrigation channels and farm dams, and where Gambusia holbrooki was not present, mature individuals, immature individuals and tadpoles were observed.

Associated PCTs within the subject land include PCTs 10, 13, 15, 17, 24, 28, and 45, however suitable habitat is likely to constitute PCTs 13, 15, 17, and 24 that comprise wetland vegetation.

SIC assessment for Southern Bell Frog

SIC assessment for vulnerable species

Lead to the long-term decrease in the size of an important population of a species.

No. There is a low likelihood that the project would lead to a long-term decrease in the size of an important population of the Southern Bell Frog. The Significant Impact Guidelines for Growling Grass Frog consider any viable population as an important population for the species (DEWHA, 2009b). The guidelines define a viable population as 'one which is not isolated from other populations or water bodies, such that it has the opportunity to interact with other nearby populations or has the ability to establish new populations when water bodies fill and become available'.

Southern Bell Frogs were recorded during targeted surveys over numerous years in large numbers within the subject land. As the population meets the criteria in the definition above, records within the subject land are considered to represent an important population for the species. Individuals are likely to be connected with those in the Coleambally Irrigation Area priority management site located to the north. The area was experiencing a seasonal boom at the time of survey following above average rainfall in the region that had led to localised flooding, a known mechanism for facilitating dispersal and widespread breeding events for the species (DEWHA 2009), resulting in movement between the two areas and into the surrounding landscape. Outside of these times, the subject land is connected to the Coleambally Irrigation Area via the Coleambally Irrigation Channel and Coleambally Outfall Drain that runs through the eastern and northern portions of the subject land respectively, and may act as a dispersal pathway.

Factors likely to lead to a long-term decrease in the size of a population include land clearing, changed hydrological regimes, increasing salinity, draining and removal of wetlands, isolation of breeding habitats and fragmentation of dispersal corridors (DSE 2012).

Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitats for the Southern Bell Frog, were avoided as much as possible. Within the subject land, there are numerous ephemeral wetlands and drainage lines associated with topographic depressions of the floodplain. Suitable aquatic habitat and low-lying areas with potential for seasonal inundation throughout the subject land have been buffered and excluded by design from development, resulting in retention of larger lignum swamps and farm dams. Direct impacts include 24.93 ha of ephemeral habitat within PCT 17, PCT 15, PCT 13 and 24. Direct impacts to Southern Bell Frog habitat are likely to represent marginal and opportunistic habitat, rather than core breeding habitat. These areas may be occupied on a seasonal or transient basis in response to flooding events, but are unlikely to maintain a resident population. In addition, 85.91 ha will be retained within the development corridor, and approximately 2,362.68 ha within the broader subject land.

The main area of suitable permanent habitat for Southern Bell Frog is associated with the Coleambally Outfall Drain, Lignum and Chenopod dominated wetlands and irrigated cropping areas with a more frequent source of permanent water in the landscape. The latter did contain evidence of tadpoles where Gambusia were not recorded. The project would involve some minor construction associated with the Coleambally Outfall Drain, and around irrigated cropping areas, that would not prevent future occupation or dispersal by the Southern Bell Frog.

The project would not result in changed hydrological regimes.

The project would result in some removal of suitable terrestrial dispersal habitat however, critical areas associated with waterbodies have been largely avoided through the design stage and the application of buffers. The operation phase of the project is considered compatible with Southern Bell Frog dispersal, and although the project would modify the terrestrial habitat it is unlikely to result in permanent barriers or obstructions to movement in the landscape for the

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Southern Bell Frog during periods of high rainfall.
All potential indirect impacts such as noise, sediments and pollutants will be managed through the Biodiversity Management Plan to ensure that the project does not compromise surrounding water quality which in turn, could impact on the species' habitat and food resources.
In consideration of the above, the project is considered unlikely to lead to a long-term decrease in the size of an important population.

Reduce the area of occupancy of an important population.

No. The area of occupancy for the Southern Bell Frog has not been defined in the National Recovery Plan. The species has a broad distribution with two distinct biogeographical groups. In the northern part of its range, frogs are concentrated in landscape refugia such as permanent waterbodies, and breeding and landscape dispersal are triggered by high rainfall and flood events (DSE 2012).
Southern Bell Frog was observed repeatedly within the subject land, even within areas not typical consistent with their preferred habitat (26 DNG). This is likely in response to the above average rainfall experienced in the area prior to survey, which facilitates landscape dispersal and breeding in this species (DSE 2012). The area of occupancy within the landscape for Southern Bell Frog at the time of survey was likely to be near the maximum extent for the species following the initial surveys in 2022. Subsequent surveys in 2023 and 2024 for Southern Bell Frog in the subject land reflect seasonal changes of occupation contracting to permanent and semi-permanent wetlands following receding of floodwaters.
There is a low likelihood that the project would reduce the area of occupancy for an important population of Southern Bell Frog. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Suitable wetland habitat and low-lying areas have been largely excluded from the development by design, with a total of 24.13 ha of direct impacts within ephemeral habitat within PCT 13, 15, 17 and 24. Where impacts to known habitat are likely to occur (such as crossings along the Coleambally Outfall Drain), these would be temporary and would not result in permanent changes to the habitat such that it would be rendered unsuitable for Southern Bell Frog.
Although the project would result in some removal of suitable dispersal habitat, critical areas of habitat surrounding permanent or semi-permanent waterbodies have largely been avoided through the design stage. The operation of the project is considered compatible with Southern Bell Frog dispersal, and although the project would modify the terrestrial habitat it is unlikely to preclude Southern Bell Frog from dispersal during periods of high rainfall to areas of retained habitat within the subject land.
There is a low likelihood that the project would result in a significant reduction in the area of occupancy of the Southern Bell Frog.

Fragment an existing important population into two or more populations.

No. Spatial arrangement and connectivity among waterbodies within the landscape is a key factor in determining presence of Southern Bell Frog at a given site (DEWHA 2009). The long-term viability of individual populations is dependent on a matrix of aquatic and terrestrial habitats that provide dispersal corridors to and from local breeding sites (DEWHA 2009). Landscape alterations that decrease connectivity between habitat patches are therefore likely to impact the viability of individual populations (DEWHA 2009).
The project is considered unlikely to lead to fragmentation of an important population into two or more populations. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Direct impacts will be limited to 24.13 ha designated for wind turbines and associated infrastructure. However, suitable wetlands, including ephemeral water bodies and the capacity within the Coleambally Outfall Drain would be retained as part of the project. This would result in a matrix of suitable wetlands remaining available for the Southern Bell Frog within the landscape, which would still be connected by suitable dispersal corridors. Impacts to suitable habitat such as the Coleambally Outfall Drain, are

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short-term and temporary, and would not affect the long-term suitability of these sites for occupation by the Southern Bell Frog.
The species is known to be capable of colonising agricultural and moderate to high rainfall pastoral land provided there are adequate waterbodies present both permanent and ephemeral (DSE 2012). While the project will result in the removal of 24.13 ha of native vegetation and pastoral land, areas to be removed are sporadic within the landscape (wind turbines) and will not result in the significant modification to dispersal pathways. The project is considered compatible with long-term dispersal for the species within the landscape. It is therefore unlikely that the development would alter the availability or accessibility of waterbodies within the landscape that may be utilised by Southern Bell Frog either permanently or seasonally.

Adversely affect habitat critical to the survival of a species.

No. Habitat critical to the survival of the species would include all breeding habitats, as well as associated waterbodies within the landscape matrix used during periods of dispersal, and surrounding refugia for individuals during hibernation. Habitat critical to the survival of the species has been identified in the SOS strategy for Southern Bell Frog, which includes the Coleambally Irrigation Area north of the site, a priority management site for the Southern Bell Frog. The habitat associated with this site is considered of high quality and vital in the long-term survival of the species and preventing further declines. Impacts to this habitat would therefore be a mechanism that may contribute to the species decline. It is therefore important to note that the project would not modify, destroy, remove or isolate the availability or quality of habitat associated with the priority management site that is critical to the ongoing survival of the Southern Bell Frog.
There is a low likelihood that the project would adversely affect habitat critical to the survival of the Southern Bell Frog through impacts within the subject land. Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Direct impacts will be limited to 24.13 ha designated for wind turbines and associated infrastructure. Indirect and prescribed impacts such as noise associated with the operational stage of the wind farm are not likely to be significant as they will be managed under a Biodiversity Management Plan for the project. Given the extent of impacts, the number and diversity of water bodies available to the species is likely to remain largely unchanged as a result of the project, and there would be no permanent alteration to connectivity during flood events.
Approximately 85.91 ha will be retained within the development corridor, and 2,362.68 ha within the broader subject land. Therefore, movement corridors and access to suitable waterways will still be available to the Southern Bell Frog following completion of the development and during the operational phase.
The project would not limit dispersal corridors or access to other suitable low-lying areas in the landscape, that would remain available to the Southern Bell Frog during periods of high-rainfall.

Disrupt the breeding cycle of an important population.

No. The Southern Bell Frog is reliant on aquatic and riparian habitats for breeding and the subsequent development of the larval stage (DSE 2012). Following breeding, the species is known to disperse into the landscape, particularly during flooding events. There is a low likelihood that the project would disrupt the breeding cycle of an important population. Direct impacts constitute the removal of 24.13 ha of PCTs 13, 15, 17 and 24, however, this is unlikely to result in any disruption to the breeding cycle, given 85.91 ha will be retained within the development corridor, and approximately 2,362.68 ha within the broader subject land, particularly the Coleambally Irrigation Area priority site which is a key source population in the region. The project would not lead to the permanent degradation or removal of habitat such that the recruitment, survival or dispersal rates of an important population would be lowered enough to have a significant impact on the species.

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Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. Quality habitat for Southern Bell Frog includes permanent and semi-permanent waterbodies, particularly those subject to seasonal flooding, containing submergent and emergent vegetation for calling, foraging and floating. Thick vegetation, rocks, logs and other debris adjacent to waterways are also important for shelter, particularly during winter hibernation (DEWHA 2009). Detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. Direct impacts will be limited to 24.13 ha suboptimal ephemeral habitat within PCT 13, 15, 17 and 24. This is considered a relatively minor impact when considered in relation to habitat available in the landscape. Prescribed impacts arising from the operational phase of the project such as noise would be managed under a Biodiversity Management Plan and are not considered to be significant. The project would not lead to the permanent degradation or removal of habitat such that the recruitment, survival or dispersal rates for Southern Bell Frog would be impacted such that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

No. The project does not include any known mechanism that would result in the establishment of invasive species harmful to Southern Bell Frog that are not already present in the area. The project would be subject to a Biodiversity Management Plan that would include biosecurity measures to limit the likelihood of introducing invasive species during construction and operation of the project and details regarding feral animal control.
It is unlikely that the project would result in the establishment of new invasive species. The project is unlikely to exacerbate the current level of invasive species populations utilising the area, such as cats and foxes.

Introduce disease that may cause the species to decline.

No. The project does not include any known mechanism that would result in the establishment of disease (i.e. Chytrid fungus) harmful to Southern Bell Frog that is not already present in the area. The project is unlikely to introduce a disease that may cause the species to decline. The project would be subject to a Biodiversity Management Plan that would include measures for biosecurity and hygiene control to limit the introduction of pathogens as a result of the construction and operation of the project.

Interfere substantially with the recovery of the species.

No. The project will not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the in the *National Recovery Plan for Growling Grass Frog* (Clemann and Gillespie 2012).

Conclusion.

Based on the assessment above, it is concluded that Southern Bell Frog is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population.
- Will not disrupt the breeding cycle of an important population, the local population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.

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SIC assessment for vulnerable species

- Will not interfere will the recovery of the species.

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Appendix 6.11. A spear-grass *Austrostipa wakoolica*

Species background

Austrostipa wakoolica is listed as endangered under the EPBC Act. The species is a densely-tufted, perennial spear-grass species which grows over one metre tall. The species is characterised by leaves that are flattened or rolled, 1.5 to 2.5 millimetres wide at their bases, slightly too strongly ribbed and densely hairy. The flower-heads are spreading and moderately dense. The species flowers in response to rain, and has been recorded flowering from October to December (DCCEEW 2014).

The species does not tolerate disturbance, and as such, requires protection from impacts of grazing and rabbits. Periodic flooding is required to maintain wet conditions within its habitat. *Austrostipa wakoolica's* distribution is confined to the floodplains of the Murray River tributaries of central-western and south-western NSW. The most significant threats to the population are habitat reduction and modification from pastoral development, irrigation and altered flooding regimes; grazing including that by domestic stock, rabbits, and kangaroos; drought due to rainfall-dependence of the species; and weed invasion and competition, particularly from exotic grasses (DCCEEW 2014).

Austrostipa wakoolica within the subject land

Recorded habitats include the edge of a lignum swamp in brown loam, creek banks in grey silty clay, mallee and lignum sandy loam flat, open cypress pine forest on low range in sandy soil and a low rock rise fenced-off from stock for about 18 months (DECCW, 2014). Can be associated with PCT 13, PCT 17, PCT 26 and PCT 28 has been assumed present in the latter zones where survey effort is deficient.

SIC assessment for *Austrostipa wakoolica*

SIC assessment for Endangered species
Lead to a long-term decrease in the size of a population
No. *Austrostipa wakoolica* has not been surveyed adequately to date, due to flooding and access constraints in November 2022 and 2023, with small areas still currently assumed present. It will be subject to further survey in November 2024. Extensive survey has been completed, and the species not found to date. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This included known habitats such as lignum swamp in brown loam with box and mallee, creek banks in grey silty clay, mallee and lignum sandy loam flat, open cypress pine forest on low range in sandy soil (DECCW, 2014). Regardless of the outcomes of the additional surveys, potential indirect impacts will be managed through mitigation measures which are outlined in the BDAR, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures. If the species is detected, further avoidance will be prioritised. It is considered unlikely that the project will lead to a long term decrease in the size of a population.

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SIC assessment for Endangered species
Reduce the area of occupancy of a population
No. *Austrostipa wakoolica* has not been surveyed adequately to date, due to flooding and access constraints in November 2022 and 2023, with small areas still currently assumed present. It will be subject to further survey in November 2024. Extensive survey has still been completed with areas or habitat that have had survey completed, this species was not identified. This species was subject to further survey in November 2023. Assumed areas where this species may be present is approximately 0.98 ha within PCT 28. This species can be associated with PCT 17 and PCT 26, and minor occurrences in PCT 13 , however representative survey has been conducted within these areas. It is unlikely that impacts would substantially reduce the occupancy for this species.
Fragment an existing population into two or more populations.
No. *Austrostipa wakoolica* has not been surveyed adequately to date, and has been assumed present. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. Regardless of the further surveys to be undertaken, it is unlikely the project would result in the fragmentation of a population.
Adversely affect habitat critical to the survival of a species.
No. No critical habitat for this species has been determined. Due to key avoidance measures, it is unlikely that any habitat critical for this species would occur in the subject land, and therefore be impacted.
Disrupt the breeding cycle of an important population.
No. It is not considered likely an important population of *Austrostipa wakoolica* occurs within the subject land.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. Due to key avoidance measures and survey undertaken to date, it is unlikely that impacts to optimal habitats, as well as areas of sub optimal habitat where this species is less likely to be present, will lead to a decline in the availability of quality habitat for this species, due to the large expanses of similar habitat in the surrounding landscape.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. Proactive and adaptive mitigation measures will be implemented during construction and operation. Within the subject land, this species habitat is highly dynamic, subject to moderate levels of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly.
Introduce disease that may cause the species to decline.
No. There currently no known diseases causing potential species decline to *Austrostipa wakoolica*.

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SIC assessment for Endangered species

Interfere substantially with the recovery of the species.

No. There is currently no known recovery plan in place for this species, however key threats listed in the conservation advice do consider habitat reduction and altered flooding regimes, primarily related though to agricultural development, to be a key threatening process to this species. It is not considered likely that the project will result in substantial impacts to the recovery of *Austrostipa wakoolica*.

Conclusion.

Based on the assessment above, it is concluded that *Austrostipa wakoolica* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population.
- Will not disrupt the breeding cycle of a population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not substantially interfere with the recovery of the species.

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Appendix 6.12. Claypan Daisy *Brachyscome muelleroides*

Species background

Claypan Daisy is listed as vulnerable under the EPBC Act. The species is an annual herb which grows to 7-14 centimeters tall. The plant's single white flowers, which are only 4 millimetres across, are produced from September to November, at the ends of thread-like stems. Thread-like, 5.5 centimeter long leaves also grow from these stems. The species is endemic to south-eastern Australia, where it is restricted to the floodplains of the Murray and Murrumbidgee Rivers and their tributaries in northern Victoria and southern New South Wales, in the Riverina and southwestern Slopes IBRA bioregions

While little is known about the former distribution and abundance of Claypan Daisy, is it likely that there has been a historical decline in abundance of the species, as much of the area within its distribution has been cleared for agriculture (DSE 2010a). The most significant threats to the species include altered hydrological regimes, invasive weeds, and grazing. A national recovery plan has been developed for the species. Claypan Daisy occurs in seasonally damp situations such as shallow depressions and around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland, grassy woodland and open forest habitats, growing in association with various grasses and seasonal aquatic plants such as *Marsilea* species.

Claypan Daisy within the subject land

This species prefers seasonally moist grey gilgaied soils on the floodplains within PCTs such as PCT 45 and PCT 46, which occur patchily across the subject land.

SIC assessment for Claypan Daisy

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. Targeted surveys for *Brachyscome muelleroides* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible (including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland). It is considered unlikely that the project will lead to a long term decrease in the size of an important population.
Reduce the area of occupancy of an important population.
No. An important population is considered to occur at Morundah Station and not linked or connected to the subject land. *Brachyscome muelleroides* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023. Approximate area of occupancy is restricted to the highest areas of potential habitat within PCT 45 and PCT 46, and would be reduced by 114 ha that is linear in nature, however as the species has not been recorded, and an important population is not considered to occur, a substantial impact to an area of occupancy of an important population is not considered likely.

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SIC assessment for vulnerable species
Fragment an existing important population into two or more populations.
No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. An important population is not considered to occur. *Brachyscome muelleroides* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. Therefore, it is considered unlikely any fragmentation would occur.
Adversely affect habitat critical to the survival of a species.
No. No habitat critical to the survival of this species is considered likely
Disrupt the breeding cycle of an important population.
No. *Brachyscome muelleroides* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. The project is unlikely to significantly impact on the breeding cycle of an important population of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. *Brachyscome muelleroides* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023and has not been recorded. In terms of avoidance, detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the subject land considered potential habitat including within seasonally damp situations such as shallow depression sand around the margins of swamps, lagoons and claypans, on heavy grey cracking clays to lighter clay loam soils, in grassland and grassy woodland. Up to 114 ha of habitat that is linear in nature may be impacted but this is unlikely to decrease the availability or quality of habitat and result in species decline, due to the substantial areas of similar habitat in the surrounding landscape.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. Proactive and adaptive mitigation measures will be implemented during construction and operation. Within the subject land, this species habitat is highly dynamic, subject to moderate levels of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly.
Introduce disease that may cause the species to decline.
No. There currently no known diseases causing potential species decline to *Brachyscome muelleroides*
Interfere substantially with the recovery of the species.
No. A current recovery plan is in place for this species (Lucas, 2010). Key threats included altered hydrological regimes, invasive weeds and grazing impacts. It is not considered likely that the project will result in exacerbating these threats and

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SIC assessment for vulnerable species
result in substantial impacts to the recovery of *Brachyscome muelleroides*. Potential impacts will be managed through mitigation measures which are outlined in the BDAR, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Conclusion.
Based on the assessment above, it is concluded that *Brachyscome muelleroides* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • The species was not recorded during surveys. • Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population. • Will not disrupt the breeding cycle of an important population, the local population or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not substantially interfere with the recovery of the species.

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Appendix 6.13. Mossgiel Daisy *Brachyscome papillosa*

Species background

The Mossgiel Daisy is listed as vulnerable under the EPBC Act. The species is a multi-stemmed perennial herb that grows up to 40 centimetres tall. Its stemless leaves grow up to 7 centimetres long and leaf edges range from being smooth edges to deeply indented. Solitary flowerheads are mauve with a yellow centre and occur on stems 10-25 centimeters tall between June and December. The species is known mainly to occur from Mossgiel to Urana, in south-western NSW. The main threat to the abundance and distribution of Mossgiel Daisy is land clearing for pasture, with other possible threats including possible habitat disturbance by feral pigs, the presence of introduced weeds, and changes to fire regimes (DEWHA 2008).

Mossgiel Daisy within the subject land

This species prefers grey and brown clay soils dominated by chenopod species and associated with PCTs 13, PCT15, PCT 17 PCT 24 and PCT 46, which occur within the subject land. Habitat within the subject land is considered suboptimal, with more optimal habitat occurring further to west of the subject land, within areas dominated by *Atriplex vesicaria* and *Maireana aphylla (OEH, 2018)*.

SIC assessment for Mossgiel Daisy

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. Targeted surveys for *Brachyscome papillosa* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. Where a shortfall in survey effort occurs, this species has been assumed present, until further surveys area conducted Spring 2024. Detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the subject land considered potential yet sub optimal habitat including within PCT, 13, PCT 15, PCT 17, PCT 24 and PCT 46. *Brachyscome papillosa* occurs over 25 km from the subject land, with the most recent record from over 20 years ago. It is considered unlikely that the project will lead to a long term decrease in the size of an important population.
Reduce the area of occupancy of an important population.
No. Strongholds for the species occur between Hay and Balranald where it appears in large numbers. *Brachyscome papillosa* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023. Approximate area of occupancy is restricted to the highest areas of potential habitat with PCT, 13, PCT 15, PCT 17, PCT 24 and PCT 46 and would be reduced by 130.85 ha that is linear in nature, however as the species has not been recorded and an important population is not considered to occur, a substantial impact to an area of occupancy of an important population is not considered likely.
Fragment an existing important population into two or more populations.
No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. An important population is not considered to occur. *Brachyscome papillosa* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. Therefore, it is considered unlikely any fragmentation would occur.

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SIC assessment for vulnerable species
Adversely affect habitat critical to the survival of a species.
No. No critical habitat for this species has been determined. Due to key avoidance measures, it is unlikely that any habitat critical for this species would occur in the subject land, and therefore be impacted.
Disrupt the breeding cycle of an important population.
No. *Brachyscome papillosa* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. The project is unlikely to significantly impact on the breeding cycle of an important population of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. The species was not recorded in the subject land. This local scale loss of habitat is not considered likely to cause *Brachyscome papillosa* to decline considering there are higher quality patches of habitat available in the region, and the wide-ranging nature of the species and large areas of more optimal habitats outside of the subject land.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. Proactive and adaptive mitigation measures will be implemented during construction and operation. Within the subject land, this species habitat is highly dynamic, subject to moderate levels of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly.
Introduce disease that may cause the species to decline.
No. The project will not result in the introduction of a disease that is harmful to *Brachyscome papillosa*.
Interfere substantially with the recovery of the species.
No. There is currently no recovery plan in place for this species, however key threats listed in the conservation advice do consider habitat reduction due to agricultural practices such as cropping and improved pastures, as well stock trampling and road maintenance. It is not considered likely that the project will result in substantial impacts to the recovery of *Brachyscome papillosa*.
Conclusion.
Based on the assessment above, it is concluded that *Brachyscome papillosa* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • The species was not recorded during surveys. • Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population. • Will not disrupt the breeding cycle of an important population, the local population or species as a whole.

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SIC assessment for vulnerable species

- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not substantially interfere with the recovery of the species.

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Appendix 6.14. Winged Peppercress *Lepidium monoplocoides*

Species background

Winged Peppercress is listed as endangered under the EPBC Act. The species is an erect herb or perennial forb, which grows 15-20 centimetres high, with angular and striped stems which are roughened with small warts. The plant grows narrow and linear leaves, mostly 2-7 centimetres long, with small flowers, borne in elongated clusters, with the petals minute or absent. Fruit in the form of a flattened circular pod grows on a spreading stalk (DSE 2010b).

Winged Peppercress is widely distributed on the inland plains of south-eastern Australia, occurring from northern NSW to western Victoria. The species is currently known from 13 locations, six in Victoria and seven in NSW. The total population is estimated at <3,000 plants each in Victoria and NSW.

Winged Peppercress within the subject land

Winged Peppercress is known to occur within the Murrumbidgee IBRA subregion, and historically within the Riverina and this distinctive perennial forb was not recorded in the subject land during field surveys that included targeted searches of suitable PCTs. BioNet lists Winged Peppercress as associated with the following PCTs 10, PCT 13, PCT 15, PCT 24 and PCT 26. Based on habitat quality, current survey effort and the localised nature of possible impacts if a population were to occur, it is concluded the Project is unlikely to lead to a significant impact.

SIC assessment for Winged Pepper-cress

SIC assessment for Endangered species
Lead to a long-term decrease in the size of a population
No. Targeted surveys for *Lepidium monoplocoides* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. Where a shortfall in survey effort occurs, this species has been assumed present, until further surveys area conducted Spring 2024. Detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the subject land considered potential habitat including within PCT 10, PCT 13, PCT 15, PCT 24 and PCT 26. *Lepidium monoplocoides* was not recorded within the subject land during targeted surveys to date. It is considered unlikely that the project will lead to a long term decrease in the size of an important population.
Reduce the area of occupancy of the species
No. *Lepidium monoplocoides* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023. Considering survey effort completed to date, with this species not recorded, and due to key avoidance measures of this species preferred habitats, it is estimated the area of occupancy restricted to the highest areas of potential habitat within PCT 10, PCT 13, PCT 15, PCT 24 and PCT 26, a total reduction in occupancy of 22.3 optimal areas of habitat, and 395.3 ha of sub optimal areas, with both impacts linear in nature are not likely to be significant.
Fragment an existing population into two or more populations.
No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. A population is not considered to occur, and thus the project will not lead to fragmentation of an existing population.

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SIC assessment for Endangered species

Adversely affect habitat critical to the survival of a species.

No. Critical habitat has not been declared for *Lepidium monoplocoides*.

Disrupt the breeding cycle of a population.

No. *Lepidium monoplocoides* regenerates from seed dispersal and often in response to rainfall events. Little is known of the biology and ecology of the *Lepidium monoplocoides.* Numbers of adult plants fluctuate from year to year and, like many annual species occurring in dry environments, some seed probably remains dormant in the soil for several years. Given partial vegetation clearing and soil disturbance will occur as part of the works, and there is the possibility to allow regeneration of low shrubs and groundcovers, if individuals of a local *Lepidium monoplocoides* population remain undetected, there could be potential natural regeneration post-disturbance given its life history. Land could be rehabilitated to allow ground layer recovery and management post construction. Therefore, the project is unlikely to disrupt the breeding cycle of a population.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. The species was not recorded in the subject land. This local scale loss of habitat is not considered likely to cause *Lepidium monoplocoides* to decline considering there are higher quality patches of habitat available in in the region, and the wide-ranging nature of the species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

No. The localised occurrences of habitat for the species are subject to existing weed invasion and pest animals as a result of land clearing and surrounding agricultural land use. The project are unlikely to result in an increase of invasive species within the known and potential habitat for *Lepidium monoplocoides.* Construction activities will be managed through standard practices to avoid new introductions and further spread of existing weeds.

Introduce disease that may cause the species to decline.

No. The project will not result in the introduction of a disease that is harmful to *Lepidium monoplocoides*.

Interfere substantially with the recovery of the species.

The National Recovery Plan for *Lepidium monoplocoides* identifies seven specific objectives for the recovery of the species are to:

- Determine distribution, abundance and population structure
- Determine habitat requirements
- Manage threats to populations
- Identify key biological functions
- Determine growth rates and viability of populations
- Establish a seed bank
- Build community support for conservation

Considering the above factors, the Project will not interfere substantially with the recovery of *Lepidium monoplocoides*.

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SIC assessment for Endangered species

Conclusion.

Based on the assessment above, it is concluded that *Lepidium monoplocoides* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population.
- Will not disrupt the breeding cycle of a population, or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not interfere will the recovery of the species.

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Appendix 6.15. Chariot Wheels *Maireana cheelii*

Species background

Chariot Wheels is listed as vulnerable under the EPBC Act. The species is a perennial forb which grows to approximately 20 centimetres high, with striped and woolly stems and a fleshy swollen taproot. Leaves are narrow, cylindrical, and slender. The distribution of the species is restricted to the southern Riverina region of NSW, mainly in the area between Deniliquin and Hay. The plant is usually found on heavier, grey clay soils with Bladder Saltbush *Atriplex vesicaria*. The species also tends to grow in shallow depressions, often on eroded or scalded surfaces (DSE 2010c).

While little is currently known about the former distribution of Chariot Wheels, it is likely that this species was once more extensively distributed and abundant throughout the inland plains from northern Victoria, through inland NSW to southern Queensland. While perennial saltbush and grassy/herb once dominated native vegetation communities throughout this region, their areas have been severely depleted due to agriculture, especially cropping and grazing. Current threats to the species include damage and destruction of habitat, weed invasion, grazing and rising salinity (DSE 2010c)

Chariot Wheels within the subject land

Recorded habitats include on the heavier grey soils and on the edge of a lignum swamp in brown loam and areas of grey silty clay with slight depressions and microrelief, with a high proportion of bare ground. Can be associated with PCT 46 and PCT 26 and has been subject to survey within these areas.

SIC assessment for Chariot Wheels

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. Although the National Recovery Plan for this species lists known population areas within the core distribution outlined for this species in NSW, important populations have not been defined. It is likely that the entire core area, based on an assessment of records, is a fragmented concentration of sub-populations, and the subject land occurs on the eastern edge of existing records. As such the population within the subject land is considered an Important Population based on being near the limit of the species range (Commonwealth of Australia 2013). Targeted surveys for *Maireana cheelii* have been carried out throughout the development footprint in September 2022-September 2023 and November 2022-2023. This species has not been recorded. It will also be subject to further survey in November 2024. In terms of avoidance, detailed constraints assessment and modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat for this species, were avoided as much as possible. This includes areas within the subject land considered potential yet habitat including within PCT 26 and PCT 46. *Maireana cheelii* occurs over 20 km from the subject land to the west. It is considered unlikely that the project will lead to a long term decrease in the size of an important population.
Reduce the area of occupancy of an important population.
No. Suitable habitat is broadly available within woodland and grassland PCTs 26 and 46 however does not fall within a known home range or on the limit of distribution. Strongholds for the species occur between Hay and Balranald where it appears in high numbers. *Maireana cheelii* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. It is unlikely that any reduction in occupancy is considered significant for this species.

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SIC assessment for vulnerable species
Fragment an existing important population into two or more populations.
No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. An important population is not considered to occur. *Maireana cheelii* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. Therefore, it is considered unlikely any fragmentation would occur.
Adversely affect habitat critical to the survival of a species.
No. Critical habitat has not been declared for *Maireana cheelii*.
Disrupt the breeding cycle of an important population.
No. *Maireana cheelii* has been surveyed for throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. As such, genetic diversity and dispersal locally and regionally is unlikely to be effected and overall, it is considered unlikely to significantly impact on the breeding cycle of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. The species was not recorded in the subject land. This local scale loss of habitat is not considered likely to cause *Maireana cheelii* to decline considering there are higher quality patches of habitat available in the region, and the wide-ranging nature of the species and more optimal habitats outside of the subject land
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. Proactive and adaptive mitigation measures will be implemented during construction and operation. Within the subject land, this species habitat is highly dynamic, subject to moderate levels of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly.
Introduce disease that may cause the species to decline.
No. The project will not result in the introduction of a disease that is harmful to *Maireana cheelii*.
Interfere substantially with the recovery of the species.
No. A current recovery plan is in place for this species (Mavromihalis, 2010). Key threats included altered threats to populations such as by land clearing and habitat reduction. It is not considered likely that the project will result in exacerbating these threats and result in substantial impacts to the recovery of *Maireana cheelii*. Potential impacts will be managed through mitigation measures which are outlined in the BDAR, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Conclusion.
Based on the assessment above, it is concluded that *Maireana cheelii* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

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SIC assessment for vulnerable species

- The species was not recorded during surveys.
- Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population.
- Will not disrupt the breeding cycle of an important population, the local population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not substantially interfere with the recovery of the species.

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Appendix 6.16. Turnip Copperburr *Sclerolaena napiformis*

Species background

Turnip Copperburr is listed as endangered under the EPBC Act. The species is a small perennial chenopod shrub, characterised by slender branches sparsely covered in short erect or curled hairs, and linear to narrowly obovate leaves, covered with appressed hairs. The plant's flowers are green and tiny while fruits have 5-6 spines and are sparsely to moderately pubescent. The species is endemic to south-eastern Australia, found in native grasslands and grassy woodlands on relatively fertile clay-loam soils (DSE 2010d).

A total of 25 populations of the species have been identified, with upper estimates of total abundance being less than 30,000 individuals. Previous distribution and abundance of the species is not known, however, judging by current distribution and habitat preferences, it is likely that the species was once distributed across a wide area of the Murray-Darling Basin in NSW and Victoria, across grasslands and grassy woodland communities. These habitats have been largely cleared for pasture. The current major threats to the species are considered to include weed invasion, habitat destruction and degradation, altered fire regimes, grazing and increased soil salinity (DSE 2010d).

Turnip Copperburr with the subject land

Recorded habitats include native grasslands and grassy woodlands on relatively fertile clay-loam soils particularly areas with *Austrostipa nodosa* and *Chloris truncata* tussock grasslands on grey to red-brown cracking clays and clay loams. Within the subject land, this includes areas of PCT 26 DNG and PCT 46. Vegetation structure may play an important role in the location of populations, with the species apparently absent from sites dominated by thick swards of grass, which forms majority of subject land, with only small areas of mosaic microrelief resulting in reduced grass cover, and increased forb richness.

SIC assessment for Turnip Copperburr

SIC assessment for Endangered species
Lead to a long-term decrease in the size of a population
No. Detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the development corridor considered potential habitat including within PCT 26 DNG, in particular sparse areas of less grass dominance and records of *Swainsona murrayana* and *Swainsona sericea,* as well as PCT 46. *Sclerolaena napiformis* was not recorded within the subject land during targeted surveys. It is considered unlikely that the project will lead to a long term decrease in the size of a population.
Reduce the area of occupancy of the species
No. *Sclerolaena napiformis* has been surveyed throughout the development footprint in September 2022-September 2023 and November 2022-2023. Due to key avoidance measures of this species preferred habitats, it is estimated the total potential reduction in area of occupancy restricted to the highest areas of potential habitat within PCT 26 DNG and PCT 46, however as the species has not been recorded, and an important population is not considered to occur, a substantial impact to an area of occupancy of an important population is not considered likely.

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SIC assessment for Endangered species

Fragment an existing population into two or more populations.

No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. A population is not considered to occur.

Adversely affect habitat critical to the survival of a species.

No. Critical habitat has not been declared for *Sclerolaena napiformis*

Disrupt the breeding cycle of an important population.

No. *Sclerolaena napiformis* has been surveyed throughout the development footprint in September 2022-September 2023 and November 2022-2023 and has not been recorded. As such, genetic diversity and dispersal locally and regionally is unlikely to be effected and overall, it is considered unlikely to significantly impact on the breeding cycle of this species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

No. The species was not recorded in the subject land. This local scale loss of habitat is not considered likely to cause *Sclerolaena napiformis* to decline considering there are higher quality patches of habitat available in in the region, and the wide-ranging nature of the species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

No. The localised occurrences of habitat for the species are subject to existing weed invasion and pest animals as a result of land clearing and surrounding agricultural land use. The project are unlikely to result in an increase of invasive species within the known and potential habitat for *Sclerolaena napiformis.*
Construction activities will be managed through standard practices to avoid new introductions and further spread of existing weeds.

Introduce disease that may cause the species to decline.

No. The project will not result in the introduction of a disease that is harmful to *Sclerolaena napiformis.*

Interfere substantially with the recovery of the species.

The National Recovery Plan for *Sclerolaena napiformis* (Mavromihalis, 2010) identifies seven specific objectives for the recovery of the species are to:

- Determine distribution, abundance and population structure
- Determine habitat requirements
- Manage threats to populations
- Identify key biological characteristics
- Determine life history and viability of populations
- Establish a seed bank
- Build community support for conservation

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SIC assessment for Endangered species
Considering the above factors, the Project will not interfere substantially with the recovery of *Sclerolaena napiformis*.
Conclusion.
Based on the assessment above, it is concluded that *Sclerolaena napiformis* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will not lead to the long term decrease of a population, reduce the areas of occupancy or fragment an existing population. • Will not disrupt the breeding cycle of a population, or species as a whole. • Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread. • Will not interfere will the recovery of the species.

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Appendix 6.17. Red Darling Pea *Swainsona plagiotropis*

Species background

Red Darling Pea is listed as vulnerable under the EPBC Act. The species is a small, perennial herb which grows to 30 centimetres tall. The compound leaves are 5 to 10 centimetres long, with 17 to 23 narrow leaflets. Flowers are 10 to 15 millimetres long, have a characteristically sideways twisted keel and fade to violet with age. The species occurs on relatively open native grasslands with 350 to 450 millimetres average annual rainfall, and on seasonally waterlogged red-brown clay and clay loam soils.

Approximately 60 populations of the species are currently known. The species occurs in the upper Murray River valley in the south-western plains of NSW and into Victoria. The Red Darling Pea was apparently abundant and widely distributed within the main part of its range at the time of European settlement of the Riverina plains. While the species is still relatively widely distributed and can be locally abundant in years of good rainfall, it is predicted that the abundance had declined due to land use changes across much of its distribution. Current threats to the species include weed invasion, grazing, habitat destruction and degradation, rising soil salinity and climate change.

Red Darling Pea in the subject land

Recorded habitats include native grasslands and grassy woodlands on relatively fertile clay-loam soils particularly areas with *Austrostipa nodosa* and *Chloris truncata* tussock grasslands on grey to red-brown cracking clays and clay loams. Within the subject land, this includes areas of PCT 26 DNG and PCT 46. Vegetation structure may play an important role in the location of populations, with the species apparently absent from sites dominated by thick swards of grass, which forms majority of subject land, with only small areas of mosaic microrelief resulting in reduced grass cover, and increased forb richness. Weeping Myall communities, both woodland and DNG, are largely homogeneous through the broader region and subject land (i.e. similar species composition), small areas of microrelief do occur on occasion that form small mosaic alterations with the introduction of some additional species, more consistent with other vegetation types, and the overall structure. Areas of derived grassland with an open structure, herb-rich inter-tussock spaces and presence of cryptogamic crust, and in the absence of *Walwhalleya proluta, Plains Grass Austrostipa aristiglumis* and *Enteropogon acicularis* as the dominant species. Swainsona habitat has also been observed to have a lower cover of grazing-tolerant robust chenopods and less dense grass sward, and where grazing activities were limited to cattle, and in the absence of heavier sheep grazing

SIC assessment for Red Darling Pea

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. Detailed constraints assessment modelling of biodiversity values was undertaken to ensure areas of high biodiversity value, and therefore most likely habitat, were avoided as much as possible. This includes areas within the development corridor considered potential habitat including within PCT 26 and PCT 46. *Swainsona plagiotropis* occurs over 20km from the subject land. This species is primarily found on the Hay Plain, which occurs anecdotally west of Oolambeyan National park on the flat scalded plains towards Balranald, but also known to occur within the Jerilderie Nature Reserve, where this species was observed from in September 2023. *Swainsona plagiotropis* has been surveyed for throughout the development footprint in September 2022 and September 2023 and has not been recorded. It is considered unlikely that the project will lead to a long term decrease in the size of an important population.

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SIC assessment for vulnerable species
Reduce the area of occupancy of an important population.
No. Suitable habitat is broadly available within woodland and grassland PCTs 26 and 46 where vegetation structure is limited to sites largely lacking thick swards of grass. Strongholds for the species occur between Hay and Balranald where it appears in high numbers. Known to occur within the Jerilderie Nature Reserve, to which this species was observed at the latter in September 2023. *Swainsona plagiotropis* has been surveyed for throughout the development footprint in September 2022 and September 2023 and has not been recorded. It is unlikely that any reduction in area of occupancy restricted to the highest areas of potential habitat within PCT 26 DNG and PCT 46 is considered significant for this species.
Fragment an existing important population into two or more populations.
No. Habitat within the subject land is partially fragmented by historical and ongoing land clearing and grazing regimes. An important population is not considered to occur. *Swainsona plagiotropis* has been surveyed for throughout the development footprint in September 2022 and September 2023 and has not been recorded. Therefore, it is considered unlikely any fragmentation would occur.
Adversely affect habitat critical to the survival of a species.
No. Critical habitat has not been declared for *Swainsona plagiotropis*.
Disrupt the breeding cycle of an important population.
No. *Swainsona plagiotropis* has been surveyed for throughout the development footprint in September 2022 and September 2023 and has not been recorded. As such, genetic diversity and dispersal locally and regionally is unlikely to be effected and overall, it is considered unlikely to significantly impact on the breeding cycle of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. The species was not recorded in the subject land. This local scale loss of habitat is not considered likely to *Swainsona plagiotropis* to decline considering there are higher quality patches of habitat available in the region, and the wide-ranging nature of the species and large areas of more optimal habitats outside of the subject land.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. Proactive and adaptive mitigation measures will be implemented during construction and operation. Within the subject land, this species habitat is highly dynamic, subject to moderate levels of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly.
Introduce disease that may cause the species to decline.
No. The project will not result in the introduction of a disease that is harmful to *Swainsona plagiotropis.*
Interfere substantially with the recovery of the species.

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SIC assessment for vulnerable species

No. A current recovery plan is in place for this species (Tonkinson, 2010) and identifies eight specific objectives for the recovery of the species are to:

- Determine distribution, abundance and population structure
- Identify habitat requirements
- Ensure that all populations and their habitat are protected and managed appropriately
- Manage threats to populations
- Identify key biological characteristics
- Determine life history and viability of populations
- Maintain ex situ collections
- Build community support for conservation

Potential impacts will be managed through mitigation measures which are outlined in the BDAR, which includes but not limited to detailed BMP, pre-clearance surveys, adaptive management and unexpected finds procedures.

Conclusion.

Based on the assessment above, it is concluded that *Swainsona plagiotropis* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- The species was not recorded during surveys.
- Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population.
- Will not disrupt the breeding cycle of an important population, the local population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not substantially interfere with the recovery of the species.

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Appendix 6.18. Slender Darling Pea *Swainsona murrayana*

Species background

Slender Darling Pea has been identified across most of inland NSW. Records of this species occur in patches from Moama to Moree and Broken Hill to north-west of Bourke. A large concentration of records are triangulated roughly between Moama, Narranderra and Hay (NSW DCCEEW 2024c).

The approved conservation advice for this species (Cth DCCEEW 2008a) details the species is '*found in grassland, herbland and open Black-box woodland, often in depressions…in heavy grey or brown clay, loam or red cracking clays…often associated with low chenopod shrubs, wallaby grass and spear grass*'.

Slender Darling Pea within the subject land

Targeted surveys identified a population of this species within the subject land. The targeted survey effort recorded an estimated 517 flowering/fruiting individuals within the subject land, with approximately 42 hectares of optimal habitat. Of this, it is estimated only a few individuals will be impacted within a 2.7 hectare area. This species has also been assumed present in vegetation zones where adequate survey is yet to be completed, up to 8.79 hectares, and until further survey can be undertaken in September 2024. Additionally a further estimated 2,000 individuals within 30 hectare area of optimal habitat were observed during targeted surveys for the adjacent Dinawan Solar Farm, of which 5.5 hectares of known habitat would be impacted.

SIC assessment for Slender Darling Pea

SIC assessment for vulnerable species
Lead to the long-term decrease in the size of an important population of a species.
No. A recovery plan has not been adopted for this species. The population of Slender Darling Pea within the subject land cannot be said to be: • Key source populations either for breeding or dispersal • Populations that are necessary for maintaining genetic diversity, and/or • Populations that are near the limit of the species range. As such the population within the subject land is not considered an Important Population of the species. The subject land occurs within an area of concentrated records for this species within NSW. Targeted surveys across the broader subject land identified a minimum population estimate of at least 2.500 individuals, of which a limited number of individuals will be directly impacted by the project. All records and suitable habitat were found to be in certain habitats of reduced grass cover, increase forb cover with species such as Bulbine lily. The project will result in an impact to known habitat for the species, but will not lead to a decrease in the size of an important population.
Reduce the area of occupancy of an important population.
No. The population within the subject land is not considered an Important Population of the species, and as such the project will not result in the reduction of the area of occupancy of an important population of this species.
Fragment an existing important population into two or more populations.
No. The project will not fragment the identified population, where this species was identified in all surrounding areas of the subject land. Connectivity will be maintained both within and adjacent to the subject land.

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SIC assessment for vulnerable species
Adversely affect habitat critical to the survival of a species.
No. Critical habitat has not been mapped for this species, therefore 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • For activities such as foraging, breeding, roosting, or dispersal. • For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators). • To maintain genetic diversity and long term evolutionary development. • For the reintroduction of populations or recovery of the species or ecological community. Habitat within the subject land is unlikely to meet the above criteria and be determined critical habitat.
Disrupt the breeding cycle of an important population.
No. The project would result in the removal of a small number of fruiting individuals, and may result in the ongoing disturbance to the seed bank of potential germinating. Breeding would be disrupted for the individuals that occur within the development footprint, however, the remaining recorded individuals within the retained habitat would not incur disruptions to the breeding cycle. Genetic diversity and dispersal locally and regionally is unlikely to be effected and overall, it is considered unlikely to significantly impact on the breeding cycle of this species. The population within the subject land is not considered an Important Population of the species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
No. As noted above, targeted survey effort recorded an estimated 517 flowering/fruiting individuals within the subject land. Of this, it is estimated only a few individuals will be impacted within a 2.7 ha area. This species has also been assumed present in vegetation zones where adequate survey is yet to be completed, up to 8.79 hectares, and until further survey can be undertaken in September 2024. Additionally a further estimated 2,000 individuals within 30 ha area of optimal habitat were observed during targeted surveys for the adjacent Dinawan Solar Farm, of which 5.5 ha of known habitat would be impacted. The loss of approximately 2.7 ha of optimal habitat, and a select few individuals is not considered an action that would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent this species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
No. The subject land is already located within a highly modified environment, dominated by land used for agricultural activities. As a part of the construction and operation management of the project a Weed and Pest Management Plan will be implemented to prevent the spread of invasive species. The CEMP and BMP to be implemented would action measures, including weed control to ensure any occurrence of this species outside the disturbance corridor are not out competed by exotic species and control the introduction of new weed species. With the implementation of the CEMP and BMP it is considered unlikely the project would introduce disease that may cause the species to decline.
Introduce disease that may cause the species to decline.
No. The project is not likely to introduce any diseases this species is susceptible to. In addition to this, the project will implement several controls and management plans including a CEMP and BMP.
Interfere substantially with the recovery of the species.
No. A recovery plan has not been adopted for this species. The approved conservation advice lists the following information: • Threats:

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SIC assessment for vulnerable species

  - Grazing from domestic livestock and rabbits.
  - Weed invasion.
  - Cultivation.
  - Roadside maintenance activities.
- Summary of regional and local priority actions:
  - Habitat loss, disturbance and modification:
    - Monitor known populations for threats and recovery progress.
    - Identify populations of high conservation priority and investigate formal agreements with landholders.
    - Manage hydrology and salinity.
    - Control access routes to minimise disturbance from public.
    - Minimise impacts from known land uses.
  - Trampling, browsing or grazing:
    - Develop and implement stock management plans.
    - Implement threat abatement plans for control and eradication of rabbits, goats and feral pigs.
  - Fire:
    - Develop and implement a suitable fire management strategy.
    - Provide maps to RFS and seek inclusion of mitigative measures for BMPs.
  - Conservation information:
    - Raise awareness in the local community, distribute information and establish formal management arrangement with land holders.
  - Invasive weeds:
    - Identify and remove weeds that could become a threat.
    - Management sites to prevent introduction of weeds.
    - Control use of herbicides in known sites.

The project will not interfere with the priority actions listed above. Mitigation measures, including exclusion of grazing, implementation of weed control and management plans are in line with the actions listed above. Monitoring of impacted population areas post construction has been recommended to be implemented as part of the BMP.

Conclusion.

Based on the assessment above, it is concluded that *Swainsona murrayana* is unlikely to be significantly impacted by the project. This conclusion was made on the basis that the project:

- Will not lead to the long term decrease of an important population, reduce the areas of occupancy or fragment an existing important population.
- Will not disrupt the breeding cycle of an important population, the local population or species as a whole.
- Will not adversely modify the species habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.
- Will not substantially interfere with the recovery of the species.

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Appendix 6.19. Natural Grasslands of the Murray Valley Plains

Community background

The vegetation is dominated by the ground layer with range of perennial grasses, forbs and small shrubs with typical characteristic species including *Rytidosperma*, *Austrostipa, Chloris, Enteropogon, Bulbine, Calotis, Chrysocephalum, Ptilotus, Rhodanthe, Swainsona,* with occasional *Atriplex* and *Maireana* (SEWPAC, 2012). Past and present grazing regimes as well as drought and rainfall patterns influence the composition of the community, and as such, some species may not always be evident above-ground, but instead exist in the seedbank (Threatened Species Scientific Committee, 2012). Most occurrences of the community are associated with alluvial sediments and gently undulating gilgai plains on heavy-textured grey cracking clay soils, however, does have a minor association with red and brown clay soils (TS Committee, 2012). The community is similar to some other derived grassland forms of the Weeping Myall woodlands listed under both the BC Act and EPBC Act however, it generally differs in the proportional composition of species (TS Committee, 2012).

Natural grasslands in the subject land

Due to the seasonal and dynamic aspects of determining natural and derived grasslands in the Riverina, a precautionary approach was undertaken. Areas of PCT 45 and PCT 46 that are located within slightly lower lying grey loam to cracking clay loosely fit the description of the EPBC Act listed Murray Valley Plains Natural Grassland TEC despite the region being on the north western edge of the TEC distribution. These native grasslands are in moderate condition due to long term grazing. The grasslands are dominated by native Spear-grasses *Austrostipa spp*., Wallaby-grasses *Rytidosperma spp*., Windmill Grass *Chloris truncata*, Panic-grass *Walwhalleya proluta* and Curly Windmill Grass *Enteropogon acicularis.* A range of grazing tolerant native herbs are present and some less grazing-tolerant native plant species occur at low densities that form mosaic in amongst Weeping Myall woodland and derived areas.

SIC assessment for Natural grasslands

SIC assessment for critically endangered communities
Reduce the extent of an ecological community
Yes. The project would result in a reduction of the extent of the Natural Grasslands of the Murray Valley Plains by 114 ha, of which 15.18 (13%) is attributed to Stage 1, and 99.24 (87%) is attributed to Stage 2 impacts. Potential areas of vegetation that will have patches commensurate with this TEC within the subject land is approximately 5,699 ha. It is estimated in the Riverina that approximately 61,000 ha remain in the region. Although areas of this TEC have been avoided, and restricted to more linear impacts in nature, the overall amount of impact and potential for cumulative impacts, it is likely that significant impacts would occur to this TEC, given its critically endangered status. The vast majority of these impacts would occur as a result of as a result of the stage 2 of the project, as it would account for the loss of 2% of remaining TEC in the locality, and 87% of the assessed community within the development corridor.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
No. The project would result in a reduction of 114 ha with this community generally occurring within a fragmented landscape impacted land use such as such as agriculture, transport and other rural infrastructure. Due to key avoidance measures implemented for these areas, it is unlikely that the project will exacerbate any impacts and result in significant increase in substantial fragmentation of this community beyond the exiting environment and land use.

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SIC assessment for critically endangered communities
Adversely affect habitat critical to the survival of an ecological community
No. The current advice on Natural Grasslands of the Murray Valley Plains (SEWPAC, 2012) does not indicate or describe any habitats or areas critical to the survival of this community. Due to key avoidance measures implemented for these areas, it is unlikely that the project will have impacts considered significant on critical habitat.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
No. The project is considered unlikely to substantially modify or destroy above mentioned abiotic factors due to small areas of local scale loss of habitat, mitigation measures and key avoidance of larger more viable patches.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
No. The project would result in a reduction of 114 ha which is generally in moderate to good condition, although subject to moderate levels of grazing regimes, both sheep and cattle. Impacts will not substantially fragment areas of this TEC that remain, meaning persistence of large high quality areas of grassland will be retained locally. The project is considered unlikely to cause substantial change to species composition of an occurrence of this TEC, particularly in retained areas and areas located more broadly, or outside of the subject land.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: **– assisting invasive species, that are harmful to the listed ecological community, to become established, or** **– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological** **- community which kill or inhibit the growth of species in the ecological community**
No. Within the subject land, this TEC is highly dynamic, subject to moderate leaves of grazing and does contain patches of weeds such as *Lolium, Hordeum* and other environmental weeds. It is considered unlikely that the project would substantially reduce the quality or integrity of the community's occurrence or significantly increase the spread of invasive species locally and or more broadly. Proarctive and adaptive mitigation measures will be implemented.
Interfere with the recovery of an ecological community
No. No national recovery plan currently exists for this community. Although 114 ha will be impacted, due to key avoidance measures implemented, retaining areas of this community and commitment to improve/maintain principles, it is unlikely that impacts resulting from the project will result in substantial impacts relating to the recovery of this TEC.
Conclusion.
Based on the assessment above, it is concluded that Natural Grasslands of the Murray Vallely Plains is likely to be significantly impacted by the project. This conclusion was made on the basis that the project: • Will reduce the extent of a critically endangered community. However the project • Will not disrupt critical habitat or increase fragmentation of this community. • Will not adversely modify the habitat or introduce invasive species/diseases – project mitigation measures are to be implemented to mitigate any potential weed incursion/disease spread.

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SIC assessment for critically endangered communities

- Will not significantly interfere will the recovery of the species.

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Appendix 6.20. Weeping Myall Woodlands

Distribution

Weeping Myall Woodlands is listed as Endangered under the EPBC Act. The community occurs in small pockets throughout the inland alluvial plains west of the Great Dividing Range in NSW and QLD and is dominated by Weeping Myall *Acacia pendula*. The main threats to this community are clearing for cropping, ongoing degradation, weed invasion and herbivory by the Bag-shelter Moth (*Ochrogaster lunifer*) (TSSC 2009b). There is no adopted or made Recovery Plan for this ecological community.

Habitat and occurrence in the subject land

Field investigation determined a total of approximately 5,771 hectares of PCT 26 Weeping Myall woodland vegetation occurs within the subject land and 991. 3 hectares and 150.46 hectares occurs within the development corridor and development footprint respectively, that's meet the listing requirements for Weeping Myall Woodlands TEC under the EPBC Act. The vast majority of the PCT 26 vegetation occurs in as DNG, which does not support the structural requirements for the EPBC Act listed community (Section 3.2.4). Only High and Moderate condition patches were determined to align with the Weeping Myall Woodlands TEC as they contained a canopy consisting of at least 5% Weeping Myall trees per hectare in patch greater than 0.5 hectares, contained more than two layers of regenerating Weeping Myall, and a tallest living layer of at least 4 metres. The project will result in the clearing of 150.46 hectares of this TEC.

SIC assessment for Weeping Myall Woodlands

SIC assessment for endangered and critically endangered ecological communities
Reduce the extent of an ecological community
Yes. Weeping Myall Woodlands occur in a broad arch across inland south-eastern Australia from the Victorian-NSW border into central Queensland (CoA 2009b). The development corridor contains a total of 991.30 ha of Weeping Myall Woodlands, of which 150.46 ha (or 15%) will be directly impacted. An approximate amount of 5,771 ha occurs within the broader subject land, but it is uncertain how much of this would meet the requirements of the EPBC listing. Though impacts to the community will occur in a highly fragmented agricultural landscape within a central part of its geographic distribution the removal of 150.46 ha is considered likely to significantly lead to an overall reduction in the extent of the community.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
No. Although project will remove up to 150.46 ha of this TEC, connectivity of the patch es outside the disturbance footprint will be maintained within the subject land. Operational impacts will be limited to widely spaced wind turbines and associated relatively low usage access tracks which are unlikely to restrict the dispersal of genetic material for species present within the community. Considering the above, the proposed impacts are unlikely to significantly increase fragmentation of the community.
Adversely affect habitat critical to the survival of an ecological community
No. There is no adopted or made Recovery Plan for this ecological community and no critical habitats have been formerly identified by the Australian Government. Under the EPBC Act, 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)

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SIC assessment for endangered and critically endangered ecological communities

- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

The development corridor contains 991.30 ha of Weeping Myall Woodland well with the ecological communities known range. The habitat it occupies cannot be said to fulfil any of the above criteria in the national context. Approximately, 15% only would be impacted, with 75% retained and managed, which is unlikely to adversely impact habitat critical for the TEC to persist.

Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival

No. Construction is likely to result permanent as well as short term temporary disturbance to soil, however construction is unlikely to substantially alter surface drainage patterns. It is unlikely that the proposed construction would alter the surface drainage, or flow regimes of watercourses within the landscape such that, substantial changes to the water regime would be observed. The construction and operation of the wind farm would not alter the nutrient levels of the soil. Persistence of adjacent undisturbed patches of Weeping Myall Woodlands are not considered likely to be compromised by the project.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.

No. All Weeping Myall Woodland stands occur in a fragmented rural / agricultural landscape where existing land use impacts have most likely reduced community integrity and functionality historically. Further clearing of the scale and extent required for the project is linear and is unlikely to further reduce species diversity and simplify community structure, as percentage of removal is not likely to reduce genetic exchange between species within the retained patches. As a part of the construction and operation management of the project a Weed and Pest Management Plan will be implemented to prevent spread of invasive species.

Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.**

No. Most locations where this community occurs are subject to a level of existing weed invasion, pest animals, erosion and chemical inputs as a result of surrounding agricultural land use. Construction activities can be managed through standard practices to avoid further sedimentation and pollution. As a part of the construction and operation management of the project a Weed and Pest Management Plan will be implemented to prevent the spread of invasive species. Therefore, proposed impacts are unlikely to increase invasive species or the use fertilizers and herbicides above existing levels.

Interfere with the recovery of an ecological community.

No. There is no adopted or made Recovery Plan for this ecological community. The approved conservation advice (DoEWHA 2008) for this species details the following recovery and threat abatement actions required for this community:

- Protecting remnants of the listed EEC through the development of conservation agreements and covenants.
- The use of strategic grazing that allows regeneration.
- Replating of understory species where they have been depleted.
- Use of lopping methods that do not result in the death of dominant tree species.
- Avoiding the application of fertilisers and herbicides in or near remnants.
- Protecting remnants from weeds including the speedy eradication of any new invasions.
- Raising awareness of the ecological community within the community.

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SIC assessment for endangered and critically endangered ecological communities
The project will not interfere with these recovery objectives given the area of the community to be impacted is small in nature.
Conclusion
The project is considered likely to significantly impact this EEC due to a substantial reduce the extent of the ecological community more than the 150 ha. However the project will not; • Fragment or increase fragmentation. • Adversely affect habitat critical to the survival of the EEC. • Modify or destroy abiotic (non-living) factors the EEC relies on. • Cause a substantial change in the species composition or a reduction in the quality or integrity of the EECs occurrence. • Interfere with the recovery of the EEC.

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Appendix 6.21. Fork-tailed Swift *Apus pacificus*

Distribution

The Fork-tailed Swift (*Apus pacificus*) is listed as migratory under the EPBC Act, and under the bilateral migratory bird agreements Australia has with Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA). The Fork-tailed Swift is a regular non-breeding migrant from Asia and generally occurs over all states and territories of Australia. Within NSW, few populations of the species have been found west of the Great Divide.

Habitat requirements

Within Australia, they mostly occur over inland plains preferring dry or open habitats, but can occur around riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They forage aerially, up to hundreds of metres above ground, but also less than 1 m above open areas or over water. They often occur in areas of updraughts, especially around cliffs and are said to search along edges of low-pressure systems, which assist flight. Low-flying Swifts are said to be precursors of unsettled weather, possibly because insect prey fly at a lower altitude when the air is humid and when the air density is low (Cameron 1952). The Fork-tailed Swift does not breed in Australia. They generally arrive in Australia around October, and depart mid-April to May.

Survey observation and important habitat

Numerous individuals of Fork-tailed Swift across were sobered incidentally enroute between BBUS surveys in March 2024.

SIC assessment for Ford-tailed Swift

SIC assessment for listed migratory species
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.
No. The project is unlikely to impact areas of important habitat for this species. Within Australia, the species is considered to be predominately aerial, however as the project is a wind farm development, this may alter the airspace above the project, therefore this species may be at risk of blade strike if in the area, or avoidance of potential habitats currently present once the wind farm becomes operational. Fork-tailed Swift undertake extensive migrations, traveling thousands of kms from their breeding grounds to their wintering areas. Their movements are influenced by factors such as food availability, weather patterns, and breeding cycles. Potential collisions is likely to be infrequent, and large-scale disruption to movement pathways is not expected, due to the irregularity of the species' occurrence, and the small numbers possibly affected do not represent a significant proportion of the total population of this species, therefore the overall risk is considered low. Potential indirect impacts will be managed through mitigation measures which are outlined in Section 9, which includes but not limited to detailed BMP and BBAMP, pre-clearance surveys, adaptive management and unexpected finds procedures.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.
No. The project will not lead to invasive species that are harmful to the Fork-tailed Swift. The project will implement several controls including a Pest and Weed Management Plan as well as BBAMP.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant

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SIC assessment for listed migratory species
proportion of the population of a migratory species.
No. The total global population of the Fork-tailed Swift is not well known. Population estimates for this species can be challenging due to their wide-ranging habitats and migratory patterns. However, they are generally considered to have stable population. Flocks of up to 50-90,000 have been recorded in Australia. Given several individuals were recorded on one occasion within the subject land, across a two year period, it is considered unlikely that an ecologically proportion of the species could be present and impacted by the Project. This the species does not breed in Australia (breeds in eastern Asia). Due to it flying to height of up to 300m, the species is considered to be at risk of blade strike, or avoidance of the area and operational wind turbines, therefore it is possible the species migration activity could be disrupted. However the species presence within the subject land is likely to be infrequent due to the irregularity of its occurrence, and the small numbers possibly affected do not represent a significant proportion of the total population of this species.
Conclusion.
The project is not considered likely to significantly impact this species. This assessment has found the project is unlikely to: • Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species. • Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species. • Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

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Appendix 7. Streamlined assessment module – Scattered trees assessment

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Requirements for application of Streamlined assessment module – Scattered trees assessment

As outlined in Appendix B of the BAM (DPIE 2020a) - an assessment of the impact of clearing scattered trees can be made using this module where:

- The impacts of clearing or development proposals are for vegetation that meets the definition of scattered trees, and
- The scattered tree is not a threatened species itself nor does it have any record of candidate species credit species (flora or fauna) incidentally using it, and
- The impact is unlikely to be serious or irreversible.

As only part of the development corridor contains scattered trees, this module has been used to assess only the impacts associated with the portion of the development footprint impacting upon scattered trees.

Scattered trees are defined under the BAM if the trees meet any of the three definitions provided in Appendix B. The definition relevant to the current assessment is as follows:

- Scattered trees are three or fewer trees that have a DBH of greater than or equal to 5 cm and are within a distance of 50 m of each other, that in turn, are greater than 50 m away from the nearest living tree that is greater than or equal to 5 cm DBH, and are completely separated by 100% exotic vegetation, human-made surfaces or bare ground.

In this case, all trees occur on current or previously cropped land. Furthermore, all trees mapped as scattered paddock trees occur are Category 2-regulated land and are surrounded by Category 1-exempt land.

Map the scattered tree vegetation zone and determine the assessment class

The follow data collection steps must be undertaken to map the scattered tree vegetation zone and determine the assessment class of each tree:

- Map scattered trees proposed to be removed by the project.
- Identify the genus and species of each tree.
- Assign each tree into one of the following classes:
- Class 1: trees that are <20 cm DBH and without hollows.
- Class 2: trees that are ≥20 cm DBH and less than the large tree benchmark for the most likely plant community type, or trees that are <20 cm DBH that contain at least one hollow.
- Class 3: trees that are greater than or equal to the large tree benchmark for the most likely plant community type.
- Record any sightings (e.g. in hollows) or evidence (e.g. scats) of threatened species (flora or fauna) using the scattered trees.

The table below provides a list of the scattered trees recorded within the subject land and likely to be impacted by the project. Many of trees were verified, some were recorded by desktop only, and assumed to be class 3 trees.

Scattered trees were recorded on-ground using handheld uncorrected GPS devices, and as such to account for potential GPS error, a 10 meter buffer was applied to the development footprint when selecting scattered trees considered impacted by the project.

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Furthermore a number of trees (or clusters of trees) were found not to meet the requirements for mapping as scattered trees when on-ground assessment was completed. This was largely due to trees being present in groups/clusters that comprised a combined cover value too high to be considered as a scattered tree defined by the BAM. This resulted in a number of small clusters being included as vegetation zones, as outlined in Section 3.3 above.

Mapped scattered trees are illustrated on Figure 10 within the BDAR.

Table A 6: Mapped scattered trees likely to be impacted by the project

Tree ID	Species	Class	Number of hollows	Development footprint	Development corridor
PT1	Weeping Myall	Class 2	No	Yes	Yes
PT2	Weeping Myall	Class 2	No	Yes	Yes
PT3	Weeping Myall	Class 2	No	Yes	Yes
PT4	Weeping Myall	Class 2	No	No	Yes
PT5	Weeping Myall	Class 2	No	No	Yes
PT6	Black Box	Class 2	No	Yes	Yes
PT7	Weeping Myall	Class 2	No	Yes	Yes
PT8	Weeping Myall	Class 2	No	Yes	Yes
PT9	Weeping Myall	Class 2	No	Yes	Yes
PT10	Weeping Myall	Class 2	No	Yes	Yes
PT11	Weeping Myall	Class 2	No	Yes	Yes
PT12	Weeping Myall	Class 2	No	Yes	Yes
PT13	Weeping Myall	Class 2	No	Yes	Yes
PT14	Weeping Myall	Class 2	No	Yes	Yes
PT15	White Cypress Pine	Class 2	No	No	Yes
PT16	White Cypress Pine	Class 2	No	No	Yes
PT17	White Cypress Pine	Class 2	No	No	Yes
PT18	Assumed - Black Box	Class 3	Yes (Assumed)	Yes	Yes
PT19	Assumed - Black Box	Class 3	Yes (Assumed)	No	Yes
PT20	Assumed - Black Box	Class 3	Yes (Assumed)	No	Yes
PT21	Assumed - Black Box	Class 3	Yes (Assumed)	No	Yes
PT22	Assumed - Black Box	Class 3	Yes (Assumed)	Yes	Yes

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Tree ID	Species	Class	Number of hollows	Development footprint	Development corridor
PT23	Assumed - Black Box	Class 3	Yes (Assumed)	Yes	Yes
PT24	Weeping Myall	Class 2	No	Yes	Yes
PT25	Weeping Myall	Class 2	No	Yes	Yes
PT26	Weeping Myall	Class 2	No	No	Yes
PT27	Weeping Myall	Class 2	No	Yes	Yes
PT28	Weeping Myall	Class 2	No	Yes	Yes
PT29	Weeping Myall	Class 2	No	No	Yes

The table below provides a summary of the numbers and classes of scattered trees likely to be impacted by the project. As outlined in Section B.3 of the BAM, no further assessment is required for Class 1 scattered trees, as they are considered to support negligible biodiversity value.

Table A 7: Summary of scattered trees likely to be impacted by the project

Class	No. trees impacted – directly or indirectly
1	-
2	23
3	6

Assessment of entities at risk of a serious or irreversible impact

The BAM requires the identification of all species at risk of a SAII that would be impacted on by the proposed clearing of the scattered trees.

No such entities exist as part of the current assessment.

Determine the offset requirements

The table below provides the project's offset associated with the proposed clearing of scattered trees, as calculated in accordance with Section B5 of the BAM. The offset requirement is also presented as a BAM Credit Summary Report provided below.

The BAM Calculator case number for the scattered tree assessment is 00034895/BAAS17051/24/00047205. Credit reports are provided in Section 13.

Table A 8: Offset credit calculations for impacted scattered trees

PCT	Class	Contains hollows	No. of trees	Credit required
PCT 13 Black Box - Lignum woodland wetland	2	No	1	1
	3	Yes	6	6

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PCT	Class	Contains hollows	No. of trees	Credit required
PCT 26 Weeping Myall open woodland	2	No	19	10
PCT 28 White Cypress Pine open woodland	2	No	3	2
TOTAL				19

Threatened ecological communities

Vegetation within the subject land was found to represent two TECs listed under the NSW BC Act., both of which can occur as single trees. As such trees representing PCT 26 and PCT 28 are considered to represent their associated TECs. Further information is provided in the below.

Table A 9: Summary of BC Act TECs represented as scattered trees

BC Act TEC	Listing status	PCT	Impacts
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Endangered	PCT 26 Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	• 19 scattered paddock trees
Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions	Endangered	PCT 28 White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone	• 3 scattered paddock trees

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Appendix 8. CRM overview and performance

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Performance of the Biosis wind turbine avian collision risk model evaluated for two species of Australian eagles

Ian Smales

January 2023

Introduction

A number of avian collision risk models are used internationally to provide forecasts of the potential for various species of birds to collide with wind turbines. Their principal application has been to inform impact assessment as a component of regulatory consent processes for proposed wind energy projects.

While it is difficult to determine the frequency of bird collisions at offshore wind farms because it is not possible to search for bird carcasses as is traditionally done at onshore facilities, validation is feasible at terrestrial wind farms. Nonetheless, few pre-consent projections of avian turbine collision risk models used for onshore wind farms have been validated by comparing them with empirical experience of operational wind farms (Masden and Cook 2016). Since validation of that kind is the real test of the performance of models, it is important that the pre-operational projections of models are compared with subsequent experience at operational wind farms. The nature of mathematical models lends them to refinement based on appropriate validation.

The general lack of model validation seems to result from a regulatory context in many jurisdictions whereby collision risk modelling is undertaken as a prerequisite to a consent decision, but once consent has been granted little further consideration is given to its estimates. However, it is also the case that a variety of factors present significant constraints on the capacity to accurately determine the total numbers of collisions that occur at operational wind farms for almost all species (see *Pre-requisites to validation*, below) and this can make it difficult to validate the forecasts of collision risk modelling.

One evaluation exercise undertaken across 46 small wind farms in Germany (Grünkorn et al. 2017) concluded that the Band model (Scottish Natural Heritage 2010a; b) substantially underestimated real numbers of fatalities for various species. In that study bird activity data was collected during operation of the wind farms rather than prior to construction and it is not apparent whether that may have influenced results.

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The Biosis avian collision risk model was developed in the early 2000s when commercial-scale wind energy was in its infancy in Australia. The model has been used to provide quantified assessment of the potential for various species of birds to collide with wind turbines for multiple proposed wind energy facilities since then.

Performance of the model can be evaluated only by comparing its forecasts of bird collision rates (generally prepared prior to wind farm construction) with rates experienced during the operation of wind farms. The latter requires post-construction mortality data of sufficient quality and quantity to permit estimation of annual mortality rate with high precision (see *Pre-requisites to validation*, below).

Background to turbine collision risk modelling

Quantitative modelling to estimate the number of collision mortalities of threatened birds is widely used as part of environmental impact assessments for proposed wind energy facilities (Huppop et al. 2006, Masden & Cook 2016, Smales 2017, Cook & Masden 2019).

Modelling of avian collision risk with wind turbines provides results measured as forecasts of the per annum average number of individual birds that may collide with turbines at a proposed wind energy facility. The forecasts are usually of very low numbers and, by the application of a range of avoidance rates (see below), a range of results is routinely provided. Frequently this range is quite narrow and, as in the examples set out here, is for an impact of within one or two individuals per annum. To the best of our knowledge, no other form of environmental impact assessment for fauna in Australia requires forecasts with this level of precision for the number of individual animals that may be impacted by a proposed action.

A modelling approach to collision risk allows the incorporation of uncertainties. These relate to imperfect knowledge about the behaviours of birds in the presence of a proposed wind farm. All modelling of this type entails the use of assumptions, but the use of a mathematical modelling approach for avian collision risk requires that necessary assumptions are based on available empirical information. Hence, collision risk is best modelled only for species for which empirical data about their flight activity has been obtained from the site of a proposed wind farm, ideally during a period sufficient to encompass a range of seasonal and other environmental conditions.

Mathematical modelling of risk is intended to provide an articulated and replicable evaluation of what may occur in the real world. The rationale behind predictions is explicitly stated in the mathematics of the model, which means that the logical consistency of the predictions can be evaluated. The explicit nature of inputs and rigour entailed in modelling means that the process is replicable, consistent and open to analysis, criticism or modification when new information becomes available. Although it is necessary to include some assumptions and arbitrary choices when deciding on the structure and parameters of a model, these choices are explicit.

Collision risk modelling incorporates multiple variables and uses specifications of the wind farm and of turbines, along with values for size and speed of particular species, and data for flight heights and flight

frequency collected during dedicated investigations at the site. The outputs of the model are numerical estimates of the rates of annual mortalities of relevant species of birds due to turbine collisions.

The modelling process uses data specific to particular turbines and relevant species of birds recorded at the wind farm site. Bird flight data represent a sample of the flight activity of particular species measured against time and airspace. In subsequent collision risk modelling, the sample of bird flights obtained from the site are extrapolated to provide per annum rates of flights that might interact with the total number of turbines proposed for the wind farm.

Avoidance rates

Avoidance rate is the capacity for a bird to avoid a collision (Cook et al. 2014), whether that occurs due to a cognitive response on the part of a bird or by chance (Martin 2011).

Birds are generally adept at avoiding obstacles within their flight space but the capacity of a bird to avoid a collision is clearly an important element in consideration of this risk. 'Avoidance' is recognised at different spatial scales. The best definitions of these are provided by Cook et al. (2014) and are summarised as follows: (1) macro-avoidance occurs when a bird responds to the presence of an entire wind farm by flying around or over it; (2) meso-avoidance refers to the response in which birds fly within the overall wind farm but avoid collisions by choosing to fly only in the airspace between turbines, or in the space below rotor-sweep; and (3) micro-avoidance happens when a bird, flying in close proximity to a turbine and that is otherwise on a collision course, does not in fact collide with the turbine. These were illustrated by Smales (2017) and are reproduced here as Figure 1.

Macro-avoidance is a simple measure of displacement of birds from the area occupied by an operational wind farm. Micro-avoidance may include cognitive behaviour in which a bird becomes aware of danger and takes evasive action, or simple chance resulting in inadvertent safe passage between turbine blades. Data for bird flight activity is collected at the site of a proposed wind farm in the absence of any turbines and thus without any avoidance. For this reason, avoidance rates applied in risk modelling must encompass the potential for avoidance at all three spatial scales.

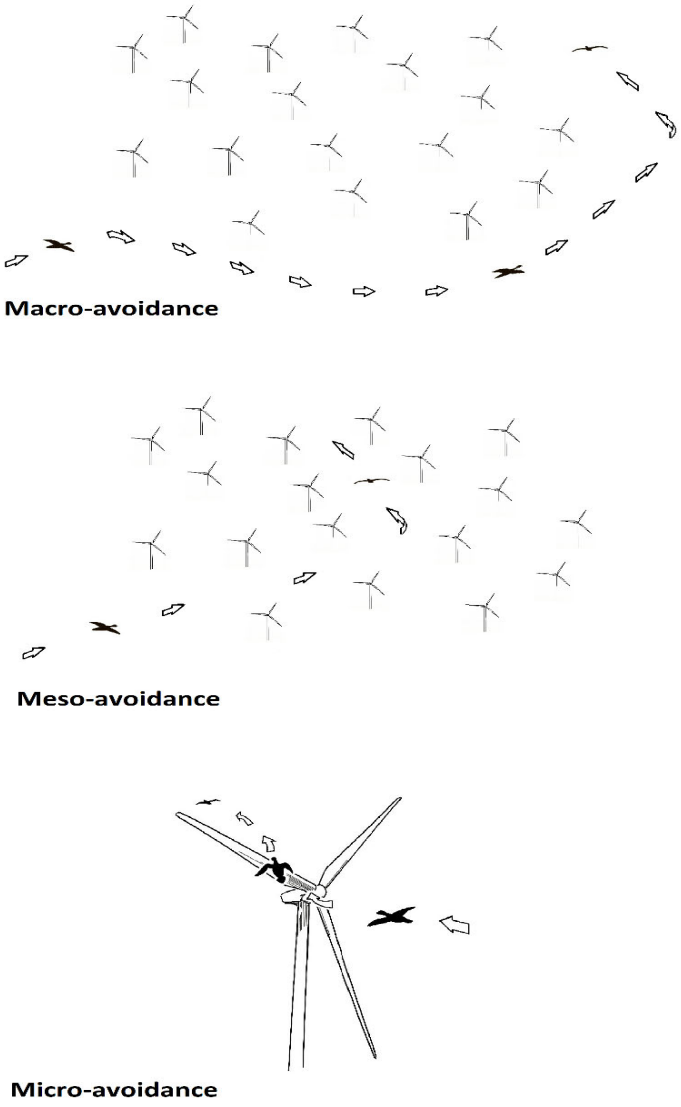


Figure 1 Three spatial scales at which avoidance of collision may occur (Smales 2017).

An avoidance parameter is incorporated into the collision risk model by scaling the number of movements at risk by (1 – v), where perfect avoidance capacity equates to 1.0, and v is a measure of the rate at which birds avoid turbines. Thus, an avoidance rate of 0.90 equates to one flight in 10 in which a bird does not avoid a turbine; an avoidance rate of 0.98 equates to one flight in 50 in which a bird does not avoid a turbine, and an avoidance rate of 0.99 equates to one flight in 100 in which a bird does not avoid a turbine.

Ideally, empirical data from observational investigations of birds flying within an operating wind farm would provide 'real' rates at which birds avoid turbine collisions at the various spatial scales. However, as discussed by various authors (Chamberlain et al. 2006; Madders & Whitfield 2006; Cook et al. 2012, Smales 2017), it has proven difficult to obtain empirical data for actual turbine avoidance rates from observational

studies. At least in part, this is because, while human observers very rarely document collisions, they experience difficulty in determining the precise flight path of a bird and whether it is actually on a potential collision course, and hence whether avoidance of any kind was involved when no collision occurs.

Owing to the difficulties associated with observational studies of avoidance, avoidance rates have usually been determined not from direct observations of the behaviour of birds within a wind farm, but by an indirect derivation in which an 'avoidance rate' is calculated from the difference between the collision rate projections of a model and the number of fatalities that actually occur (Whitfield 2009; Band 2012; Cook et al. 2012, 2014; Grünkorn et al. 2017; Smales 2017). That is: avoidance rate = 1 – (actual deaths/predicted deaths assuming no avoidance). This approach has a number of problems. Estimation of the total number of deaths at onshore wind farms is based on the number of collision carcasses detected during a search regime, and accounting for carcasses missed by searchers and lost to scavengers. While methods to account for searcher efficiency and carcass persistence have improved (e.g. Huso et al. 2017), the process most often results in mortality estimates with very large confidence intervals. As a consequence, a derived avoidance rate will be imprecise. In addition, the simple difference between the number of fatalities predicted and those experienced may include multiple factors other than avoidance and will also encompass any error in the model (Whitfield 2009; Hull & Muir 2013; Cook et al. 2014; Grünkorn et al. 2017; Smales 2017).

Some advances have been made recently in efforts to obtain empirical data for actual collisions (e.g. Coppack et al. 2015; Cullinan et al. 2015; Larkin 2015; Perrow et al. 2015; Skov et al. 2018). Such studies describe methods using technologies such as fixed pencil-beam radar in combination with an infrared-sensitive camera system, automated thermal imaging, multidimensional radar and Global Positioning System (GPS) boat-based tracking to detect and record collisions and birds' avoidance of collisions at offshore wind farms. While similar technologies have begun to be applied at a few onshore Australian wind farms to achieve targeted curtailment of turbines when a bird is detected in close proximity to a turbine, they have not been applied to ascertain avoidance rates.

In the Biosis model, the turbine is decomposed into its static and dynamic components. The entire turbine (including the tower, nacelle and the rotor when stationary) represents the static component. The dynamic component is the volume swept by the leading edge of the rotor blades in the time it takes a bird of a given length and flight speed to pass across the depth of the rotor-swept disk. Static components (i.e. the stationary turbine) are considered to pose minimal collision risk as they are very likely to be seen and avoided by birds in flight. The dynamic component of the sweeping rotor blades is considered to represent higher risk due to their speed and the likely difficulty of a bird in flight avoiding them. The model takes the two elements into account by allocating different avoidance rates to them.

Model result metrics

Collision risk results are projections extrapolated from the sampled rates of flight activity of a particular species. With the incorporation of a site population estimate, the model's results are expressed as the average number of potential collisions by individual birds that may occur per annum for the various

modelled avoidance rates.

Results are shown to one or more decimal places as per original modelling. This is done for the purposes of indicating differences between results rather than to indicate precision in the results.

The model is necessarily deterministic, but it is important to note that if collisions occur at the operational wind farm their numbers can be expected to vary around a long-term mean for any species.

At present, there are no avoidance rates obtained from empirical studies available for any species of Australian bird. For this reason, results of the Biosis collision risk model are routinely provided for a range of dynamic avoidance rates, often from 0.90 or 0.95 to 0.99.

Model validation

Pre-requisites to validation

Performance of the model can be evaluated only by comparing its forecasts of bird collision rates (generally prepared prior to wind farm construction) with rates experienced during operation of the wind farm. The latter requires post-construction mortality data that is sufficient to permit calculation of a quite precise annual mortality rate. Conditions of regulatory approval for most wind farms that have been built to-date in Australia have varied considerably within and between State jurisdictions and over time. While post-construction monitoring of bird collisions with wind turbines and periodic estimation of total strike rates have been regulatory conditions of approval for many wind energy projects, there has been no standard methodology for these (Moloney et al. 2019) and the consequent variation in reported results has hampered capacity to validate forecasts of the model.

Post-construction monitoring of bird mortalities is a sampling exercise and it is always likely that only a portion of the total number of collision victims will be detected even by well-designed and effective regimes of carcass searches. Factors influencing this include the rate at which carcasses disappear due to scavengers or natural decay; the capacity of searchers to find carcasses; the interval between regular searches and, the portion of the turbine array which is searched. Estimates of total mortality, based on the number of carcasses detected, take account of these additional factors but all of them encompass uncertainty. Worldwide evidence indicates that bird collisions with wind turbines are relatively rare events and for any given species, the number of carcasses detected is most often very low. For each of 56 species of birds, Moloney et al. (2019) document a mode of just 1 fatality detected during monitoring of a combined total 15 wind farms, each of which was monitored for between 2 and 3.5 years. As a consequence, estimates of total collision mortality for birds most often have confidence intervals that may be orders of magnitude greater than the number of carcasses detected. Another consequence of low numbers of collisions is that annual averages of fatalities are prone to significant influence of inter-annual variability (Huso et al. 2017; Moloney et al. 2019).

For these reasons, the ideal species to use in evaluation of the model's performance will be one that has the following characteristics:

- is not favoured by scavengers so that carcasses are likely to persist and be found
- is readily detected by searchers
- has a relatively high collision rate

These characteristics provide data allowing for greater confidence when the number of carcasses detected is used as the basis for calculating an estimate of total collision fatalities.

A recent study of bird carcass persistence at Yaloak South wind farm in southern Victoria (Elmoby Ecology Bennett 2019; 2020; 2021) placed multiple bird carcasses over a period spanning four years and used remote cameras to monitor their persistence. The study included a total of 24 Wedge-tailed Eagle *Aquila audax* carcasses that were monitored until no evidence of the carcasses remained. This was the first substantial investigation using eagle carcasses in Australia.

The study found that Wedge-tailed Eagle carcasses had a mean persistence time of 260 days with a 95% confidence interval of between 119 and 567 days, whereas for all small and medium-sized birds (including some small raptors) mean persistence time was 2.8 days with a 95% confidence interval of between 2 and 4 days.

It was found that the Red Foxes *Vulpes vulpes*, the principal scavenger of bird carcasses at the site, ignored Wedge-tailed Eagle carcasses. The one potential scavenger detected was other Wedge-tailed Eagles, however they did not remove carcasses, which substantially remained in place (E. Bennett pers. comm.). The Elmoby Ecology Bennett reports conclude that there was a high level of confidence that all Wedge-tailed Eagles killed by collision with wind turbines were found and thus that the number of eagles detected were highly likely to reflect the total number of collisions by the species. A similar conclusion was previously drawn for Wedge-tailed Eagle collisions at Bluff Point and Studland Bay wind farms in Tasmania (Hydro Tasmania 2013; Hull et al. 2013) (see below), albeit it without the corroborating evidence from carcass persistence trials using eagles. At those two wind farms scavenger-exclusion fences were in place around a radius of a subset of turbines and they prevented removal of collision carcasses by mammals such as Tasmanian Devils *Sarcophilus harrisii*.

The Wedge-tailed Eagle is one of a very small number of species that experience a relatively high turbine collision rate. Moloney et al (2019) document a total of 58 Wedge-tailed Eagles found during carcass searches at 15 wind farms that were each monitored for between 2 and 3.5 years.

Wedge-tailed Eagles maintain large territories and, by comparison with many other bird species, occur at low densities. These factors along with their flight behaviour and the capacity to readily distinguish adults from younger birds, makes it relatively straightforward to estimate with good precision the number of Wedge-tailed Eagles utilising a wind farm site. The ability to make such an estimate is a key requirement allowing the Biosis model to provide an output in terms of the number of individuals at risk per annum.

No displacement of eagles is apparent at any operational wind farm studied in Australia and it thus appears that macro-avoidance does not have an influence on collision risk for eagles here.

All of these aspects serve to make the Wedge-tailed Eagle a good species for use in validation of the Biosis collision risk model. For the reasons set out above, estimates of total mortalities for the species (by others) are considered to closely equate to the numbers of carcasses detected and to have small 95% confidence intervals. This means that comparisons of model projections and actual mortalities described below, allow avoidance rates to be derived with a high degree of confidence.

Comparing the model's predictions with empirical data – case histories

The Biosis model has been used to provide projections of potential collisions by Wedge-tailed Eagles and/or White-bellied Sea-eagles *Haliaeetus leucogaster* as part of environmental impact assessments for the following projects:

- Codrington Wind Farm, Victoria
- Bluff Point Wind Farm, Tasmania
- Studland Bay Wind Farm, Tasmania
- Yaloak Wind Farm, Victoria
- Yaloak South Wind Farm, Victoria
- Musselroe Wind Farm, Tasmania
- Cattle Hill Wind Farm, Tasmania
- Low Head Wind Farm, Tasmania
- Kentbruck Wind Farm, Victoria

Codrington, Bluff Point, Studland Bay, Yaloak South, Musselore and Cattle Hill wind farms have all been operational for a number of years. Codrington was the first commercial scale wind farm built in Australia. Carcass searches were undertaken there under seven turbines for just seven months. No eagle carcasses were found. Yaloak Wind Farm did not proceed as proposed but was replaced by the smaller Yaloak South Wind Farm. Collision risk modelling for Cattle Hill Wind Farm was undertaken for a proposal with more than twice the number of turbines that were subsequently installed. Cattle Hill also operates a successful automated system to detect either species of eagle and curtail turbines whilst an eagle is within a predetermined proximity of a turbine (Goldwind 2022). This system facility was not envisaged at the time of the modelling. As a consequence of the differences between the proposed and actual wind farm, the model results were for a greater number of eagle mortalities than have been reported from the operational wind farm. Low Head Wind Farm is not yet operational and planning processes for Kentbruck are in process at the time of writing.

The Biosis model was used to provide projections of potential collisions by Wedge-tailed Eagles for four of these wind farms where intensive carcass searching was subsequently undertaken and for which results are publicly available. They are Bluff Point, Studland Bay, Musselroe and Yaloak South wind farms. At the first three of these, White-bellied Sea-eagles were also resident and modelling was also provided for that species and mortality results for it are also published. We consider it is likely that the factors that make the

Wedge-tailed Eagle particularly suitable for use in validation of the model apply equally to the White-bellied Sea-eagle and the following case examples provide details for both species.

Eagle flight activity data was collected by Biosis prior to wind farm construction at Bluff Point, Studland Bay and Musselroe wind farms. At Yaloak South Wind Farm, eagle flight activity data was collected by others during 2006. Biosis collected additional data in 2009 and 2010. In all cases Biosis prepared the collision risk modelling. Carcass searches during the operation of the wind farms were undertaken by other parties in all cases.

Data for the results of carcass searches for eagles were provided by wind farm operators and/or consultant reports prepared by those parties.

Bluff Point and Studland Bay wind farms

Substantial investigations of the Tasmanian subspecies of Wedge-tailed Eagle *Aquila audax fleayi* and White-bellied Sea-eagle have been undertaken at Bluff Point and Studland Bay Wind Farms operated by Woolnorth Renewables in north-western Tasmania. These included utilisation surveys designed to measure eagle activity before and after development of the wind farm; collision carcass monitoring; eagle breeding success; and eagle behaviours and movements relative to turbines. Details of design and outcomes of these are provided in annual environmental performance reports prepared by Woolnorth Renewables and its predecessors. Hull et al. (2013) detail a specific study of eagle behaviour during early years of the operation of the two wind farms. Commissioning of turbines began at Bluff Point Wind Farm in 2002 and at Studland Bay Wind Farm in 2007. Bluff Point Wind Farm consists of 37 Vestas V66 turbines in a scattered array on an area of 1,524 ha. Studland Bay Wind Farm is situated 3 km south of Bluff Point and comprises 25 Vesta V90 turbines in a scattered array over an area of 1,410 ha. Both wind farms are close to the coast and both species are resident at both sites.

Monitoring eagle flights

Flight activity data for both species were collected during 20-minute point counts at Bluff Point Wind Farm site during three years prior to construction of turbines and in four years after they commenced operating. At Studland Bay, they were collected in six years prior to turbine construction and in three years after turbines commenced operation. As prescribed by regulatory authorities, point counts were undertaken in autumn and spring. Ten replicate point counts were made in each season at each of 18 locations within each wind farm. There were 545 point counts undertaken at Bluff Point between 1999 and 2007 and 854 point counts at Studland Bay between 1999 and 2009.

Collision risk model results

The model was used to estimate risk for populations of six Wedge-tailed Eagles and four White-bellied Sea-eagles at each of the two wind farms.

State regulatory authorities required that the collision risk model be re-run with the accumulated sum of eagle movement data obtained during the entire period of both pre-construction and operation of the two of the two wind farms spanning the period from 1999 to 2009 (Table 1). As the numbers of eagles using the sites were not apparently affected, it was reasonable to pool the data from both periods. Static avoidance was modelled at a rate of 0.99 in all cases and dynamic avoidance at 0.90; 0.95; 0.98 and 0.99 (Biosis Research 2008, 2010; Smales et al. 2013). The model results are shown in Table 1.

Table 1. Modelled mean annual turbine collision estimates for White-bellied Sea-eagle and Wedge-tailed Eagle at Bluff Point and Studland Bay Wind Farms for four avoidance rates.

	White-bellied Sea-eagle		Wedge-tailed Eagle	
Avoidance rate	Bluff Point	Studland Bay	Bluff Point	Studland Bay
0.90	0.9	0.8	2.7	1.9
0.95	0.5	0.4	1.5	1.1
0.98	0.2	0.2	0.7	0.5
0.99	0.1	0.1	0.4	0.3

Documented eagle collisions

Carcass monitoring surveys were conducted at Bluff Point and Studland Bay wind farms from when they commenced operating. Fences to exclude mammalian scavengers were maintained at 27% of turbines across the two sites. All turbines, both fenced and unfenced, were searched routinely within a 100 m radius of the tower base. Red Fox does not occur in Tasmania but native mammals with capacity to scavenge eagle carcasses include the Tasmanian Devil *Sarcophilus harrisi* and Spot-tailed Quoll *Dasyurus maculatus*. The region of the wind farms is an area where facial tumour disease has had little impact on the Tasmanian Devil population.

The frequency of carcass searches was informed by trials to determine rates of loss to scavengers and of observers' capacity to detect carcasses. From 2007, searches were carried out twice weekly during periods that may have represented higher risk to the species (i.e. eagle courtship display period June – August, inclusive, and eagle fledging period mid December – February, inclusive) and fortnightly outside these periods (Hull et al. 2013). Carcass searches were undertaken by human observers. Searches were carried out at Bluff Point in eleven years (2003 – 2013, inclusive) and at Studland Bay they were carried out in seven years (2007 - 2013, inclusive).

Assessment of the extent of undetected eagle collisions (Woolnorth Wind Farm Holding 2013) concluded that it is unlikely that significant numbers of eagle carcasses were missed because they are conspicuous; the search zone around turbines was adequate to detect eagle carcasses where they fell after colliding with turbines (Hull and Muir 2010); personnel on site had capacity to detect carcasses that may have been moved from formal search zones; eagle carcasses in vegetation were found not to decompose readily and,

even when scavenged, remains were identifiable; and, while mammalian scavengers could remove carcasses this was controlled at the subset of fenced turbines; survey intensity was informed by predetermined scavenger removal rates; and, while a small number of eagles survived collision with a turbine, in all documented cases such birds were unable to fly and are likely to have been detected as both scavenger exclusion or farm fences prevented them from leaving the immediate area. The empirical results of eagle carcass persistence trials recently provided by Elmoby Ecology Bennett (2021) corroborate the conclusions of Hydro Tasmania (2013) and Hull et al. (2013).

Table 2 shows the numbers of carcasses of the two species detected at the two sites for each year of monitoring.

Table 2. Numbers of collision mortalities of two species of eagle detected during targeted searches at Bluff Point and Studland Bay Wind Farms.

	Bluff Point		Studland Bay	
Year	White-bellied Sea-eagle	Wedge-tailed Eagle	White-bellied Sea-eagle	Wedge-tailed Eagle
2003	0	1		
2004	0	0		
2005	0	0		
2006	0	6		
2007	0	1	0	3
2008	1	3	0	1
2009	1	1	0	0
2010	0	1	0	1
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
total	2	13	0	5

Mean annual mortality rates and associated 95% confidence intervals for both species at the two wind farms are shown in Table 3.

Table 3. Mean annual mortality rates and variance for eagle species based on carcasses detected at Bluff Point and Studland Bay wind farms.

	White-bellied Sea-eagle		Wedge-tailed Eagle	
Year	Bluff Point	Studland Bay	Bluff Point	Studland Bay
mean annual mortalities	0.18	0.00	1.18	0.71
annual variance (95% C.I.)	0.01-0.41	-	0.15-2.22	0.00-1.48

Comparison of collision risk model estimates with actual mortality rates

Estimates of annual collisions modelled for avoidance rates between 0.90 and 0.99 correctly encompassed the long-term average of real collisions for both species at the two wind farms. The 95% confidence intervals associated with the average real collision rates were entirely encompassed by the model's estimates.

Comparison of the model's projections (Table 1) with the annual average documented collision rates (Table 3) indicate the following:

- For White-bellied Sea-eagle at Bluff Point the annual average of actual mortalities (0.18) is slightly lower than the model's projections for an avoidance rate of 0.98 (0.2 collisions p.a.)
- No White-bellied Sea-eagle collisions were recorded during five years of monitoring at Studland Bay so the model's estimates are higher than actual experience for that species there.
- For Wedge-tailed Eagle at Bluff Point the annual average of actual mortalities (1.18) is between the model's projections for an avoidance rate of 0.95 and 0.98 (1.5 – 0.7 collisions p.a.) and most closely approximates an avoidance rate of 0.96.
- For Wedge-tailed Eagle at Studland Bay the annual average of actual mortalities (0.71) is between the model's projections for an avoidance rate of 0.95 and 0.98 (1.1 – 0.5 collisions p.a.) and most closely approximates an avoidance rate of 0.97.

Hull and Muir (2013) documented turbine avoidance from observations of eagle activity at these two wind farms. They found that White-bellied Sea-eagles showed empirical avoidance rates of 0.89 and 0.97 at Studland Bay and Bluff Point, respectively, and that Wedge-tailed Eagles had empirical avoidance rates of 0.81 and 0.90, at Studland Bay and Bluff Point, respectively. These values are as expected because they indicate that the principal avoidance they documented was meso-avoidance (the rate at which the birds flew within the wind farm but avoided close proximity to turbines). However, as a small number of collisions occurred at the wind farms, it is evident that some eagles did, in fact fly within the rotor-swept zone of turbines. This indicates that in addition to meso-avoidance, a level of micro-avoidance occurs. This additional level of avoidance serves to increase the overall avoidance rate of eagles at the wind farms. It is therefore reasonable to assume that the overall avoidance rates for the two species would be higher than the meso-avoidance rates documented by Hull and Muir (2013).

Musselroe Wind Farm

Substantial investigations have been undertaken at Musselroe Wind Farm operated by Woolnorth Renewables at Cape Portland in north- eastern Tasmania. These have included utilisation surveys designed to measure eagle activity before and after development of the wind farm; collision carcass monitoring; eagle breeding success; eagle behaviours and movements relative to turbines and investigations and trails aimed at reduction of collisions. Details of design and outcomes of these are provided in annual

environmental performance reports prepared by Woolnorth Renewables and its predecessors. Commissioning of turbines began at Musselroe Wind Farm in 2013. The wind farm consists of 56 Vesta V90 turbines in a scattered array. The wind farms is close to the coast and both species are resident at the site.

Monitoring eagle flights

Flight activity data for both species were collected during timed point counts at Musselroe Wind Farm site during three years prior to construction of the wind farm. Data were recorded from nine point count locations during 2002 and then at 19 fixed point count locations, including the original nine sites, during 2005 and 2006.

Collision risk model results

The model was used to estimate risk based on movement data for populations of eight Wedge-tailed Eagles and eight White-bellied Sea-eagles at the wind farm.

Collision risk modelling was undertaken for a number of turbine configurations under consideration in 2011 (Biosis Research 2011). That included the design that was subsequently built and has been operational since 2013. Static avoidance was modelled at a rate of 0.99 in all cases and dynamic avoidance at 0.90; 0.95; 0.98 and 0.99. The model results are shown in Table 4.

Table 4. Modelled mean annual turbine collision estimates for White-bellied Sea-eagle and Wedge-tailed Eagle at Musselroe Wind Farms for four avoidance rates.

Avoidance rate	White-bellied Sea-eagle	Wedge-tailed Eagle
0.90	0.53	2.05
0.95	0.31	1.23
0.98	0.17	0.69
0.99	0.13	0.50

Documented eagle collisions

Carcass monitoring surveys were conducted at Musselroe Wind Farm since it commenced operating. All turbines were searched routinely within a 100 m radius of the tower base. Native mammals with capacity to scavenge eagle carcasses include the Tasmanian Devil and Spot-tailed Quoll. Tasmanian Devils have remained quite prevalent at Musselroe Wind Farm (Driessen et al. 2018).

As required by the State and Commonwealth regulators, the monitoring regime for detecting bird collisions at wind turbines during the period from 2013 to 2017 differed in intensity across the site in line with perceived risk. Six turbines in the north-west of the array were monitored twice weekly during periods that were regarded as high risk for migratory waders (during the portion of the year in which those species are present in Australia and utilised nearby wetlands). Outside these periods and across the rest of the wind

farm, each turbine was searched once every eight weeks, using a regime in which a quarter of the turbines were searched every two weeks (Woolnorth Wind Farm Holding 2014). After it became evident that migratory waders were not materially at risk of turbine collisions, from November 2017 a change to the search regime was approved and from then all turbines have been searched once every eight weeks, using a regime in which a quarter of the turbines were searched every two weeks (Woolnorth Wind Farm Holding 2019). Carcass searches were undertaken by human observers. Searches have been carried out at Musselroe in 10 years (2013 – 2022, inclusive (Woolnorth Renewables 2022).

Assessment of the extent of undetected eagle collisions at Musselroe is outlined in Woolnorth Wind Farm Holding (2016). Searcher efficiency trials and carcass persistence trials were undertaken and results for eagles is reported to have been similar to that at Bluff Point and Studland Bay wind farms where searcher efficiency for large birds was 98%. Carcass persistence trials at Musselroe demonstrate there was an average time to complete disappearance of 80 days with a 95% confidence interval of between 74 and 86 days. As each turbine was surveyed every 8 weeks, these trials indicate that the majority of eagle collision fatality carcasses would have been detectable during at least one or more surveys. Results of the trials indicate there is a high probability that the great majority, if not all, eagle carcasses have been detected.

Table 5 shows the numbers of carcasses of the two species detected at the two sites for each year of monitoring.

Table 5. Numbers of collision mortalities of two species of eagle detected during targeted searches at Musselroe Wind Farm.

Year	White-bellied Sea-eagle	Wedge-tailed Eagle
2013	1	2
2014	0	0
2015	0	4
2016	0	1
2017	0	2
2018	0	2
2019	0	8
2020	0	7
2021	1	0
2022	0	3
total	2	29

Mean annual mortality rates and associated 95% confidence intervals for both species at the two wind farms are shown in Table 6.

Table 6. Mean annual mortality rates and variance for eagle species based on carcasses detected at Musselroe Wind Farm.

Year	White-bellied Sea-eagle	Wedge-tailed Eagle
mean annual mortalities	0.20	2.90
annual variance (95% C.I.)	0.00-0.45	1.30-4.50

Comparison of collision risk model estimates with actual mortality rates

Estimates of annual collisions modelled for avoidance rates between 0.90 and 0.99 correctly encompassed the long-term average of real collisions for White-bellied Sea-eagle at the wind farm. The 95% confidence intervals associated with the average real collision rates were entirely encompassed by the model's estimates for that species.

Comparison of the model's projections (Table 4) with the annual average documented collision rates for White-bellied Sea-eagle (Table 6) indicate that:

- For White-bellied Sea-eagle at Musselroe the model's projections for an avoidance rate of slightly less than 0.98 (0.17 collisions p.a.) closely approximates the annual average of actual mortalities (0.20).

The model's estimates of annual collisions for Wedge-tailed Eagle at avoidance rates between 0.90 and 0.99 were a little lower than the mean annual number of collisions that occurred.

Comparison of the model's projections (Table 1) with the annual average documented collision rates for Wedge-tailed Eagle (Table 3) indicate that:

- At Musselroe the model's projections for an avoidance rate of 0.90 (2.05 collisions p.a.) was lower than the annual average of actual mortalities (2.90).

While the model's forecasts are lower than the annual average of actual mortalities known to have occurred, they are still close to that value. As noted above, annual averages of fatalities are prone to significant influence of inter-annual variability. In the case of Wedge-tailed Eagles at Musselroe, there were eight years in which mortalities detected were between 0 and 4 and two years in which there were 7 and 8 known mortalities. It is not known whether this degree of variation may continue over the life of the wind farm, but it remains plausible that the model's projections will encompass the annual average of actual mortalities over that timespan.

Yaloak South Wind Farm

Yaloak South Wind Farm is operated by Pacific Hydro Pty Ltd near Ballan in western Victoria. The wind farm consists of 14 Senvion MM92 turbines in a scattered array. The wind farm property and immediate vicinity have a high degree of topographic variability including a significant escarpment associated with the Parwan

Valley. The wind farm is situated on the plateau above the escarpment. The local area is attractive to Wedge-tailed Eagles as its topography creates thermal uplift for soaring and local land uses provide substantial food resources. Studies of the species there have included utilisation surveys designed to measure eagle activity before and after development of the wind farm; collision carcass monitoring; eagle breeding success; eagle behaviours and the most comprehensive and long-term investigations of eagle carcass persistence and searcher efficiency undertaken in Australia. Details of design and outcomes of these are provided in reports prepared by consultants for Pacific Hydro (Biosis 2019; Elmoby Ecology Bennett 2019, 2020, 2021). The wind farm reached practical completion in 2018 and a three-year post-construction program of monitoring of eagles commenced in July 2018.

Monitoring eagle flights

Flight activity data for Wedge-tailed Eagles were obtained during point counts undertaken during 2006 and between July 2009 and March 2010. Ten point count locations were used for a total of 543 x 20-minute counts.

Collision risk model results

The model was used to estimate risk based on movement data for a Wedge-tailed Eagle population in which an average of six birds using the site for 90% of the year and fifteen birds using the site for 10% of the year. These values were agreed to by State regulators prior to final modelling undertaken as part of environmental assessment of the proposed wind farm.

Static avoidance was modelled at a rate of 0.99 in all cases and dynamic avoidance at 0.90; 0.95; 0.98, 0.99 and 0.998. The model results are shown in Table 7.

Table 7. Modelled mean annual turbine collision estimates for Wedge-tailed Eagle at Yaloak South Wind Farms for five avoidance rates.

Avoidance rate	6 Wedge-tailed Eagles (90% of year)	15 Wedge-tailed Eagles (10% of year)	Combined annual total collisions
0.90	4.4	0.9	5.3
0.95	3.2	0.5	3.7
0.98	2.0	0.3	2.3
0.99	1.5	0.2	1.7
0.998	0.3	0.0	0.3

Documented eagle collisions

Carcass monitoring surveys were conducted at Yaloak South Wind Farm since it commenced operating. All turbines were searched routinely to cover a horizontal radius of 60 metres centered on the base of the

turbine tower. On the basis of analyses of Huso and Dalthorp (2014) this search zone was selected to encompass more than 95% of collision carcasses for the dimensions of turbines at the wind farm.

As required by State regulators, the monitoring regime for detecting bird collisions at wind turbines differed in frequency over time in response to the findings of preceding search periods. Carcass surveys were conducted by trained detection dogs and their handlers weekly between July 2018 and June 2019, fortnightly between June 2019 and December 2019 and monthly from January 2019 to June 2021, inclusive, at all 14 turbines. Additional 'pulse' surveys were conducted between November and May in each of the three years of the program for the detection of bats, but also documented all birds found. A total of 1355 surveys were undertaken at the 14 turbines over the three-year period.

Overall, searches were carried out at Yaloak South in three years (from July 2018 – June 2021, inclusive (Elmoby Ecology Bennet 2021).

As discussed previously, investigations at Yaloak South included study of bird carcass persistence and searcher efficiency (Elmoby Ecology Bennett 2019; 2020; 2021), with a specific focus on Wedge-tailed Eagles and was the first substantial investigation using eagle carcasses in Australia. The study found that Wedge-tailed Eagle carcasses had a mean persistence time of 260 days with a 95% confidence interval of between 119 and 567 days, whereas for all small and medium-sized birds (including some small raptors) mean persistence time was 2.8 days with a 95% confidence interval of between 2 and 4 days. The Elmoby Ecology Bennett reports conclude that there was a high level of confidence that all Wedge-tailed Eagles killed by collision with wind turbines were found and thus that the number of eagles detected was highly likely to reflect the total of collisions by the species.

Table 8 shows the numbers of Wedge-tailed Eagle carcasses detected at the site for each year of monitoring.

Table 8. Numbers of collision mortalities of Wedge-tailed Eagles detected during targeted searches at Yaloak South Wind Farm.

Year	Wedge-tailed Eagle
2018/19	4
2019/20	3
2020/21	4
total	11

The mean annual mortality rate and associated 95% confidence intervals for the species at Yaloak South Wind Farm is shown in Table 9.

Table 9. Mean annual mortality rate and variance for Wedge-tailed Eagle based on carcasses detected at Yaloak South Wind Farm.

Year	Wedge-tailed Eagle
mean annual mortalities	3.62
annual variance (95% C.I.)	0.04-7.29

Comparison of collision risk model estimates with actual mortality rates

Estimates of annual collisions modelled for avoidance rates between 0.90 and 0.998 correctly encompassed the long-term average of real collisions for Wedge-tailed Eagle at the wind farm. The 95% confidence intervals associated with the average real collision rates were largely encompassed by the model's estimates for the species.

Comparison of the model's projections (Table 7) with the annual average documented collision rates for Wedge-tailed Eagle (Table 9) indicate that:

- The model's projections for an avoidance rate of 0.95 (3.7 collisions p.a.) closely approximates the annual average of actual mortalities (3.62).

Conclusion

The Biosis collision risk model has provided forecasts of the annual average numbers of turbine collisions by Wedge-tailed Eagle and White-bellied Sea-eagle. Comparison of the forecasts with data for known and estimated total collisions from targeted carcass searches at four operational wind farms indicate that results of the model for the range of avoidance rates reported were accurate and in every case the forecasts were precise to within less than one Wedge-tailed Eagle collision per annum and were more accurate for White-bellied Sea-eagles.

It is not feasible to make similar comparisons for the great majority of bird species that may interact with wind turbines in Australia due to a high degree of uncertainty about the true numbers of collisions that occur. The factors influencing uncertainty are outlined in *Pre-requisites to validation*, above. Careful and refined design of carcass search regimes, such as standard use of pulse searches, and the application of appropriate, specific mathematical methods to the estimation of total collisions (e.g. Huso et al. 2017) should be used in efforts to reduce such uncertainties.

In 2006 the then Australian Government Department of the Environment and Heritage published reports by Biosis Research (2006) that provided methodologies for assessment of cumulative impacts due to turbine collisions of multiple wind energy facilities. Four species of birds, including the Tasmanian Wedge-tailed Eagle were used as examples of how this could work. That work was not prepared for, and was not used for, environmental impact assessment of any project. The exercise was undertaken for many wind

farms, including a significant number that were then mooted but have not since been carried to fruition and are no longer proposed. Some of the wind farms that have since been built differ from the designs that were then proposed. The reports noted the heuristic value of mathematical modelling. At the time of preparation of that work there was almost no empirical information about actual collisions by Wedge-tailed Eagles. The report said that it was likely that avoidance rates for Tasmanian Wedge-tailed Eagle would generally be in the range of 0.95 to 1.00 in most conditions. Then available information for the closely related Golden Eagle *Aquila chrysaetos* was cited that suggested an avoidance rate of greater than 0.99. At the request of the Department of the Environment and Heritage, the report provided modelling for avoidance rates of 0.95, 0.98 and 0.99, but also noted, "we recommend that [avoidance rate] is a key area requiring further soundly based investigation within operational wind farms." The case studies detailed above have used collision risk modelling that was prepared specifically for wind farms as designed and subsequently approved and now in operation. The comparisons with documented eagle collisions have achieved the recommendation of the 2006 Biosis Research report.

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Wind Energy and Wildlife Conservation

A Description of the Biosis Model to Assess Risk of Bird Collisions With Wind Turbines

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ABSTRACT We describe the model of Biosis Propriety Limited for quantifying potential risk to birds of collisions with wind turbines. The description follows the sequence of the model's processes from input parameters, through modules of the model itself. Aspects of the model that differentiate it from similar models are the primary focus of the description. These include its capacity to evaluate risk for multi-directional flights by its calculation of a mean presented area of a turbine; its use of bird flight data to determine annual flux of movements; a mathematical solution to a typical number of turbines that might be encountered in a given bird flight; capacity to assess wind-farm configurations ranging from turbines scattered in the landscape to linear rows of turbines; and the option of assigning different avoidance rates to structural elements of turbines that pose more or less risk. We also integrate estimates of the population of birds at risk with data for numbers of their flights to predict a number of individual birds that are at risk of collision. Our model has been widely applied in assessments of potential wind-energy developments in Australia. We provide a case history of the model's application to 2 eagle species and its performance relative to empirical experience of collisions by those species. © 2013 The Wildlife Society.

KEY WORDS bird, collision, model, risk, turbine, wind energy.

A number of mathematical models have been developed for the purposes of either describing the interaction of a bird with a wind turbine or to predict the risks of bird collisions with turbines (Tucker 1996*a*, *b*; Podolsky 2003, 2005; Bolker et al. 2006; Band et al. 2007). Tucker (1996*a*, *b*) and Band et al. (2007) detailed their models in the peer-reviewed literature. The collision risk model developed by Biosis Propriety Limited has been widely used to assess wind-energy developments in Australia since 2002, but it has not previously been described in detail. Given high levels of interest in effects of wind turbines on fauna, we believe it is important for the model to be accessible.

Our model provides a predicted number of collisions between turbines and a local or migrating population of birds. It has the potential to be modified to accommodate Monte-Carlo simulation, although at its core it uses a deterministic approach. It is modular by design, and allows various customizations, depending upon the unique configuration of the wind facility and characteristics of the taxa modeled.

The initial calculation involves species-specific parameters for speed and size of birds and specifications of the turbine, including its dimensions and rotational speed of its blades. Using these parameters, we derive the mean area of turbine presented to a bird in flight. This allows the model to accommodate flight approaches from any potential direction. Alternatively, unidirectional flights can be modeled by using the relevant turbine surface area presented to birds approaching from a given direction.

Data for bird flights are collected at the wind-farm site according to a specific and consistent field methodology. These data are used to determine the flux (density) of bird flights. When combined with turbine specifications, this yields the probability of collision during a single flight–turbine interaction. The density flux approach has not been used for this application previously.

The number of movements at risk of collision with one turbine is then scaled according to a typical number of turbines that a bird might encounter in a given flight. This is further refined by a metric for the capacity of the particular species to avoid collisions. Where a population census or estimate is available for the number of birds that may be at risk, a further deduction is used to attribute the number of flights-at-risk to individuals, and hence provide a final model output as the number of individuals at risk of collisions. The ability to transform from flights-at-risk to individuals-at-risk has been uniquely developed and applied as a routine component of our model.

DESCRIPTION OF THE MODEL

The model requires data for input parameters and, using these, functions in a sequence of modules (Fig. 1).

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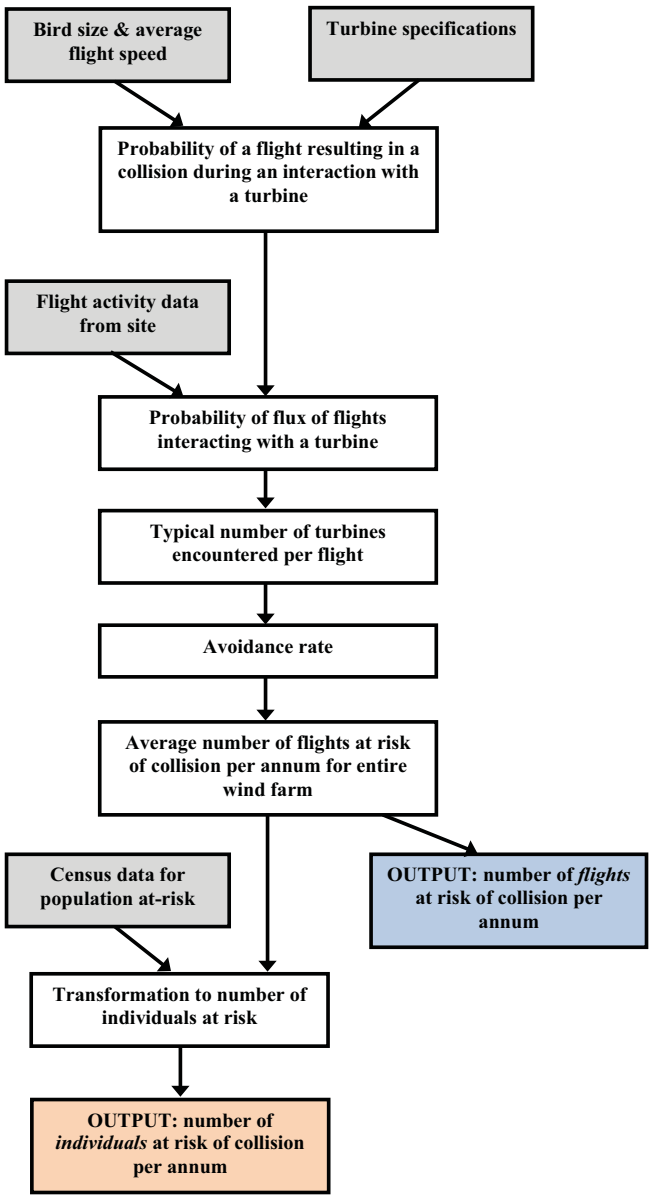


Figure 1. Overview of the collision risk model that quantifies risk to birds of colliding with wind turbines, showing input parameters (gray boxes), modules, and sequence.

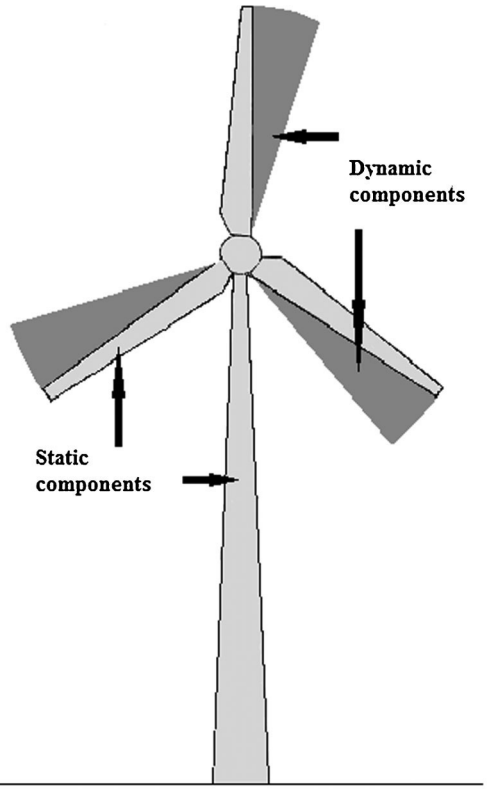


Figure 2. Schematic indication of the static and dynamic components of a wind turbine that may be encountered by a flying bird. The dynamic component is the area swept by rotor blades during the time that a bird of a particular species would take to pass through the rotor-swept zone.

Model Inputs

Turbine parameters.—The primary risk faced by a flying bird, whether it may strike or be struck by a turbine, is that the machine presents a potential obstacle in its path. Ultimately this equates to the surface area of the turbine presented to the bird from whatever its angle of approach. Other models, such as probably Band et al. (2007), use individualistic representations of birds. Our model uses a projection of the presented area onto all possible flight angles. For this reason, multiple dimensions of turbine components and rotor speed for the particular type of turbine are used as input values to the risk model. Turbine specifications are as provided by the machine's manufacturer.

The modeled wind turbine consists of 2 fundamental components representing potentially different risks. We refer to these as the static and dynamic components (Fig. 2). The static areas of a turbine include all surfaces of the entire machine comprising a tower, which in current turbines is a simple taper with known base and top diameters; a rectangular nacelle housing the generator; a hemi-spherical hub; and rotor blades that taper in 2 planes. The dynamic component is the area swept by the leading edges of rotor blades during the time that a bird would take to pass through the rotor-swept zone.

Size and flight speed of birds.—For each taxon, the model requires values for the total length of the bird in flight, from bill tip to tip of the tail or outstretched legs, and the average speed of the species' flights. We obtained bird lengths either from museum specimens or from standard ornithological texts.

Accurate determinations of bird flight speeds can be complex and difficult to obtain (Videler 2005, Pennycuick 2008) and published data are not available for most species. However, published radar studies (e.g., Bruderer 1995, Bruderer and Boldt 2001) provide ranges of flight speeds for a variety of species, including congenerics with similar morphologies and ecological traits to a number of species we have assessed. Use of radar to collect bird flight data at the wind-farm site may provide flight speeds for species of interest. We consider that average ground speed (as opposed to air speed) is appropriate for modeling of multidirectional movements of birds.

Bird flight data.—The model requires data from the wind-farm site for the number of flights made by species of interest within a measured time and volume of airspace. Movement data may be obtained from fixed-time point counts using a methodology adapted from Reynolds et al. (1980), incorporating an effective detection range (Buckland et al. 1993). It may be collected by human observers or by using horizontal and vertical radar combined with call recording or visual species identification (e.g., Gauthreaux and Belser 2003, Desholm et al. 2006). Data represent the number of flights that birds make within a cylinder of airspace that is centered horizontally on the observer and the height of which is the maximum reached by rotor blades of the turbines. The data collection regime is designed with the aim of providing a representative sample of flight activity across the local range of diel, seasonal, and other environmental variables.

Model Modules

Probability of a single flight interacting with a turbine.—In some situations, such as during highly directional migratory passage, the presented area of turbines is determined from the angle of the birds' flight relative to the compass orientation of turbines. However, for the great majority of species (including temporary or permanent residents at an on-shore wind farm) this does not apply, and flights can be expected to approach turbines from any direction. For this situation, all dimensions of the turbine contribute to the area with which a flying bird might collide and the model uses a simple integration to determine a mean presented area. This represents a substantial advance over other collision risk models that depend on the assumption of a specific angle of approach as a bird encounters a turbine (e.g., Tucker 1996*a*, *b*; Bolker et al. 2006; Band et al. 2007).

We calculate the area presented by the static components of a turbine using a conservative assumption that none of them overlap or obscure any others. The area of each component is calculated individually, and these are then summed to determine a total static area for the turbine. Static areas are calculated from the simple length × width dimensions of all components visible by line of sight. These are then projected onto an arbitrary approach direction (effectively scaling by the cosine of the approach angle). For example, viewed directly from one side, only the side panel of the nacelle is visible. However, approached from 45° to the turbine, both the front and side panels are visible, and are thus scaled by $\cos(45) \varrho 1/\sqrt{2}$ to match that particular angle of view.

We calculate the dynamic area, swept during the movement of blades, from the dimensions of the stationary blades and the distance they travel at their average speed during the time taken by a bird to fly through the rotor-swept area. We assume that all flights involve forward movement, so the swept-area is derived from the length and speed of the particular species of bird, in combination with the thickness of the sweeping blade.

Each rotor blade is tapered in 2 planes. Thus the thickness of the blades, used to determine the time taken for a bird to cross through the swept area, is actually a function of the point in the rotor radius at which an individual bird's flight intersects the swept area. This presents a complication that we overcome by defining an effective blade, which is a simple rectangular cross-section that sweeps out precisely the same volume of space as the physical blade. In doing so, we calculate a constant thickness of blade that accounts for the fact that the thinner tips actually sweep far more space than the thicker base of the blade. This ensures also that our flux calculation is not compromised by introduction of a spatial variation at odds with other aspects of the model.

A further input parameter is the percentage of time per annum when rotors are not turning due to inappropriate wind speeds and routine turbine maintenance. Prior to commissioning of a wind farm, wind speed data are usually gathered and the expected percentage of downtime due to inappropriate wind speeds is determined. During downtime periods the rotor simply stops turning; and so risks associated with dynamic components only are reduced by this percentage of time, while all static components of the turbine remain as potential obstacles to flying birds.

Combining all presented areas of the turbine.—Modeling for multidirectional bird movements requires no dependence on approach angles nor on complexities of interactions between flight direction and wind direction. We thus reduce the turbine to its mean presented area. This is solved by the equation

$$\frac{1}{\pi}\int_0^{\pi} A(\theta)\,\mathrm{d}\theta$$

where A is the presented area of the turbine as a function of approach angle θ. We solve this numerically using a trapezoidal integrator (Press et al. 1992).

Probability of multiple flights interacting with a turbine.—Because counts of bird flights have been made across the wind-farm site and there is no obligatory relationship between point-count locations and particular sites proposed for turbines, we combine the data collected from all point counts. This provides a measure of flight activity, which is assumed to be constant across the site. Thus the field data reduce to a single ratio value for the subject species, which is the sum of all flights documented during all counts divided by the total time of observations. This equates to a maximum likelihood estimation of the mean of an assumed Poisson distribution.

To calculate a number of flights at risk of collision, we first reduce documented bird movements (M) to a measure of flux (F) using the equation

$$F = \frac{M}{T_{\mathrm{obs}} A_{\mathrm{obs}}}$$

where T_{obs} is the combined total time of all point counts and A_{obs} is the area of the vertical plane dissecting the observation cylinder. This flux is a measure of bird movements per time per square meter of vertical airspace. The third dimension, volume of airspace, is redundant (or tacit) due to the

assumption that, unless involved in a collision, flight paths do not end arbitrarily in space.

We next multiply activity measure by the number of minutes in which the species is active during the 24-hour diel period, T, and the total presented area of the turbine, A. For year-round resident species, the "active minutes" are calculated for the entire year, while for seasonal or migratory species, they are calculated for the portion of the year that the species is present at the site. This then gives a measure of risk to the bird movements, $M_{\text{risk}} = \text{FTA}$.

Because the flight data are a measure of movements by the species in question and do not discriminate the number of individuals making the movements, the measure (M_{risk}) quantifies the total movements-at-risk for the species and does not reflect risk to individual birds.

To determine a risk rate from total of recorded movements-at-risk, it is necessary to extrapolate to a total number of expected bird movements per annum, M_{yearly}. We calculate this from the flight data, extrapolating the movements to a yearly total through the equation

$$M_{\text{yearly}} = M \frac{T_{\text{yearly}}}{T_{\text{obs}}}$$

We then deduce a probability of flights at risk of collision as $M_{\text{risk}}/M_{\text{yearly}}$. Note that T_{year} is the total time in a year, and not the diel activity period of the species, which has already been factored into the calculation of movements at risk.

The resultant value is now a probability of flights being at risk of collision with a single turbine. To this point, no account is taken of the bird's own ability to avert a collision. This is modified later through use of an avoidance factor.

Estimating number of turbines encountered per flight.—Every turbine is presumed to represent some risk for birds, so the total number of turbines proposed for the wind farm is an input to the model. Turbine layout of modern wind farms is primarily determined by the wind resource and turbines are micro-sited accordingly. Consequently, the machines are usually scattered on the landscape. Older wind farms had turbines arrayed in rows, and occasional modern facilities may be linear where they follow a single topographic feature.

To account for the number of turbines with which a single flight might interact, it would be necessary either to know precisely the route of every flight or to make informed assumptions about flight paths. The manner in which turbines are arrayed in the landscape is important to ascertain a typical number of turbines that a bird might encounter in a given flight. This number differs according to whether turbines are in a scattered array or a single row, and these require different calculations.

For a row of turbines, the likely number of encounters can be visualized by considering a row of N turbines in plan view and a flight path at angle Φ to the row. A flight directly along the line of turbines (Φ') will interact with all N turbines. As the angle of flight relative to the row increases toward 90°, flight paths have potential to interact with fewer turbines until an angle (Φ'') is reached at which the path has potential to interact with a maximum of one turbine.

For a single row of turbines, we define the piecewise smooth function, which gives the number of turbines for a given angle of crossing with,

$$n_{\text{interaction}} = \begin{cases} N, & \text{if } \theta \le \phi\prime \\ \cot(\theta), & \text{if } \phi' < \theta \le \phi'' \\ 1, & \text{if } \phi'' < \theta \le \frac{\pi}{2} \end{cases}$$

This gives us an expected number of interactions as

$$\langle n_{\text{interaction}} \rangle = \frac{2}{\pi} \left[N \arctan\left(\frac{1}{N}\right) + \frac{\pi}{4} - \ln\left(\sqrt{2}\sin\left(\arctan\left(\frac{1}{N}\right)\right)\right)\right]$$

For scattered turbine arrays it is not realistic to assume that a bird will encounter all turbines in the wind farm in a given flight. We assume each flight has potential to cross between any 2 points on the outer edges of the farm. Given the size of most on-shore wind farms, this is a reasonable assumption for typical species of concern, such as raptors. When multiple flight paths are drawn randomly across the plan view of a wind farm, some paths may be circuitous and have potential to encounter many turbines, while others will pass through a small portion of the site and have potential to encounter relatively few turbines.

To deduce an average number of turbines likely to be encountered by any flight we use a topological, non-affine mapping technique. This spatial transformation can be illustrated as follows: if we were to throw a lasso around the perimeter of the site and shorten it to its minimum, we would find that all the turbines had collected in a circle. A straight flight path through this "lassoed" site is mathematically equivalent to a random walk across the unconstrained layout. The average of all flight paths crossing the center of this remapped farm will intersect with $\sqrt{N}$ turbines (where N is the total no. of turbines in the wind farm). This value is used in the model for the number of turbines that might be encountered per flight within a scattered turbine array.

For arrays that are neither entirely scattered nor linear, the model employs a simple weighted average of the values for fully scattered and entirely linear arrays.

Application of turbine avoidance capacity.—Birds have substantial ability to avoid obstacles; therefore, it is necessary to incorporate this capacity into the model. In common with other workers (Percival et al. 1999), we use "avoidance" in specific reference to behavior on the part of a bird that averts a potential collision with a turbine. The "avoidance rate" equates to the proportion of flights that might otherwise have involved interaction with a turbine but where the bird alters course and the flight does not result in a collision. For the purposes of the model it is of no consequence whether or not this is a result of a cognitive response by the bird to the presence of the turbine.

Turbine avoidance remains little-studied for any species, and empirical information about actual avoidance can be obtained for a given site only by studying the responses of birds in the presence of operational turbines (Chamberlain et al. 2006). One recent investigation has compared flight behaviors of 2 species of eagles in the presence of turbines at

2 operating wind farms with their behaviors at a site without turbines (Hull and Muir 2013).

Avoidance rate is incorporated into the model by scaling the movements at risk by $(1 - v)$, where v is a measure of the bird's ability to avoid objects. In this scenario, $v = 0$ corresponds to a blind, non-responsive projectile, and $v = 1$ represents a perfectly responsive bird able to avoid any object.

A novel feature of our model is its capacity to apply different avoidance values to the static and dynamic portions of a turbine. As noted by Martin (2011), birds are known to collide with both stationary and moving parts of turbines. This aspect of our model allows for differences in capacity of birds to detect and avoid the large, static components of modern turbines relative to their capacity to detect and avoid the small and fast-moving leading edges of rotor blades.

Size of population at risk.—When information about the size of the population at-risk is available, this can be factored directly into our model to provide results in the form of an expected number of individuals at risk of collision per annum. This is an important consideration because an input measured in terms of bird movements cannot provide an output in terms of individual birds. This aspect appears to have been largely overlooked by other workers, although Chamberlain et al. (2006) alluded to the use of a number of flights only, without incorporation of the number of individuals, as a potential issue in evaluation of collision estimates provided by the Band model (Band et al. 2007).

To deduce a predicted number of individual birds that are at risk of collision, a valid estimate is required of the number of individuals that may interact with turbines at the wind farm in the course of a year. If it is not feasible to obtain this for a species, then the output of the collision risk model will necessarily be the number of flights-at-risk per annum. Although this metric is not predictive of the number of individuals that might collide, it permits risk to be compared for various designs of a wind farm or between one facility and another. In rare cases, such as where there is a single migration passage through the site per annum, the number of movements may equate with the number of individual birds that are at risk. The great majority of risk modeling we have undertaken has been for raptors that are year-round residents. Due to their territoriality and relatively low densities, our studies at wind-farm sites have been able to ascertain the number of individuals using a site per annum, including both resident adults and juveniles, with a high level of confidence. For some other species, such as cranes (Gruidae), we have undertaken home-range studies to determine numbers present during the breeding season, and we have obtained local census data to estimate numbers of individuals that might encounter turbines during non-breeding seasons.

Given a population estimate, the number of flights at risk is attributed equally to the relevant number of individuals through the simple relation $M_{\text{individuals}} = \text{Yearly Movements}/\text{Population}$. We can then attribute individual mortality through

$$\text{mortality} = \text{Population}\left(1 - \frac{\text{Movements At Risk}}{\text{Yearly Movements}}\right)^{M_{\text{individuals}}}$$

MODEL VALIDATION

The model we describe here has been used to assess potential turbine collision risk for numerous species of birds for 23 commercial-scale wind farms proposed in Australia and one in Fiji. Eleven of these facilities have subsequently been built and are now operational. The model's projections have been used by regulatory authorities in determination of approval or modification to wind-farm designs for a range of species of concern. These include taxa as diverse as the orange-bellied parrot (*Neophema chrysogaster*), wedge-tailed eagle (*Aquila audax*), brolga (*Grus rubicunda*), and the large and readily observable Pacific fruit-bat (*Pteropus tonganus*) in Fiji.

The model's performance can be validated only when it can be compared with post-construction mortality data that are sufficient to permit calculation of an actual annual mortality rate and a 95% confidence interval for that rate. Conditions of regulatory approval for most wind farms that have been built to-date in Australia have varied considerably between state jurisdictions and over time. Generally they have not required rigorous investigation or public reporting of avian collisions that occur during operation. We have thus had limited opportunity to validate our model against empirical information for actual collisions. However, where these are available, we can compare the model's predicted average estimates with the measured confidence interval for actual mortalities to assess its predictive capacity. We present one such case study below.

Comparing the Model's Predictions With Empirical Data—A Case History

Substantial investigations have been undertaken at Bluff Point and Studland Bay wind farms in northwestern Tasmania entailing a number of studies of wedge-tailed eagle and white-bellied sea-eagle (*Haliaeetus leucogaster*). These have included utilization surveys designed to measure eagle activity before and after development of the wind farm; collision monitoring; eagle breeding success; eagle behaviors and movements relative to turbines and observers; and investigations and trials aimed at reduction of collisions (Hull et al. 2013). Commissioning of turbines began at Bluff Point Wind Farm in 2002 and at Studland Bay Wind Farm in 2007. Bluff Point Wind Farm consisted of 37 Vestas V66 turbines in a scattered array on an area of 1,524 ha. Studland Bay Wind Farm was situated 3 km south of Bluff Point and comprised 25 Vesta V90 turbines in a scattered array over an area of 1,410 ha. Both wind farms were close to the coast of northwestern Tasmania and resident white-bellied sea-eagles and Tasmanian subspecies of wedge-tailed eagle (*A. a. fleayi*) occurred at both sites.

Monitoring Eagle Flights

Movement data for both species were collected during point counts at Bluff Point Wind Farm site in 3 years prior to construction of turbines and in 4 years after they commenced operating. At Studland Bay, they were collected in 6 years prior to turbine construction and in 3 years after turbines commenced operation. As prescribed by regulatory authorities, point counts were undertaken in the austral autumn and spring. Ten replicate point counts were made in each season

at 18 locations per wind farm. There were 545 point counts undertaken at Bluff Point between 1999 and 2007 and 854 point counts at Studland Bay between 1999 and 2009.

Collision Risk Model Results

We used the model to estimate risk based on movement data collected prior to construction for populations of 6 wedge-tailed eagles and 4 white-bellied sea-eagles at-risk per annum at each of the 2 wind farms.

State regulatory authorities have required that the collision risk model be re-run with the accumulated sum of eagle movement data obtained during the entire period of both pre-construction and operation of the 2 wind farms spanning the period from 1999 to 2009 (Table 1). We modeled static avoidance rate at 99% in all cases.

Documented Eagle Collisions

Carcass monitoring surveys were conducted at the Bluff Point and Studland Bay wind farms since they commenced operating. Fences to exclude mammalian scavengers were maintained at 27% of turbines across the 2 sites. All turbines, both fenced and unfenced, were searched routinely within a 100-m radius of the tower base. Search frequency was initially informed by trials to determine rates of loss to scavengers and of observers' capacity to detect carcasses. Since 2007, searches were carried out twice weekly during periods that may have represented higher risk to the species (i.e., eagle display period Jun–Aug, inclusive; and eagle fledging period mid-Dec–Feb, inclusive) and fortnightly outside these periods (Hull et al. 2013). Assessment of the extent of undetected eagle collisions (Hydro Tasmania 2012; Hull et al. 2013) concluded that it is unlikely that significant numbers of eagle carcasses were missed because they are conspicuous; the search zone around turbines was adequate to detect eagle carcasses where they will fall after colliding with turbines (Hull and Muir 2010); personnel on site had capacity to detect carcasses that may have been moved from the formal search zones; eagle carcasses in vegetation were found not to decompose readily and, even when scavenged, remains were identifiable; avian scavengers did not remove all evidence of carcasses and, although mammalian scavengers could remove carcasses, this was controlled at the subset of fenced turbines; survey intensity was informed by predetermined scavenger removal rates; and, although a small number of eagles survived collision with a turbine, in all documented cases such birds were unable to fly and are likely to have been detected because both scavenger exclusion and farm fences prevented them from leaving the site.

Table 1. Modeled mean annual turbine collision estimates for 2 eagle species based on movement data collected over the span of pre-construction and operation of 2 wind farms in northwestern Tasmania, Australia, from 1999 to 2009. Estimates are shown for 4 potential dynamic avoidance rates. Static avoidance rate was modeled at 99% in all cases

	White-bellied sea-eagle		Wedge-tailed eagle	
Dynamic avoidance rate (%)	Bluff Point	Studland Bay	Bluff Point	Studland Bay
90	0.9	0.8	2.7	1.9
95	0.5	0.4	1.5	1.1
98	0.2	0.2	0.7	0.5
99	0.1	0.1	0.4	0.3

Comparison of Collision Risk Model Estimates With Actual Mortality Rates

Given constraints of statistically low collision numbers, the model's estimates of annual collisions, based on the combined total of movement data from pre-construction and operation of the 2 wind farms from 1999 until 2009 (Table 1), compare well with actual mortality of the 2 eagle species at both wind farms (Table 2). The model's estimate of the number of wedge-tailed eagle collisions per annum at Bluff Point at a 95% avoidance rate was 1.5, which is the same as the mean number of documented mortalities per annum. Estimates provided for this case by model iterations for 90% and 95% avoidance rates fell within the 95% confidence interval of measured mortality rates. The model's estimates for number of collisions at a 95% avoidance rate for white-bellied sea-eagles at Bluff Point (0.5) and for wedge-tailed eagles at Studland Bay (1.1; Table 1) also closely approximated the mean numbers of documented mortalities per annum for the 2 species (0.4 and 1.0, respectively; Table 2). For those cases, the model's estimates for the range of avoidance rates between 90% and 99% fell within the 95% confidence interval of measured mortality rates. No white-bellied sea-eagle collisions have yet been reported from Studland Bay so, to date, the model's estimates are higher than actual experience for that species there.

MANAGEMENT IMPLICATIONS

We consider that there are 2 different, although not mutually exclusive, applications for modeling of bird collision risks at prospective wind farms. These are to provide projections of long-term effects of a particular wind-energy facility on key bird species; and to determine relative risks for key species that are associated with different wind-farm sites, different portions of large wind farms, and different types of turbines and/or turbine configurations.

In many respects, we consider the latter use of collision risk modeling is the most important contribution it offers. This application provides a tool for planning of wind farms to avoid, reduce, or mitigate potential risks to birds. The model we describe here has now been used in such an iterative manner for a number of prospective sites to evaluate relative risks to key species posed by different types, sizes, numbers, and layouts of turbines.

The integration in our model of data for numbers of bird flights with numbers of birds in the population at-risk is key to the accurate prediction of potential numbers of collisions. This aspect appears not to have been adequately considered previously but has real implications to the appropriate determination of actual risks posed by a wind farm. Our model's use of bird flight data to determine annual flux of movements; a mathematical solution to the typical number of turbines that might be encountered in a bird flight; capacity to assess wind-farm configurations ranging from turbines scattered in the landscape to linear rows of turbines; and the option of assigning different avoidance rates to components

Table 2. Average annual mortality rate and variance for 2 eagle species based on carcasses detected at 2 wind farms in northwestern Tasmania, Australia

	White-bellied sea-eagle		Wedge-tailed eagle	
Wind farm	**Mean annual mortality**	**Annual variance (95% CI)**	**Mean annual mortality**	**Annual variance (95% CI)**
Bluff Point 2002–2012	0.4	0.1–1.0	1.5	0.8–2.6
Studland Bay 2007–2012	0.0	0.0–0.7	1.0	0.3–2.2

of turbines that pose more or less risk, all represent refinements designed to improve the predictive capacity of turbine collision risk modeling.

In the cases outlined here, where long-term mortality data sets have permitted validation of the model's collision estimates at given avoidance rates, the two have closely approximated each other. We will seek further opportunities to compare the results of our model with empirical mortality information from operating wind farms, with a view to wider application of the model.

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