EIS Volume 2 Appendix I

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EIS Volume 2 Appendix I-1

Species Likelihood Assessments

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Appendix I-1: Species Likelihood Assessments

1. Introduction

This appendix contains species likelihood assessments and lists of threatened species recorded in the Ecological Study Area (ESA) to support the discussion in Chapter 11 Flora and Fauna.

2. Flora

2.1 EPBC-listed flora species likelihood

Table 1: Likelihood assessment for potential EPBC listed flora species in transmission line corridor

Species name	Common name	AUS[1]	SA[2]	Likely to occur?	Summary of justification for likelihood of occurrence within transmission line corridor [3,4]
Acacia glandulicarpa	Hairy-pod Wattle	V	E	Unlikely	PMST suggests may occur in 5 km buffer on the proposed alignment. Three recent records (1998, 2005,2007), over 10 historical records in the northwest end of the ESA. Found in two small populations in South Australia. The main population is within a 30 km radius south of Burra, where it is mostly associated with rocky hillsides (SA Seed Conservation Centre (SASCC) 2019). In South Australia, the species grows in shrubland dominated by *Dodonaea viscosa subsp. angustissima*, *Olearia decurrens* and *Beyeria lechnaultii* on light sandy clay loams (Burra Creek Gorge); and tall shrubland with dominant *Acacia pycnantha* and subdominant *Cryptandra amara* and *Themeda triandra* on skeletal soils with outcropping shales (Carter 2011). No records within the transmission line corridor, not observed during surveys, suitable habitat not within the corridor, therefore considered unlikely to occur.
Acacia menzelii	Menzel's Wattle	V	V	Unlikely	PMST suggests may occur. Not observed during surveys, no preferred habitat (e.g. rocky ridges) within transmission line corridor. No records within the ESA or transmission line corridor, and closest records are over 100km south of the ESA, therefore considered unlikely to occur within the transmission line corridor.
Acacia spilleriana	Spiller's Wattle	E	E	Unlikely	PMST suggests known to occur. Endemic to South Australia and most records restricted to northern Mount Lofty Ranges between Tarlee and Burra, growing in open mallee communities on low hills on calcareous soils (SASCC 2019, NatureMaps 2020).

Species name	Common name	AUS[1]	SA[2]	Likely to occur?	Summary of justification for likelihood of occurrence within transmission line corridor [3,4]
					Ten recent (2003-2012) and multiple historical records at the western end of the ESA in rocky habitats. No records within the transmission line corridor. Given lack of records or suitable habitat in the corridor, and location of records in the ESA, species unlikely to occur.
Caladenia xantholeuca	White Rabbits, Flinders Ranges White Caladenia	E		Unlikely	PMST suggests may occur within area. No records in the ESA or transmission line corridor. Known from Telowie Gorge, not observed since the 1980s, presumed extinct (SASCC 2020). Given lack of records, considered unlikely.
Caladenia tensa	Greencomb Spider-orchid / Rigid Spider Orchid	E	Not rated	Unlikely	PMST suggests likely to occur. One record in the ESA (2007), from the Tothill Ranges (Lagoon Hill Summit, approximately 7 km west of Robertstown). No records within the transmission line corridor. SASCC (2020) taxonomy assessment of this species suggests it only occurs "*in the upper South-east in South Australia, growing in dry woodland and mallee on sandy loams. Also found in Victoria with four old record from the central west of New South Wales*" (SASCC 2019). This taxonomic assessment overrides BDBSA records for this species, which are numerous and widespread in SA. Given lack of records within corridor and known distribution, considered unlikely to occur in the transmission line corridor.
Codonocarpus pyramidalis	Slender Bell-fruit	V	E	Unlikely	PMST suggests likely to occur. One recent record (2013) occurs western end of ESA, 13 km northwest of Robertstown / end of transmission line corridor. Known from the Flinders Ranges and Olary Ranges, prefers shaley hill slopes and crests (SAAL NRM 2010). Not observed during site surveys. Considered unlikely in the transmission line corridor due to lack of suitable habitat and limited records
Dodonaea procumbens	Trailing Hop-bush	V	V	Unlikely	Not highlighted by PMST, but BDBSA records within the ESA. Four BDBSA records, 24 km from the proposed alignment near Black Springs. No records within the TLC. The majority of records for the species in the region are north of Burra, or south near Clare, Saddleworth or Eudunda. There are also records on the southern Eyre Peninsula and the South-East. Occurs in low lying areas that are seasonally inundated in Winter in grasslands and open woodlands. Not observed during site surveys. Given limited records and lack of habitat, considered unlikely in the transmission line corridor.
Dodonaea subglandulifera	Peep Hill Hop-bush	E	E	Present	PMST suggests known to occur. Twenty-three recent records (2000-2013) within the western end of the ESA, including one within the transmission line corridor. Endemic to South Australia and occurs in the eastern Mount Lofty Ranges and on Yorke Peninsula, on low hills on loamy soils associated with rocky

Species name	Common name	AUS[1]	SA[2]	Likely to occur?	Summary of justification for likelihood of occurrence within transmission line corridor [3,4]
					outcrops in open woodland (often *Callitris gracilis* and / or *Allocasuarina verticillata*), open shrubland (often Acacia) and mallee. Observed as part of Robertstown substation upgrade vegetation assessments of a separate ElectraNet alignment (F1846) which runs parallel, approximately 50m south of the proposed alignment (i.e. within the transmission line corridor. One group of three plants is known within existing this infrastructure corridor and is avoided by track maintenance / upgrades as it occurs on a rocky slope. Another group observed 800m east of this group (50-100 plants, Jan 2021). These plants are all within the transmission line corridor and near known records (in similar habitat, the 'Robertstown Subpopulation') (Moritz and Bickerton 2010). Given records, habitat and occurrence near Robertstown substation species is considered present within transmission line corridor, plants are spread out in proximity to each other at the western end of the transmission line corridor (refer to Figure 11.4).
Lachnagrostis limitanea	Spalding Blown-grass	E	E	Unlikely	Not highlighted by PMST, but BDBSA records within the ESA. One record within the ESA, 17 km from proposed alignment. Known from the Northern Lofty and Northern York Regions. Records south of the alignment near Hopkins Creek conservation park. Other records near Spalding and Riverton. Given lack of records and limited extent in SA, considered unlikely.
Olearia pannosa subsp. pannosa	Silver Daisy-bush	V	V	Possible	PMST suggests known to occur. Three records (2003) at the western end of the ESA near Hallelujah Hills, rocky habitats. These records are not within the transmission line corridor (> 4km from the western end). Endemic to South Australia, scattered widely in the Mt Lofty Block, localised on eastern Eyre Peninsula, upper South East, mid North and southern Flinders. Most populations are on roadsides and include few individual plants. Occurs in heath, mallee, woodland and forest communities on a range of soils (sandy, duplex) and terrains (slopes and plains). It is a long-lived perennial, often suckering. Whilst not observed during site surveys, given the wide range of landforms and soil types in which this species occurs, and records near the transmission line corridor, it is possible (but unlikely) that is occurs within the far western end of the corridor.
Solanum karsense	Menindee Nightshade	V	Not rated	Unlikely	PMST suggests may occur. There are no records within the ESA, only one record in SA on the border of NSW well outside the ESA north of Danggali Wilderness Area. Not observed during site surveys. Given lack of records and suitable habitat, species is considered unlikely within transmission line corridor.
Swainsona pyrophila	Yellow Swainson-pea	V	R	Possible	PMST suggests likely to occur.

Species name	Common name	AUS[1]	SA[2]	Likely to occur?	Summary of justification for likelihood of occurrence within transmission line corridor [3,4]
					Five historical records within the original ESA (1979, 1981). No recent records within current ESA or transmission line corridor. Suitable habitat occurs within the ESA. The species is short-lived, adapted to fire and widely distributed in SA. Germination is triggered by soil disturbance or fire. Although not observed during site surveys, given suitable habitat and species characteristics it is possible the species occurs within the ESA and transmission line corridor.

[1] Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE) Endangered (EN), Vulnerable (VU)

[2] South Australian National Parks and Wildlife Act 1972 Status: Endangered (E); Vulnerable (V); Rare (R), EX (Presumed extinct)

[3] BDBSA records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided.

[4] Records are from BDBSA purchased BDBSA extract DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020.

2.2 State-listed flora species likelihood

Table 2: State-listed threatened flora recorded in ESA / transmission line corridor from 1995 to present

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Acacia lineata	Streaked Wattle	R	1	No	Unlikely. 1 record in the ESA > 5 km away, no records in the TLC. Not recorded previous or current surveys. Whilst suitable habitat is present, no records north of River Murray, therefore considered unlikely to be present
Austrostipa breviglumis	Cane Spear-grass	R	13	No	Unlikely. Records in the ESA> 11 km from alignment, no records in the TLC. Not recorded previous or current surveys. No suitable habitat present.
Austrostipa gibbosa	Spiny Spear-grass	R	1	No	Unlikely. Not recorded previous or current surveys. Grassland/grassy woodland specialist. Suitable habitat not present in transmission line corridor.
Brachyscome graminea	Grass Daisy	R	16	No	Unlikely. Not recorded previous or current survey. Records in ESA (from 2003, 2007) are all from one riverine location (Overland Corner). No records in the TLC. Not recorded current or previous surveys.
Brachyscome paludicola	Swamp Daisy	R*	117	No	Unlikely. 117 records in the ESA, no records in the TLC. Records are primarily from Riverine locations. Given lack of habitat and records, considered unlikely in the TLC. Not recorded current or previous surveys.
Callistemon brachyandrus	Prickly Bottlebrush	R	13	No	Unlikely. Not recorded previous or current surveys. Occurs on alluvial flats. Habitat not present in transmission line corridor.

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Calocephalus sonderi	Pale Beauty-heads		11	No	Unlikely. Records in the ESA (1995-2011), 8 are > 5 km away. No records in the TLC. Not recorded previous or current surveys. Occurs on grassland or open woodland on sandy to clay soils, floodplain. Habitat not present in TLC.
Calotis scapigera	Tufted Burr-daisy	R	166	No	Unlikely. Whilst there are 166 records in the ESA, only 4 are 1-5 km from the transmission line corridor. No records in the TLC. Not recorded previous or current surveys. Records are from numerous riverine floodplain locations south of the TLC.
Corynotheca licrota	Sand Lily	R	4	No	Unlikely. 4 records in the ESA, only 1 between 1-5 km from the TLC. No records in the TLC (January 2021 alignment). Not recorded previous or current surveys. Records are primarily from sandy / floodplain habitats.
Cryptandra campanulata	Long-flower Cryptandra	R	12	No	Unlikely. Records in the ESA > 11 km from alignment, no records in the TLC. Not recorded previous or current surveys. Occurs in grassy habitats. Habitat not present in transmission line corridor.
Cullen Parvum	Small Scurf-Pea	V	1	No	Unlikely. 1 record in the ESA > 11 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in floodplain, riparian / wetlands habitats. Habitat unlikely in transmission line corridor.
Daviesia benthamii ssp. humilis (NC). Split into two species *Daviesia Schwarzenegger* and *Daviesia devito.*	Mallee Bitter-pea	R	1	No	Unlikely. 1 record in the ESA 13 km from alignment (Burra Gorge), no records in TLC. State taxonomy has split into two species. Species occurring in transmission line corridor is *Daviesia schwarzenegger*. Not recorded during current surveys, some records previous survey for related species prior to taxonomic split. Occurs in mallee on clay soils, hence unlikely in transmission line corridor given, lack of records and mallee only occurs on dunes or sandy loams in the corridor.
Dianella porracea	Yellow-anther Flax-lilly	V	6	No	Unlikely. 6 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. 1 record at Calperum Station (riverine habitats). In SA, occurs in two disjunction populations, west of Broken Hill and around the upper reaches of the Murray River, growing on sandy soils and usually in the vicinity of water. Given lack of habitat in the TLC, considered unlikely.
Diuris behrii	Behr's Cowslip Orchid	V	2	No	Unlikely. 2 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Known from Southern Flinders and Mt Lofty Ranges in grassy ecosystems, more fertile soils, especially amongst *Themeda* and *Triodia* on gentle slopes and flats. Habitat not present within transmission line corridor.

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Duma horrida ssp. horrida	Spiny Lignum	R	21	No	Unlikely. 21 records in the ESA and 2 records are < 5 km from alignment, no records in the TLC. Not recorded previous or current surveys. Records are from riverine / floodplain habitats. Given lack of habitat considered unlikely.
Echinopogon ovatus	Rough-beard Grass	R	2	No	Unlikely. 2 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Elatine gratioloides	Waterwort	R	9	No	Unlikely. 9 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Water plant, habitat not present in transmission line corridor.
Eragrostis lacunaria	Purple Love-grass	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Regional records are concentrated in riverine / floodplain habitats.
Eragrostis infecunda	Barren Cane-grass	R	1	No.	Unlikely. Limited records. Limited habitat.
Eryngium ovinum	Blue Devil	V	11	No	Unlikely. 11 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in grassy habitats, unlikely to be present in transmission line corridor.
Eucalyptus cajuputea	Green Mallee / Narrow-leaved Peppermint Box	R*	1	No	Unlikely. Limited records. One Record World's End, creekline. Grows on rocky hillslopes and ridges and deeper soils on the footslopes. TLC is outside known range (Gammon Ranges, Flinders Ranges, NE of Burra).
Exocarpos strictus	Pale-fruit Cherry	R	10	No	Unlikely. 9 records in the ESA, 2 records are < 5 km from alignment, but not within TLC. Not recorded previous or current surveys. Records are from south of Wentworth Road at eastern end of transmission line corridor in riverine environments, floodplain habitats.
Geijera parviflora	Wilga	R	2	No	Unlikely. 2 records in the ESA > 5 km from alignment, no records in TLC, Not recorded previous surveys. Recorded at BAM sites 14a and 15a, which are within 1 km of each other. These sites are about 20 km north of Waikerie and 1 km north of (outside) the current alignment. In general species records are concentrated north of transmission line corridor in Dangalli WA, habitat unlikely in transmission line corridor.
Goodenia gracilis	Grampians Goodenia	V	1	No	Unlikely. 1 record in the ESA < 5 km from alignment, but not within TLC. Not recorded previous or current surveys. One record (2014) in Chowilla GR in wetland habitats. Suitable habitat unlikely in transmission line corridor.
Goodenia heteromera	Spreading Goodenia	R	18	No	Unlikely. 5 records in the ESA < 5 km from alignment, but not within TLC. Not recorded previous or current surveys Regional records are concentrated in wetland, floodplain habitats.

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Gratiola pumilo	Dwarf Brooklime	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Water plant, habitat not present in transmission line corridor.
Hakea tephrosperma	Hooked Needlewood	R	1	No	Unlikely. One record (1995) in HA 1060 in Mallee Hopbush community on sand dune, more suitable to common H. leucoptera. Record is an outlier in a roadside survey. Grows in open arid spinifex and Blue-bush shrubland. Given limited records and outside known range (north of Dengali) considered unlikely.
Hydrilla verticillata	Waterthyme	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Water plant, habitat not present in transmission line corridor.
Juncus radula	Hoary Rush	V	1	No	Unlikely. 1 record in the ESA, 17 km from the alignment. No records or suitable habitat in the corridor. Not recorded current or previous surveys.
Lachnagrostis robusta	Tall Blown-grass	R	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Leptorhynchos elongatus	Lanky Buttons	E	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in grassy habitats, unlikely transmission line corridor.
Logania saxatilis	Rock Logania	R	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs on rocky slopes, habitat not in transmission line corridor.
Maireana decalvans	Black Cotton-bush	E	5	No	Unlikely. 5 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Prefers heavily seasonally waterlogged soil, habitat unlikely in transmission line corridor.
Maireana pentagona	Slender Fissure-plant	R	6	No	Unlikely. 56 records in the ESA, 3 records < 5 km from alignment (most 18 km away), no records in TLC. Whilst, recorded in Cooltong CP as part of SNI. Occurs in heavier red and brown soils. Often found growing in large numbers on cracking grey clay of the River Murray floodplains. Habitat in the transmission line corridor is unlikely.
Maireana rohrlachii	Rohrlach's Bluebush	R	2	No	Possible. 3 records in the ESA > 5 km from alignment (10-15km away), no records in TLC which have spatial reliability < 1km and post 1995. Not recorded current surveys. Recorded as part of SNI surveys on rocky hills / remnant patch western end, but was avoided. Occurs on heavy soils, widespread. Records are from Cooltong CP and White's Dam CP. Given widespread and alignment runs near these CPs, considered possible, although stock can graze heavily if present.
Mentha satureioides	Native Pennyroyal	R	5	No	Unlikely. 5 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in wet habitats, creek lines. Habitat not in transmission line corridor.

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Myoporum parvifolium	Creeping Boobialla	R	32	1	Unlikely. 32 records in the ESA > 5 km from alignment, one records in TLC, but in roadside vegetation survey, in rocky habitat, atypical for the species. Not recorded previous or current surveys. Occurs on floodplains. Habitat not in transmission line corridor.
Myriophyllum crispatum	Upright Milfoil	V	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in water habitats, not present within transmission line corridor.
Myriophyllum papillosum	Robust Milfoil	R	8	No	Unlikely. 8 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in water habitats, not present within transmission line corridor.
Najas tenuifolia	Water Nymph	E	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in water habitats, not present within transmission line corridor.
Nymphoides crenata	Wavy Marshwort	R	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in water habitat, not present within transmission line corridor.
Olearia picridifolia	Rasp Daisy-bush	R	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Mainly in mallee and heath on alkaline soils derived from limestone or dunes. Suitable habitat may occur in transmission line corridor, but given lack of records, in wider ESA, unlikely.
Osteocarpum acropterum var. deminutum	Wingless Bonefruit	R	2	No	Unlikely. 2 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in periodically waterlogged soil. Habitat unlikely in transmission line corridor.
Ottelia ovalifolia ssp. ovalifolia	Swamp Lily	R	4	No	Unlikely. 4 records in the ESA > 5 km from alignment, no records in TL no records in TLC. Not recorded previous or current surveys. Occurs in water habitats, not present in transmission line corridor.
Phebalium glandulosum ssp. macrocalyx	Glandular Phebalium	E	1	No	Unlikely. 1 record in the ESA < 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Philotheca verrucosa	Bendigo Wax-flower	V	11	No	Unlikely. 11 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Records are concentrated in the Tothil Ranges, suitable habitat in the transmission line corridor is unlikely.
Phlegmatospermum eremaeum	Spreading Cress	R	2	No	Unlikely. 12 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.

Species name	Common name	SA status[1]	Records in ESA[2,3]	Records in transmission line corridor (TLC)[2,3]	Likelihood of occurrence in the transmission line corridor
Picris squarrosa	Squat Picris	R	39	No	Unlikely. 1 record in the ESA < 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Records are concentrated in riverine / floodplain environments, suitable habitat unlikely to occur in transmission line corridor.
Ptilotus erubescens	Hairy-tails	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in grass ecosystems of the MLR, southern Flinders. Habitat not present in the transmission line corridor.
Pultenaea kraehenbuehlii	Tothill Bush-pea	R	54	No	Unlikely. 54 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Known from Tothil Ranges, habitat not present in transmission line corridor.
Rumex dumosus	Wiry Dock	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys. Occurs in wetlands, habitat not present in transmission line corridor.
Rytidosperma tenuius	Short-awn Wallaby-grass	R	1	No	Unlikely. 1 record in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Swainsona behriana	Behr's Swainson-pea	V	1	No	Unlikely. 1 record in ESA near Black Springs, 24.6 km from alignment. Considered possibly extinct in the Murray Mallee, mainly occurs on the northern and eastern side of the MLR in moist grassland and woodland (SASCC 2020). Not recorded current or previous surveys. Given lack of records and habitat, considered unlikely in TLC.
Thelymitra aristata	Great Sun-orchid	E	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Thelymitra grandiflora	Giant Sun-orchid	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.
Thysanotus tenellus	Grassy Fringe-lily	R	3	No	Unlikely. 3 records in the ESA > 5 km from alignment, no records in TLC. Not recorded previous or current surveys.

[1] Status as per National Parks and Wildlife Act 1972 E = Endangered, V = Vulnerable, R = Rare, R* = not evaluated / requires classification, EX = Presumed Extinct; 2 BDBSA records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided.

[2, 3] Records are from purchased BDBSA extracts DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020.

2.3 List of regional flora species

Table 3: Regional threatened flora recorded in transmission line corridor from 1995 to present

Species name	Common name	Family name	EPBC Act status[1]	NPW Act status[2]	Bioregional status[3]
Acacia calamifolia	Wallowa	LEGUMINOSAE			RA
Acacia colletioides	Veined Wait-a-while	LEGUMINOSAE			LC
Acacia nyssophylla	Spine Bush	LEGUMINOSAE			LC
Acacia oswaldii	Umbrella Wattle	LEGUMINOSAE			LC
Alectryon oleifolius ssp. canescens	Bullock Bush	SAPINDACEAE			LC
Arabidella nasturtium	Yellow Cress	CRUCIFERAE			RA
Atriplex stipitata	Bitter Saltbush	CHENOPODIACEAE			LC
Austrostipa elegantissima	Feather Spear-grass	GRAMINEAE			LC
Austrostipa mollis	Soft Spear-grass	GRAMINEAE			LC
Austrostipa nitida	Balcarra Spear-grass	GRAMINEAE			LC
Austrostipa platychaeta	Flat-awn Spear-grass	GRAMINEAE			LC
Brachyscome ciliaris var. ciliaris	Variable Daisy	COMPOSITAE			LC
Brachyscome lineariloba	Hard-head Daisy	COMPOSITAE			LC
Calandrinia eremaea	Dryland Purslane	PORTULACACEAE			LC
Callitris glaucophylla	White Cypress-pine	CUPRESSACEAE			NT
Calotis erinacea	Tangled Burr-daisy	COMPOSITAE			NT
Calotis hispidula	Hairy Burr-daisy	COMPOSITAE			LC
Casuarina pauper	Black Oak	CASUARINACEAE			LC
Casuarina pauper	Black Oak	CASUARINACEAE			NT
Chenopodium curvispicatum	Cottony Goosefoot	CHENOPODIACEAE			LC
Convolvulus remotus	Grassy Bindweed	CONVOLVULACEAE			LC

Species name	Common name	Family name	EPBC Act status[1]	NPW Act status[2]	Bioregional status[3]
Crassula colorata var. acuminata	Dense Crassula	CRASSULACEAE			LC
Crinum flaccidum	Murray Lily	AMARYLLIDACEAE			RA
Dissocarpus paradoxus	Ball Bindyi	CHENOPODIACEAE			LC
Dodonaea subglandulifera		SAPINDACEAE	EN	E	VU
Dodonaea viscosa ssp. angustissima	Narrow-leaf Hop-bush	SAPINDACEAE			LC
Elachanthus pusillus	Elachanth	COMPOSITAE			NT
Enchylaena tomentosa var. tomentosa	Ruby Saltbush	CHENOPODIACEAE			LC
Enneapogon nigricans	Black-head Grass	GRAMINEAE			LC
Eremophila glabra ssp. glabra	Tar Bush	MYOPORACEAE			LC
Eremophila longifolia	Weeping Emubush	MYOPORACEAE			LC
Eremophila scoparia	Broom Emubush	MYOPORACEAE			LC
Eriochiton sclerolaenoides	Woolly-fruit Bluebush	CHENOPODIACEAE			LC
Erodium crinitum	Blue Heron's-bill	GERANIACEAE			LC
Eucalyptus brachycalyx	Gilja	MYRTACEAE			LC
Eucalyptus dumosa	White Mallee	MYRTACEAE			RA
Eucalyptus gracilis	Yorrell	MYRTACEAE			LC
Eucalyptus largiflorens	River Box	MYRTACEAE			NT
Eucalyptus porosa	Mallee Box	MYRTACEAE			LC
Eucalyptus socialis ssp. socialis	Beaked Red Mallee	MYRTACEAE			LC
Exocarpos aphyllus	Leafless Cherry	SANTALACEAE			LC
Goodenia pusilliflora	Small-flower Goodenia	GOODENIACEAE			LC
Grevillea huegelii	Comb Grevillea	PROTEACEAE			LC

Species name	Common name	Family name	EPBC Act status[1]	NPW Act status[2]	Bioregional status[3]
Grevillea huegelii	Comb Grevillea	PROTEACEAE			NT
Hakea leucoptera ssp. leucoptera	Silver Needlewood	PROTEACEAE			LC
Hakea rostrata	Beaked Hakea	PROTEACEAE			RA
Hyalosperma semisterile	Orange Sunray	COMPOSITAE			LC
Isoetopsis graminifolia	Grass Cushion	COMPOSITAE			LC
Lawrencia squamata	Thorny Lawrencia	MALVACEAE			LC
Lycium australe	Australian Boxthorn	SOLANACEAE			LC
Lysiana exocarpi ssp. exocarpi	Harlequin Mistletoe	LORANTHACEAE			LC
Maireana aphylla	Cotton-bush	CHENOPODIACEAE			VU
Maireana brevifolia	Short-leaf Bluebush	CHENOPODIACEAE			LC
Maireana erioclada	Rosy Bluebush	CHENOPODIACEAE			LC
Maireana georgei	Satiny Bluebush	CHENOPODIACEAE			RA
Maireana pentatropis	Erect Mallee Bluebush	CHENOPODIACEAE			LC
Maireana pyramidata	Black Bluebush	CHENOPODIACEAE			LC
Maireana sedifolia	Bluebush	CHENOPODIACEAE			LC
Maireana trichoptera	Hairy-fruit Bluebush	CHENOPODIACEAE			LC
Maireana turbinata	Top-fruit Bluebush	CHENOPODIACEAE			RA
Minuria cunninghamii	Bush Minuria	COMPOSITAE			RA
Minuria leptophylla	Minnie Daisy	COMPOSITAE			LC
Myoporum parvifolium	Creeping Boobialla	MYOPORACEAE		R	
Myoporum platycarpum ssp. platycarpum	False Sandalwood	MYOPORACEAE			LC
Nitraria billardierei	Nitre-bush	ZYGOPHYLLACEAE			LC

Species name	Common name	Family name	EPBC Act status[1]	NPW Act status[2]	Bioregional status[3]
Olearia pimeleoides	Pimelea Daisy-bush	COMPOSITAE			LC
Pimelea microcephala ssp. microcephala	Shrubby Riceflower	THYMELAEACEAE			LC
Pittosporum angustifolium	Native Apricot	PITTOSPORACEAE			LC
Rhagodia parabolica	Mealy Saltbush	CHENOPODIACEAE			LC
Rhagodia spinescens	Spiny Saltbush	CHENOPODIACEAE			LC
Rhagodia ulicina	Intricate Saltbush	CHENOPODIACEAE			LC
Roepera ammophila	Sand Twinleaf	ZYGOPHYLLACEAE			LC
Roepera angustifolia	Scrambling Twinleaf	ZYGOPHYLLACEAE			LC
Roepera apiculata	Pointed Twinleaf	ZYGOPHYLLACEAE			LC
Roepera aurantiaca ssp. aurantiaca	Shrubby Twinleaf	ZYGOPHYLLACEAE			LC
Roepera iodocarpa	Violet Twinleaf	ZYGOPHYLLACEAE			LC
Salsola australis	Buckbush	CHENOPODIACEAE			LC
Scaevola spinescens	Spiny Fanflower	GOODENIACEAE			LC
Sclerolaena diacantha	Grey Bindyi	CHENOPODIACEAE			LC
Sclerolaena obliquicuspis	Oblique-spined Bindyi	CHENOPODIACEAE			LC
Sclerolaena patenticuspis	Spear-fruit Bindyi	CHENOPODIACEAE			LC
Senna artemisioides ssp. filifolia	Fine-leaf Desert Senna	LEGUMINOSAE			LC
Senna artemisioides ssp. petiolaris		LEGUMINOSAE			LC
Senna artemisioides ssp. X artemisioides	Silver Senna	LEGUMINOSAE			LC
Senna artemisioides ssp. X coriacea	Broad-leaf Desert Senna	LEGUMINOSAE			LC
Solanum esuriale	Quena	SOLANACEAE			LC
Stenopetalum lineare	Narrow Thread-petal	CRUCIFERAE			LC

Species name	Common name	Family name	EPBC Act status[1]	NPW Act status[2]	Bioregional status[3]
Tetragonia eremaea	Desert Spinach	AIZOACEAE			LC

[1]Environment Protection and Biodiversity Conservation Act 1999 Status: Endangered (EN), Vulnerable (VU)

[2]South Australian National Parks and Wildlife Act 1972 Status: Endangered (E); Vulnerable (V); Rare (R), EX (Presumed extinct)

[3]List based on BDBSA records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided.

Records are from BDBSA purchased BDBSA extract DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020.

Regional status as per BDBSA extract: Rare (RA, Least Concern (LC), Near Threatened (NT).

3. Fauna

3.1 EPBC-listed fauna species likelihood (threatened and migratory)

Table 4: Likelihood assessment of EPBC listed fauna species with potential to occur in transmission line corridor

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
Botaurus poiciloptilus	Australian Bittern	E	V	Possible	EPBC PMST suggests known to occur. Widespread, but uncommon over south-eastern Australia. Shy elusive species that favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. There are 8 recent BDBSA records (2010) within the ESA (all at the same location), records are in the River corridor south-west of Berri and 7 km south of the alignment near Morgan. One Birdlife record (2017) 17 km from the proposed alignment (near Berri). No records within the transmission line corridor. Possible within riverine environments south of the corridor, potential flyover.
Manorina melanotis / Manorina flavigula melanotis	Black-eared Miner	E	E	Present	EPBC PMST suggests known to occur. Endemic to the Murray Mallee region of Victoria, South Australia and New South Wales where the majority of records are from the Riverland Biosphere Reserve, South Australia and the Murray-Sunset National Park, Victoria. Birds are restricted to large tracts of mature, unfragmented mallee. Preferred habitat is old growth mallee (over Spinifex, Saltbush or Bluebush) that has not been burnt for at least 45 years, and not degraded by grazing (Clarke et al. 2005 cited in TSSC 2016b, Nature Advisory 2019). A wildfire in 2006 in the Riverland Biosphere Reserve reduced the largest remaining area of long unburnt habitat by about a third. A subsequent fire in 2014 also burnt large areas of available habitat in the southern portion of the biosphere reserve (TSSC 2016b, NatureMaps 2020). The transmission line traverses the southern boundary of **Taylorville Station and Calperum Station which are listed under the Register of Critical Habitat as part of a block critical habitat for the Black-eared Miner. The Critical Habitat area is not bisected or fragmented by the project.**

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
					The main threats to this species are past vegetation clearance and habitat disturbance, destruction of habitat by fire and grazing pressure leading to habitat degradation and / or reduction. There has been taxonomic controversy over this species, whether considered a full species or a subspecies of Yellow-throated Miner, hence listed as either *Manorina melanotis* or *Manorina flavigula melanotis* (SPRAT 2019). One Birdlife record for *Manorina flavigula melanotis* in the transmission line corridor (2000) in Taylorville Station (10 km NNW of Hawks Nest). There are approximately 200 records (BDBSA and Birdlife) within the ESA, and 800 recent records north of the ESA boundary. The majority of records in the ESA are in Calperum and Taylorville Stations as well as Gluepot Reserve, in areas of mallee unburnt for 15 years and up to 40 years. There are also 8 recent records for the common Yellow Throated Miner in the transmission line corridor, and over 400 recent records within ESA; as well as 60 records within the ESA for hybrids of these species (*Manorina flavigula* x *melanotis*), indicating frequent interbreeding with Yellow-throated Miners already occurs in in the ESA. Targeted surveys (Nature Advisory 2021) located the species at 3 sites within the Project Area (Taylorville Station and Calperum Station), therefore given numerous regional records and presence of habitat, is considered present within mallee habitats of the centre of the transmission line corridor.
Calidris ferruginea	Curlew Sandpiper	CE / M	Not rated	Possible	EPBC PMST suggests likely to occur. A common summer migrant from northern hemisphere, found in many Australian coastal sites and may also be seen inland in suitable habitats. It is most common in the far south-east and north-west of Australia. It is found on intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters. Core habitat does not occur within the ESA, but the species may be an occasional visitor to inland water habitats. Within the ESA, there is one recent BDBSA record, 22 km from alignment (2011), 4 recent BDBSA records > 25 km from the alignment and there are 3 historical records in proximity to the transmission line corridor (1.9 km from alignment, Lake Merreti). There are 5 Birdlife records (1999-2013), 13-17 km from the alignment. None of the records are within the transmission line corridor, but the historical records are close to the corridor. Species is considered possible in riverine environments adjacent the transmission line corridor (refer Wetland Birds Summary).
Numenius madagascariensis	Eastern Curlew	CE / M	V	Unlikely	EPBC PMST suggests may to occur. Migratory wader / large shorebird. Breeds in NE Asia, Siberia in damp bogs and peaty marches and is a spring migrant to Australia where it is found in all states. Within Australia, has a primarily coastal distribution, with very few inland records. Its preferred habitat is coastal lakes, inlets, bays and estuaries where is occupies intertidal mudflats, particularly exposed seagrass beds. No BDBSA or birdlife records within the ESA or transmission line corridor, nearest records are approximately 50 km away from the eastern end of the corridor in New South Wales. Given lack of records and preferred habitat, considered unlikely in the transmission line corridor.

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
Aprasia pseudopulchella	Flinders-ranges Worm-lizard	V	Not rated	Possible	EPBC PMST suggests likely to occur. Endemic to South Australia, occurs in open woodland, native tussock grassland, riparian habitats and rocky isolates. Species prefers stony soils or clay soils with a stony surface and has been found sheltering in soil beneath stones and rotting stumps. All species of *Aprasia* are known to burrow freely in loose soil or litter and in root systems below shrubs. Has been recorded from the Southern Flinders, Clare Hills, rocky slopes north and south of Burra, and northern suburbs of Adelaide (Cobbler Creek Recreation Reserve), which are all west of the Project. There are 5 recent records (from 2003, 15-24 km from alignment) within the western end of the ESA, none located within the transmission line corridor. Records were from Lomandra and/or Triodia grassland (4 sites) and Sheoak woodland (one site). The nearest record (from 2011) is ~ 10 km northwest of the Project Area, but has low spatial reliability (> 1km). Record was from 'gullies near a homestead'. The western margins of the ESA are at the eastern limit of the known range. Only the far western end of the transmission line corridor may contain suitable habitat. Based on the above, the species is considered as a possible occurrence in the transmission line corridor.
Falco hypoleucos	Grey Falcon	V	R	Unlikely	EPBC PMST suggests likely to occur. A rare pale inland falcon. Sparsely distributed across Australia and rarely encountered. Preferred habitat includes open plains and treed watercourses in arid inland areas. When not actively hunting roosts in shady trees or communications towers (Menkorst et al. 2017). Wide ranging occurrence and habitat would occur in the transmission line corridor, however given sparse distribution and lack of records, and limited preferred habitat considered unlikely. No BDBSA or Birdlife records (recent or historical) within entire ESA.
Thinornis cucullatus cucullatus	Hooded Plover	V	VU	Unlikely	Not suggested by PMST, one record within ESA. A coastal resident shorebird species. Record is well outside known habitat and range for the species One BDBSA record 2006, 5.8 km from proposed alignment near Overland Corner. No Birdlife records. Given no records in the transmission line corridor or suitable coastal beach habitat, considered unlikely in the transmission line corridor.
Leipoa ocellata	Malleefowl	V	V	Present	EPBC PMST suggests known to occur. Terrestrial ground-dwelling species which makes large conspicuous nesting mounds. Preferred habitat is semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. Sandy soils and abundance leaf litter are required for breeding (National Malleefowl Recovery Team 2019). Over the course of a year the birds may range over one to several square kilometres; home-ranges overlap considerably. There are over well 2000 recent (1995-2018) BDBSA and Birldlife records in the ESA and an additional 267 BDBSA records within the transmission line corridor. It is noted that many of these records are duplicate records of regularly surveyed mound locations, and there are no records for active nests in the transmission line corridor.

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
					Records are widespread in mallee habitat with concentrations around CPs (e.g. Pooginook and Cooltong) and Stations within the Biosphere Reserve. The boundaries of these CPs and Taylorville are traversed by the Project, and a (30 km) section of the proposed alignment runs through Calperum Station. No Malleefowl mounds / nests or Malleefowl were observed during site surveys of the proposed alignment, however Malleefowl footprints were observed during targeted survey in spring 2019 (Nature Advisory 2021). Whilst Malleefowl have not been observed in the transmission line corridor, there are numerous records and presence of habitat, therefore they are considered as present within the corridor and would occur in mallee habitats, and are also known to traverse along tracks and forage in cropped / stubble areas.
Pezoporus occidentalis	Night Parrot	E	E	Unlikely	EPBC PMST suggests species is extinct within the search area. Nocturnal / elusive ground-dwelling bird listed as extinct in SA. Given there are no historical or recent records within the ESA, and lack of preferred habitat in the transmission line corridor, species is considered unlikely.
Grantiella picta	Painted Honeyeater	V	R	Possible	EPBC PMST suggests may occur. Endemic to mainland Australia, primarily occurring in Queensland and New South Wales and Victoria. It is also found occasionally in the Northern Territory and may be a vagrant to South Australia. It is rare throughout its range. There are few records in South Australia and these are outside of the known range. Occurs in dry open forests and woodlands, and is strongly associated with mistletoe. It may also be found along rivers, on plains with scattered trees and on farmland with remnant vegetation. It has been seen in urban parks and gardens where large eucalypts are available. There are no recent BDBSA records within the ESA. There are 3 Birdlife records within the ESA (from 2000, 2011, 8-24 km from the alignment. There are 6 birdlife records 29-32 km north of the transmission line corridor near Gluepot Homestead in Mallee Vegetation. Given the limited records within the ESA and its status as a vagrant in South Australia, its occurrence within the transmission line corridor is considered possible.
Rostratula australis	Painted Snipe	E	V	Possible	EPBC PMST suggests likely to occur. Endemic to Australia, widespread over much of north and eastern Australia, and localised around Perth, but rarely observed. Prefers inland swamps and temporary water regimes, marshes with moderate cover. Inhabits many different types of shallow, brackish or freshwater terrestrial wetlands, especially temporary ones which have muddy margins and small, low-lying islands. Suitable wetlands usually support a mosaic of low, patchy vegetation, as well as lignum and cane-grass. Preferred habitats occur within the wider ESA and adjacent the eastern end of the transmission line corridor. There is one recent BDBSA record (2001 at Berri Sewage works) and 3 Birdlife records within the ESA. There are also 2 recent records outside the ESA near Berri and the Noora Disposal Basin, but no records in the transmission line corridor. Given limited records and preferred habitat adjacent the eastern end of the transmission line, occurrence within the transmission line corridor is unlikely, but possible in adjacent Ramsar habitat or as flyover species (considered further in Wetland Birds Summary).

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
Pedionomus torquatus	Plains-wanderer	CE	E	Unlikely	EPBC PMST suggests likely to occur. Nomadic species, which inhabits sparse, treeless, lowland native grasslands which usually occur on hard red-brown clay soils. Occasionally occurs in other types of habitat such as in stubble; amongst low cereal crops; and in low, sparse chenopod shrubland. Three historical records in the ESA, most recent 1964 approximately 15 km south of the of the transmission line corridor near Waikerie. No Birdlife records in the ESA. Highest concentrations of records are in the Riverina region of south-western NSW and north-central region of Victoria. Given lack of records and distance to strongholds / populations species is considered unlikely in the transmission line corridor.
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	E	E	Possible	EPBC PMST suggests known to occur. Preferred habitat is unploughed grassland, commonly Lomandra grassland (with spider holes). It has been recorded from the mid-north of South Australia with most records between Burra and Jamestown. There are 2 recent records (2008) in the ESA, no records in the transmission line corridor, nearest records (>500) all from same location ~ 31 km northwest of the western end of the transmission line corridor. Records are in an un-ploughed grassland. The transmission line corridor is east of all known records. Only the far western end of the study area may contain suitable habitat, however no preferred or suitable habitat observed in the corridor during site surveys to date. Based on the above occurrence in the transmission line corridor is considered possible.
Pachycephala rufogularis	Red-lored Whistler	V	R	Present	EPBC PMST suggests likely to occur. Occurs in the Murray Mallee both north and south of the Murray River, with isolated populations in central-western New South Wales, and on the Eyre Peninsula (which is likely extinct following fire in 2005). The core population occurs in the South Australia near the Victoria border. Distribution within the range is patchy as large areas are not utilised because they are not suitable (e.g. grazing, fire impacts). Whilst previously had wide-spread occurrence in the Riverland Biosphere Reserve, landscape-scale fires have reduced numbers substantially in these areas. Breeds in areas of open mallee over a fairly dense, but patchy, shrub layer. Species prefers Spinifex (*Triodia*) mallee, shrubland or mallee heath shrubland (e.g. *Melaleuca uncinata*) where canopy is sparse and shrubs at high densities (DEWLP 2016, Nature Advisory 2019). It is considered to have strict habitat requirements with distribution in mallee and mallee heath, limited by presence of *Triodia scariosa*, often nesting in Spinifex hummock grasslands. Feeds mainly on the ground or in low shrubs. They have large home ranges and occur at low densities within these ranges. The Riverland Biosphere Reserve population, estimated to be about 1000 birds in 2011, is considered to be one of the largest populations. In that reserve they are known to occur > 6 km from water points and associated grazing impacts and predominantly in areas of long-unburnt mallee. Landscape scale fires have caused substantial declines of populations in recent years, particularly in Billiatt and Ngarkat Conservation Parks and the Riverland Biosphere Reserve (DEWLP 2016).

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
					There are 6 recent BDBSA records 43 Birdlife records in the ESA (1995-2010), no records in the transmission line corridor). The majority of these records are north of or on the edge of areas burnt by wildfire in 2006, 2014 ~ 30 km north of the transmission line corridor. Although there are limited records in the ESA, 4 of the records were <5km from the alignment near Pooginook CP, the species was also observed near that CP during targeted surveys (Nature Advisory 2021). Based on the above considered, present in the un-burnt / old growth mallee habitats of the transmission line corridor, however likely to occur in low abundance (Nature Advisory 2021).
Polytelis anthopeplus monarchoides	Regent Parrot	V	V	Likely	EPBC PMST suggests breeding likely to occur. Nests within River Red Gums forests. Typical nest trees are large, mature healthy trees with many hollows (though dead trees are used) and are usually located close to watercourses. Principal foraging habitat is mallee woodlands, though foraging also occurs in riverine forests and woodlands. Mallee woodland within 20 kilometres of nesting sites is considered critical foraging habitat for breeding birds (Baker-gabb and Hurley 2011). They may utilise cereal crops and will feed on spilt grain. Birds move between the riverine nesting habitat and foraging sites along corridors of natural vegetation. They also forage widely in mallee areas / agricultural land. The ESA includes both breeding and foraging habitat, breeding habitat does not occur in the transmission line corridor, but rather south of the corridor in riverine environments. There are over 620 recent BDBSA records and 335 Birdlife records within the broader ESA (1995-2020), most along the River Murray corridor, but there are also records in mallee vegetation to the north of the ESA in Taylorville and Calperum Station and the species has been recorded in Pooginook CP, Cooltong CP, most likely associated with foraging behaviour rather than breeding. There are two recent BDBSA records (2012, 2013), and no Birdlife records in the transmission line corridor. The species was not observed during targeted surveys of the corridor. Based on the above, species is considered likely within the transmission line corridor, in mallee habitats (foraging habitat). Noting that nesting habitat does not occur in the transmission line corridor and species is more likely in mallee that is within 20 km (maximum) of nesting habitats along the River Murray.
Nyctophilus corbeni	South-eastern Long-eared Bat	V	V[4]	Possible	EPBC PMST suggests likely to occur. Microbat previously referred to as *Nyctophilus species 2* (South-eastern long-eared Bat) (Churchill 2008). Species has scattered distribution in the Murray-Darling basin. Occurs within a wide range of inland woodland vegetation types. More commonly associated with Box, Ironbark and Cypress Pine Woodland on the western slopes and plains of inland northern NSW. Has a stronghold with core populations located in the Pilliga Scrub in NSW. Roosts in tree hollows, crevices and under loose bark. Generally roosting solitarily or in groups of 10-20. Slow flying, but agile and hunts for flying prey, foliage gleaning or foraging on the ground, foraging very close to vegetation. In South Australia, records are all confined to mallee shrubland. It is most commonly recorded in extensive stands of vegetation, old-growth vegetation, and areas with a dense understorey. Bushfires are a likely threat, causing direct mortality and through loss of foraging habitat and roosting sites.

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3,4]
					There is one recent record within the ESA, 20 km from the alignment (1998 Calpernum Station) and no recent records in the transmission line corridor. All records are within a large tract of intact mallee. Given recent record in the ESA, aerial nature and habitat present within the ESA and transmission line corridor, it is possible this species occurs in mallee habitats within the corridor.
Litoria raniformis	Southern Bell Frog / Growling Grass Frog	V	V	Possible	EPBC PMST suggests known to occur. Occupies a variety of natural and artificial wetland habitats including swamps, lakes, streams, riverine floodplains, farm dams and irrigation channels. Occupied waterbodies are typically still to slow-flowing and may be permanent or ephemeral. Submergent, floating and/or emergent vegetation is often present. In South Australia, occurs along the length of the River Murray corridor, Lower Lakes, and the South East region. For populations bordering the River Murray, breeding is triggered by flooding of ephemeral waterbodies during spring or summer. In this area the frogs are concentrated in refugia prior to flooding, then disperse across the landscape during flooding / breeding events. Species is highly mobile and can move at least one km in 24 hrs. There is evidence that its persistence in many areas is dependent upon the movement of adults between particular waterbodies, and between breeding and non-breeding habitats. At least some populations may be dependent upon a small number of waterbodies in which successful breeding occurs. Fences and roads may be barriers to frog movement and may compromise the viability of many populations. There are 402 recent records (1995-2017) within the ESA, with <1km spatial reliability, no records in the transmission line corridor and no suitable habitat. These records occur along the River Murray corridor with occasional records from nearby evaporation ponds. Given the number of records, it is considered possible this species may occur in the transmission line corridor, but it is more likely to occur in the River Murray and associated wetlands that are avoided by the project.

[1]Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE) Endangered (EN), Vulnerable (VU), Migratory (M)

[2] South Australian National Parks and Wildlife Act 1972 Status: Endangered (E); Vulnerable (V); Rare (R), EX (Presumed extinct)

[3] BDBSA records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided.

[4] Records are from BDBSA purchased BDBSA extract DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020.

Table 5: Likelihood assessment of EPBC listed migratory species with potential to occur in the transmission line corridor

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3]
Apus pacificus	Fork-tailed Swift	MM	Not rated	Possible	EPBC PMST suggests likely to occur within area. Highly mobile, almost entirely aerial species, flying < 1 m to 1000 m above the ground - seldom recorded on the ground. The species occurs above a wide range of habitats, which vary from rainforests to treeless plains. Numerous records from much of inland and coastal Australia. One recent BDBSA record (2006), 4 Birdlife records (2002, 2003, 2006) within the ESA, no recent records within transmission line corridor. Species unlikely to utilize terrestrial habitat within the TLC, but may occur as an overfly visitor, given aerial nature.
Migratory Terrestrial (MT)					
Motacilla cinerea	Grey Wagtail	MT	Not rated	Unlikely	EPBC PMST suggests may occur within area. Uncommon migratory wagtail. Breeds in the northern hemisphere and are rare vagrants to Australia. Most records within Australia are coastal records from Northern Australia. However, there are widely scattered records elsewhere in Australia. No BDBSA or Birdlife records in ESA or transmission line corridor. In SA, there are 3 historical ALA records from Adelaide and recent (2013) records from the lower South East. Suitable habitat may be present within the transmission line corridor, but is unlikely to provide core habitat. Based on this and given lack of / limited recent BDBSA records, considered unlikely to occur.
Motacilla flava	Yellow Wagtail	MT	Not rated	Unlikely	EPBC PMST suggests may occur within area. Uncommon migratory wagtail. Nearly all Australia records are coastal, with a few widely scattered inland records. Typically forages in damp grassland and on relatively bare open ground at edges of rivers, lakes and wetlands, but also feeds in dry grassland and in fields of cereal crops. No BDBSA or Birdlife records in ESA or transmission line corridor. There are four ALA records in South Australia, some historical and some recent (Lower South East to Central SA). Suitable habitat may be present within the corridor, but is unlikely to provide core habitat. Based on this and given lack of records, considered unlikely to occur.
Myiagra cyanoleuca	Satin Flycatcher	MT	E	Unlikely	EPBC PMST suggests known to occur within area. Occurs along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. In South Australia, records are few and far between. Inhabits vegetated gullies in eucalypt-dominated forests and taller woodlands, often near watercourses. Within the ESA, there one BDBSA record and one Birdlife record (1998), near Burra and Morgan. There are no other records in the ESA or the transmission line corridor. An occasional visitor to SA and considered unlikely within the transmission line corridor, given limited records.

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3]
Actitis hypoleucos	Common Sandpiper	MW	R	Possible	EPBC PMST suggests may occur within area. Uses a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on intertidal mudflats. Visits Australia from late July to March; in a variety of habitats including steep sided sewage ponds, dams, solitary or in small groups. Will also occur in muddy habitats / shallow edges of inland farm dams, mangrove-lined inlets. Non-core habitat exists adjacent the transmission line corridor and within water habitats of the ESA. There are 4 BDBSA records and 9 Birdlife records within the ESA near Waikerie and Berri (Sewage treatment works), no records from the transmission line corridor. Given suitable habitat in the Riverland Wetland complex and local dams within / adjacent the transmission line corridor, species is considered possible in suitable habitats and potential flyover species.
Calidris acuminata	Sharp-tailed Sandpiper	MW	Not rated	Likely	EPBC PMST suggests known to occur within area. Migratory wader / shorebird. Breeds in Siberia, migrates to New Guinea and Australia. Occurs in coastal and inland areas, but prefers non-tidal fresh or brackish wetlands. Recorded from wetlands throughout Australia. One of the most numerous migratory shorebirds to occur in fresh to saline inland wetlands, also forages in nearby damp grasslands, sometimes dams. There are 18 BDBSA and 30 Birdlife records within the ESA, from the River Murray and adjoining wetlands, Lake Merretti and no records from the transmission line corridor. Given records and preferred habitat south of the eastern end of the transmission line corridor (near Lake Merretti), considered likely in suitable habitats and potential flyover species.
Calidris melanotos	Pectoral Sandpiper	MW	R	Possible	EPBC PMST suggests likely to occur within area. Breeds in northern North America and Siberia, and migrates (from late June) to South America and to a lesser extent Australasia. Occurs solitary or in small flocks on freshwater wetlands, grassy or lightly vegetated coastal and inland swamps. Habitat occurs south of the eastern end of the TLC in the Riverland Wetland Complex. Two BDBSA and one Birdlife records and three historical records (1981 and 1987) within ESA (from Lake Meretti). Given records and habitat adjacent corridor, considered possible in suitable habitats and potential flyover species.
Calidris ruficollis	Red-necked Stint	MW	Not rated	Likely	EPBC PMST suggests known to occur within area. Widespread throughout Australia. Occurs on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They can also occur in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting. Widespread along the coast of SA and the River Murray, including within the ESA. There are 130 BDBSA and Birdlife records (1999-2017) within the ESA, all from the River Murray and Lake Meretti. Species is considered likely in riverine wetland environments and potential flyover species.

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3]
Gallinago hardwickii	Latham's Snipe	MW	R	Possible	EPBC PMST suggests likely to occur within area. Migratory wader / marsh dweller. Breeds in Japan and summer non-breeding migrant to Australia, primarily along the east coast. Prefers tussock grass and low dense sedges surrounding freshwater wetland, permanent and ephemeral wetlands. Can also occur in habitats with saline or brackish water. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and in saltmarsh and creek edges on migration. They also use crops and pasture when inundated. There are only three recent records (2006-2009) within the ESA, from the River and adjoining wetlands, and historical record at Lake Meretti. Given suitable habitat occurs adjacent the eastern end of the transmission line corridor and limited records, considered possible and potential flyover species.
Hydroprogne caspia	Caspian Tern	Mi	Not rated	Likely	Not suggested by PMST, but multiple recent records within ESA. Migratory marine species that is widespread in Australian Coastlines and inland northern to central-eastern Australia. Occurs in sheltered coastal waters, but also uses inland water bodies, including large rivers, fresh to saline lakes, reservoirs and temporary wetlands. Species forages for fish, usually patrolling 15-30m above the water (Menkhorst et al. 2017). Well over 700 BDBSA and Birdlife records in the ESA (1997-2019), including records in Lake Merretti. No records in the transmission line corridor. Records are concentrated around riverine environments of the River Murray near Morgan, Waikerie, the Ramsar Wetland and Lake Merreti. Species is considered likely in riverine environments adjacent the transmission lien corridor, refer Wetlands bird report for further detail.
Pandion haliaetus cristatus	Eastern Osprey	MW	E	Possible	EPBC PMST suggests likely to occur within area. Raptor, prefers open water foraging habitat and tall woodland nesting habitat. Generally occur on or near the coast, but also range inland along large rivers, bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands. Nest in trees (often dead or with dead tops), rocky coastlines and on artificial structures such as telecommunication towers. Preferred habitat of open water bodies, lakes, rivers for foraging are present adjacent the transmission line corridor (eastern end). Will also nest on tall manmade structures, therefore have the potential to move into the corridor once towers are constructed. Majority of SA records are coastal or off-shore. 3 Birdlife records (2010, 2012, 2013) within the ESA (Chowilla Game Reserve, homesteads). Given limited records considered possible in water habitats, have the potential to nest in towers once constructed and potential flyover.
Pluvialis fulva	Pacific Golden Plover	MW	R	Possible	EPBC PMST suggests known to occur within area. Migratory shorebird. Breeds in Siberia and Alaska, migrates to a number of countries including Australia. Preferred habitat is intertidal sand and mudflat, coastal saltmarsh and rocky shores, will roost in pasture near these water habitats. Range is primarily coastal, with a small population inland, near wetland habitats. Within SA mainly coastal, but occasional inland records. One recent Birdlife record (2001) in ESA (Berri Sewage Pond), two historical records in ESA, no records in transmission line corridor. Given limited records

Species name	Common name	AUS[1]	SA[2]	Likely to occur	Summary of justification for likelihood of occurrence within the transmission line corridor[3]
					and wetland habitats adjacent eastern end of corridor, considered possible in suitable habitats and potential flyover.
Tringa glareola	Wood Sandpiper	MW	R	Possible	EPBC PMST suggests known to occur within area. Migratory shorebird. Breeds in Europe to Siberia, migrates to Africa, southern Asia and Australia. When in Australia (Aug-April), generally occurs in northern Australia. Prefers inland freshwater wetlands and rarely on intertidal mudflats. Prefers sites with emergent sedges and other small plants, with taller fringing vegetation. Often occurs solitary or in small clusters near shorelines in mud or shallow water of wetlands. When disturbed will fly very high before wheeling and gliding back to ground. Within SA the majority of records are from the coast off Gulf St Vincent, Spencer Gulf, and the Coorong region. However, there are 7 Birdlife records within ESA (near Berri / Waikerie), no records within the transmission line corridor. Given limited records and wetland habitats adjacent eastern end of corridor, considered possible in wetland habitats and potential flyover.
Tringa nebularia	Common Greenshank	MW	Not rated	Likely	EPBC PMST suggests known to occur within area. Migratory wader / shorebird. Breeds in northern hemisphere from Europe to Siberia, summer migrant to Australia, Africa and Asia. Prefers intertidal mudflats, fresh and saltwater wetlands of coast and inland. Widespread in SA, including coastal and inland in estuaries and mudflats, mangrove swamps and lagoons, as well as billabongs, swamps, sewage farms and flooded crops. ESA occurs within known regularly occupied range. Over 30 BDBSA and Birdlife records from the ESA. No records in the transmission line corridor. Given multiple records and habitats adjacent eastern end of corridor, considered likely in suitable habitats and potential flyover.
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	MW	Not rated	Possible	EPBC PMST suggests known to occur within area. Migratory shorebird. Breeds in Europe and Asia, migrates to Africa, Southern Asia and Australia. Preferred habitat includes coast and inland fresh or saltwater wetlands, avoids intertidal wetlands, but large numbers can occur along the northern Australian coast (Geering et al. 2008, Menkhorst et al. 2017). Study area occurs in known regularly used range (Menkhorst et al. 2017). Records are south of the corridor in riverine habitats. Five Birdlife records within ESA, 5 BDBSA records south of ESA (25-25 km). Given limited records and habitat adjacent eastern end of corridor, considered possible in wetland habitats and potential flyover.

[1]Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW)

[2] South Australian National Parks and Wildlife Act 1972 Status: Endangered (E), Rare (R), Vulnerable (V)

[3] Records from Biological Database of South Australia (BDBSA), September 2019 extract; records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided. Records are from BDBSA purchased BDBSA extract DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020; Protected Matters Search Tool (PMST) (species or species habitat potential unless stated, e.g. breeding, Atlas of Living Australia

[4] References generally from Menkhorst et al. 2017, Simpson and Day 2010, Geering et al . 2008, SPRAT profiles, Jacobs preliminary constraints report, Jacobs significant impact assessment).

3.2 State-listed threatened fauna likelihood

Table 6: State listed fauna with records in ESA and transmission line corridor (1995-present, <1km reliability)

(excludes EPBC listed and Migratory already presented elsewhere)

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Birds						
Anhinga novaehollandiae	Australasian Darter		R	>1600 (BDBSA + Birdlife) (1995-2020)	No	Unlikely in transmission line corridor, present in water habitats adjacent transmission line corridor. ESA records concentrated along River Murry and Wetlands, including Lake Meretti and within the Chowilla Game Reserve (GR), Morgan Conservation Park (CP), Loch Luna (GR), and Murray River National Park (NP), Heritage Agreements (HA) 1120, 1544 1582 and 448
Spatula rhynchotis rhynchotis	Australasian Shoveler		R	397 (BDBSA, Birdlife) (1996-2019)	No	Unlikely in transmission line corridor, possible in adjacent wetland habitats. Records in the ESA are concentrated in riverine habitats, 1120 (HA), 1544 (HA), Chowilla (GR), Morgan (CP) and Murray River (NP). Prefers well vegetated permanent wetlands, but will use most freshwater habitats. May be a breeding resident in permanent wetlands, but can also be nomadic.
Ardeotis australis	Australian Bustard		V	3 (2002-2004)	No	Possible. Limited recent records. Scattered, declining distribution. Occurs in open country, dry grasslands, sand plains with spinifex, pasture stubble. In pairs or family groups. Nomadic visitor to South Olary Plains (SKM 2002).
Ceyx azureus azureus	Azure Kingfisher		E	2 (2002, 1999), Birdlife only	No	Unlikely in transmission line corridor, possible in water habitats. Nests in burrows near water.
Ixobrychus dubius	Australian Little Bittern (Black-backed Bittern)		E	4 (BDBSA, Birdlife) (2005, 2011, 2015)	No	Unlikely in transmission line corridor, possible in adjacent wetland habitats south of transmission line corridor. Records are concentrated along the River Murray near Morgan, Loch Luna Game Reserve and Renmark. Preferred habitat is tall freshwater reedbeds and rushes, dense emergent vegetation in freshwater wetlands. Also occurs in inundate Melaleuca shrub thickets.
Cladorhynchus leucocephalus	Banded Stilt		V	40 (Birdlife, BDBSA) (1999-2018)	1 (Birdlife)(2000)	Unlikely in transmission line corridor, possible in adjacent water habitats. Records primarily coastal and inland wetland environments. Records from Murraylands and Riverland, Lake Meretti (TLC record).

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Falco subniger	Black Falcon		R	9 (BDBSA, Birdlife)(1997-2011)	No	Possible in transmission line corridor, wide-ranging. Records from Murraylands and Riverland and Northern and Yorke.
Melithreptus gularis gularis	Black-chinned Honeyeater (south eastern subspecies)		Ssp V	1 (2006)	No	Unlikely within transmission line corridor. Records are primarily around MLR, Fleurieu Peninsula and South East SA. Uncommon across it's range, prefers rough-barked eucalypt in dry forest or woodlands and River Red Gums along watercourses.
Oxyura australis	Blue-billed Duck		R	50 (BDBSA and Birdlife) (1999-2016)	No	Unlikely in the transmission line corridor, possible in water habitats adjacent the transmission line corridor. Wholly aquatic species, inhabits deep freshwater wetlands. Records in the ESA are from River Murray habitats, within HA 1120, 1544 , Morgan (CP) and Murray River (NP).
Entomyzon cyanotis cyanotis	Blue-faced Honeyeater		R	>100 (BDBSA, Birdlife) (1998-2020)	No	Unlikely in transmission line corridor, possible in adjacent wetland habitats south of transmission line corridor. Primarily occurs in northern and east coast of Australia. Prefers riverine forest, in tropics occurs in rainforest and mangroves. Records in ESA within HA 1544, 1582, Chowilla (GR), Morgan (CP), Morgan (CP), and Murray River (NP).
Neophema chrysostoma	Blue-winged Parrot		V	5 Birdlife, BDBSA) (1998-2009)	1 (Calperum homestead, Birdlife) (2016)	Possible in the transmission line corridor, given record near homestead. Limited recent records in the ESA, 12-24 km from the TLC. Records spread across eastern SA from the north east to the South East, but records concentrated around the SE. Nests in coastal and subcoastal eucalypt forest and woodland, forages on grassland, saltmarsh, rough pasture. Post-breeding dispersal into semi-arid inland areas.
Grus rubicunda	Brolga		V	21 (2004-2011)	No	Unlikely in transmission line corridor, possible in adjacent wetland habitats south of transmission line corridor. Record in the River Murray habitats, Murray River (NP). More common in northern and eastern Australia. Occurs in pairs, family groups or large aggregations around swamps, lagoons, floodplains and coastal mudflats. Will also occur in irrigated fields, crops and saltmarsh.
Coturnix ypsilophora	Brown Quail		V	25 (BDBSA, Birdlife) (2004-2018)	No	Unlikely in transmission line corridor, possible in dense swampy wetland habitats adjacent transmission line corridor. Few records in the ESA, primarily in reserves, Renmark waste treatment ponds and along River Murray within HA 1120 and HA 1544, duplication of records at several sites from regular riverine surveys. Birdlife records 10-24 km from TLC. Occurs in tall vegetation or grass, ferns, in damp swampy areas around wetlands

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Burhinus grallarius	Bush Stonecurlew		R	>150 (Birdlife, BDBSA) (2003-2020)	4 (2005-2010)	Likely in transmission line corridor. Numerous records concentrated in wetland areas adjacent transmission line corridor within Chowilla Game Reserve, and HA 1544, although outside known range, more common in northern Australia, tropics. Occurs in pairs or singly, in grassy woodlands, open forests and grasslands pasture.
Cereopsis novaehollandiae (NC)	Cape Barren Goose		R	4 (2017)	No	Unlikely. Limited records in the region. Records in ESA primarily in riverine habitats, Murraylands and Riverland. In SA more broadly from coastal areas, Coorong and offshore islands.
Cinclosoma castanotum	Chestnut-backed Quailthrush (Chestnut Quailthrush (Eastern subspecies)		R	>300 (BDBSA, Birdlife) (1999-2015)	3 (2000-2005)	Likely in transmission line corridor. Multiple records scattered throughout region in reserves and other areas. Records in HA 1464, 1519, 1543, Chowilla (RR), Cooltong (CP), and Pooginook (CP). Inhabits a variety of semi-arid, scrubby habitats in the Murray Mallee, with sandy substrate (e.g. Mallee over Spinifex). Recorded in SNI surveys (SKM 2002).
Stagonopleura guttata	Diamond Firetail		V	30(1998-2017)	No	Unlikely in transmission line corridor. Records in SA are concentrated along the MLR, in the ESA recent records are around the western end of the transmission line corridor, within HA 1082, 1448, and Hopkins Creek (CP), 9-15 km from the TLC. No records north and south of transmission line corridor. Inhabits drier forests and open grassy woodland (*E. brachycalyx, E. oleosa, Acacia, Callitris*, rocky hills).
Bubulcus ibis coromandus	Eastern Cattle Egret		R	2 (2000, 2004)	No	Unlikely in transmission line corridor, limited regional records. More common in coastal locations, Coorong, Lake Alexandrina.
Neophema elegans	Elegant Parrot		R	17 (BDBSA, Birdlife) (1999-2017)	No	Possible in the transmission line corridor. Recent records in the ESA within Hopkins Creek (CP) and Cooltong (CP). Occurs in a variety of habitats including open woodland, grassland, saltmarsh and rough pasture. Overlaps with Blue-winged Parrot during non-breeding period.
Stictonetta naevosa	Freckled Duck		V	162 (1999-2018) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, possible in adjacent water habitats. Records in ESA primarily in riverine habitats. Records within the HA 1120, 1544, Chowilla (GR), Morgan (CP) and Murray River (NP). Sedentary around permanent freshwater, but dispersive if local conditions are poor, would occur on any large wetland. Breeds in well-vegetated lignum or canegrass swamps.
Petroica phoenicea	Flame Robin		V	1 (2000)	No	Possible. 1 Birdlife record 22 km from the TLC. Core range is southeastern SA an eastern NSW most of Victoria. Proposed alignment

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
						occurs is irregular range. Habitat is present that would be used by the species, open forest woodland, farmland grasslands, burnt areas.
Pachycephala inornata	Gilbert's Whistler		R	62 (BDBSA, 114 Birdlife) (1995-2017)	No	Likely in the transmission line corridor. Multiple recent records across the ESA. Records concentrated within Calperum (HA 1544), Chowilla (GR), Cooltong (CP), Hogwash Bend (CP), Morgan (CP), Murray River (NP) and White Dam (CP). Occurs in a wide range of habitats, dry scrub and woodland and open *Callitris* woodland *Acacia* thicket.
Plegadis falcinellus	Glossy Ibis		R	>30 (1997-2018) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, possible in adjacent habitats. Records in the ESA are concentrated in riverine habitat within the Chowilla (GR), Morgan (CP) and the Murray River (NP). Inhabits shallow fresh water, roosts in trees near water, sometimes in large flocks.
Podiceps cristatus	Great Crested Grebe		R	40 (1999-2016) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, possible in adjacent habitats. Records in the ESA are concentrated in riverine habitats. Records in HA 1120, 1544 and Murray River (NP). Breeds on freshwater wetlands with open water and aquatic vegetation, will also congregate on large saline lakes and sheltered coastal waters.
Melanodryas cucullata cucullata	Hooded Robin (SE, MM, MLR, AP, YP, MN)		R	>200 (1995-2019 (BDBSA, Birdlife))	3 (2001-2012)	Likely within transmission line corridor. Records scattered from just north of western end of transmission line corridor to the South East of SA. ESA records within the HA 1120 1464, 383, 958, Moorook (GR), Pooginook (CP), and White Dam (CP). Occurs in lightly timbered habitats (e.g. *E. oleosa, E socialis, E gracilis*), *Casuarina pauper*, Myoporum montanum shrubland, Callitris woodlands) and *Acacia nyssophylla* shrublands (DEWNR Fauna spreadsheet 2016). Recorded in SNI surveys (SKM 2002).
Microeca fascinans	Jacky Winter		R (ssp) / NA	218 (BDBSA), 451 (Birdlife)(1996-2017)	8	Likely. Recorded in SNI surveys (SKM 2002). Multiple records within ESA and records within TL. Note rating is for subspecies *M.f. fascinans.* However, alignment is in range of the common species, so records are more likely *M.f. assimilis.*
Hieraaetus morphnoides	Little Eagle		V	>90 (1997-2017) (BDBSA, Birdlife)		Possible in transmission line corridor, possible in adjacent wetland habitats. Records in the ESA within HA 1120, 1582, 1582, Chowilla (GR), Maize Island Lagoon (CP), Morgan (CP), Murray River (NP) and White Dam (CP).
Egretta garzetta	Little Egret		R	>30(1999-2016) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, possible in adjacent wetland habitats. Records in the ESA primarily along the River Murray and in

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
						wetland areas in primarily in Riverland and Murraylands. Records at Lake Meretti.
Philemon citreogularis citreogularis	Little Friarbird		R	>240 (1997-2018) (BDBSA, Birdlife	No	Unlikely in the transmission line corridor, possible in water habitats adjacent. Records in the ESA are concentrated to the south of the transmission line corridor in riverine habitats within HA 1544, 1582, Chowilla (GR), Morgan (CP) and Murray River (NP), Renmark Caravan Park. Inhabits a wide range of forest and woodlands, but common in riverine forest, coastal communities and mangroves.
Sternula albifrons	Little Tern		E	2 (2011)	No	Unlikely in transmission line corridor, low possibility in adjacent water habitats. SA records concentrated in coastal areas. Recent limited records in the ESA are from riverine habitats near Waikerie in the in Riverland and Murraylands. Preferred habitat is oceanic waters, sandy beaches.
Calidris subminuta	Long Toed Stint		R	1 (1995)	No	Unlikely in transmission line corridor. Records in the ESA in the Riverland and Murraylands.
Anseranas semipalmata	Magpie Goose		E	1 (2007)	No	Unlikely in transmission line corridor. Records in the ESA within the Murray River (NP).
Lophochroa leadbeateri	Major Mitchell		R	22 (1999-2008)	1 (1999)	Likely. Given transmission line corridor is within species range, likely in semi-arid mallee Mulga habitats. Records in Chowilla (RR), Calpernum Station, within the Riverland and Murraylands. Known from the South Olary Plains survey in tall mallee (Carpenter 2002).
Biziura lobata	Musk Duck		R	>200 (1999-2018) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, likely in water habitats adjacent transmission line corridor. ESA records are near the River Murray and wetlands adjacent to the transmission line corridor including HA 1120, 1544, Chowilla (GR), Morgan (CP) and Murray River (NP).
Oriolus sagittatus sagittatus	Olive-backed Oriole		R	12(1996-2014)	No	Unlikely in the transmission line corridor. Few records in the ESA. Mostly occurs in northern Australia in eucalypt open forest and woodland, rainforest edges, riparian and coastal vegetation.
Turnix varius	Painted Buttonquail		R	11 (2000-2017) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor. Records in SA are concentrated in the southern Lofty Ranges, MLR and across the South East. Few records in the ESA are west of the transmission line corridor and within HA 1448 and 1520. Occurs in drier eucalypt forest and woodlands with deep leaf-litter and sparse understorey of grass, small shrubs and fallen timber.

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Falco peregrinus	Peregrine Falcon		R	75 (1996-2018) (BDBSA, Birdlife)	No	Likely in transmission line corridor. Records scattered across ESA and within the 1093 (HA), 1093 (HA), 1582 (HA), 655 (HA) and Morgan (CP). Inhabits most environments, prefers cliff face for nesting. Inhabits most environments, prefers cliff face for nesting. Wide ranging, preys on bids particularly parrots, pigeons, waterfowl, starlings and small seabirds.
Ardea intermedia plumifera	Plumed Egret		R	98 (1999-2018) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, but has potential in nearby water habitats. Records in the ESA within HA 1120, Loch Luna (GR), and Murray River (NP).
Lichenostomus cratitius occidentalis	Purple-gaped Honeyeater (mainland SA)		R	15 (2000-2012) (BDBSA, Birdlife)	No	Possible in transmission line corridor, although little known, uses tall heath / mallee habitats. Records are primarily south of the transmission line corridor and concentrated in conservation areas of the Murray (Billiat Wilderness Area) and South East (Messent CP). ESA records are within HA 1120, 1543 ,1544 , 1582 , 448 , Chowilla (GR), Loch Luna (GR), Moorook (GR), Morgan (CP), and Murray River (NP). Known *from E. socialis, E. incrassata, E. oleosa, E. leptophylla* (DEWNR Fauna spreadsheet 2016).
Myiagra inquieta	Restless Flycatcher		R	195 (1996-2019) (BDBSA, Birdlife)	20 (2001) (Birdlife)	Possible in the transmission line corridor. Records scattered across the region from north of the transmission line corridor to the MLR, Fleurieu and Southeast and within HA 1543 and the Murray River (NP). Widespread in open eucalypt woodland, treed farmland and mallee (e.g. *E. gracilis, E. oleosa, E. socialis, E. brachycalyx*). Recorded in SNI surveys (SKM 2002).
Arenaria interpres interpres	Ruddy Turnstone	M	R	2 (1995)	No	Unlikely in transmission line corridor. Records in the ESA in the Stockyard Plain Disposal Basin within the Riverland and Murraylands.
Petroica boodang boodang	Scarlet Robin (SE, MLR, FR, EP)		R	>40 (1998-2018) (BDBSA, Birdlife)	No	Possible. Records in SA are concentrated in the MLR / Fleurieu region, KI and scattered across the SE. Records in the ESA are concentrated west of the transmission line corridor in the Tothill Ranges within HA 1082, 1093, 1448 and 655. Occurs in open sclerophyll forest and woodland.
Neophema splendida	Scarlet-chested Parrot		R	12 (2000-2016) (BDBSA, Birdlife)	No	Possible in the transmission line corridor. Recent records in the ESA in habitats near the River Murray and habitats north of the transmission line corridor (e.g. Gluepot and Dangalli WA / CP) within HA 1543 and Pooginook (CP). Prefers arid mallee and Acacia woodland with low shrub understorey or recently burnt areas, feeds on ground in low vegetation.

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Calamanthus (Hylacola) cauta cauta	Shy Heathwren (EP, MM, upper SE, YP, FR)		R	>50 (1995-2012) (BDBSA, Birdlife)	4 (2000-2001) (BDBSA, Birdlife)	Possible in transmission line corridor. Most records in Chowilla (RR), Pooginook (CP) and White Dam (CP). Uncommon species that occurs in dense understory, including regrowth. Possible in Black Oak Woodland, dense mallee. Recorded in SNI surveys (SKM 2002).
Acanthiza iredalei iredalei	Slender-billed Thornbill (Western)		Ssp (R)	3 (2010) (BDBSA, Birdlife)	No	Possible, limited records, some habitat, most of SA range is Eyre Peninsula and Far west in Chenopod and Samphire habitat. Records are 5 km NW of Cadell Lagoon (2km from TLC), and 5 km from TLC. Not recorded in SNI surveys or recent surveys (SKM 2002, Nature Advisory 2021). However some suitable habitat at the western end (e.g. 10 km west White Dam CP), Powerline Road.
Amytornis striatus	Striated Grasswren		R	>140 (1996-2012) (BDBSA, Birdlife)	No	Possible in transmission line corridor, known from Murray Mallee region. ESA records are mostly concentrated around Cooltong CP and Pooginook CP, north of Old Calperum and also within HA 1543 and 1544. Known to occur in Cooltong-Calperum region where Triodia is extensive in association with *E. socialis* and *E. cyanophylla* open scrub and recorded in Cooltong CP during SNI surveys (SKM 2002). Considered in recent targeted fauna surveys, given subspecies Mallee Striated Grasswren (*Amytornis striatus striatus*) has potential to be EPBC listed in the future. Was once widespread in the centre part of the transmission line corridor (Taylorville, Hawks Nest and Calperum Stations). Species not located during targeted assessments and considered to be declining in the region (Nature Advisory 2019).
Zapornia tabuensis	Spotless Crake		R	25 (1999-2014) (BDBSA, Birdlife)	No	Unlikely in transmission line corridor, possible in wetland habitats. Records in the ESA in the Morgan (CP) and Murray River (NP) within the Riverland and Murraylands.
Lophoictinia isura	Square-tailed Kite		E	1 (Birdlife) (2012	No	Possible. Limited records, but is wide ranging and suitable habitat would occur. Alignment is in irregular occurrence range, not core range.
Plectorhyncha lanceolata	Striped Honeyeater		R	>670 (1996-2018) (BDBSA, Birdlife)	3 (2003, 2015) (Birdlife)	Likely in the transmission line corridor. Records in the ESA concentrated along River Murray habitats conservation areas north and south of the transmission line corridor and also within HA 1543, 1544, 1582 , Chowilla (GR), Cooltong (CP), Murray River (NP) and Pooginook (CP). Inhabits tall open woodlands, (e.g. *E. gracilis, E. oleosa, E. incrassata, E. socialis), Acacia, Allocasuarina, Callitris* and open mallee. Recorded in SNI surveys (SKM 2002).

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Gerygone fusca	Western Gerygoyne		R	2 (Birdlife) (2005, 2003)	No	Unlikely in the TLC. Proposed alignment is outside range, limited range in SA. Occurs in drier regions, Eucalypt forest, Acacia dominated woodlands. Records are 7-22 km from the TLC.
Haliaeetus leucogaster	White-bellied Sea Eagle	LM	E	26 (2004-2016) (BDBSA, Birdlife)	No	Possible in transmission line corridor. Most known nesting pairs occur along the coastlines of Australia; in SA nesting sites area coastal SA (e.g. Eyre Peninsula, Kangaroo Island) (Dennis et al. 2011, Menkhorst 2017). Records in ESA are primarily from riverine environments, or flying over adjacent habitats within the Chowilla (GR) and Murray River (NP). Considered as possible to occur foraging in riverine environments and habitats adjacent the transmission line corridor.
Climacteris affinis superciliosa	White-browed Treecreeper (FR, LNE, MM)		R	8 (2007-2019) (BDBSA, Birdlife)	1 (2000) (Birdlife)	Possible in transmission line corridor. Records in northern part of ESA and beyond, primarily in Moorook area. Prefers semi-arid woodlands, tall shrublands, Mulga, Native Pine and Sheoak, uncommon in eucalypt woodlands. Known to occur in the Blackoak Woodlands of Chowilla Station near the NSW border not recorded in SNI surveys (SKM 2002 or mallee bird report (Nature Advisory 2021).
Corcorax melanorhamphos	White-winged Chough		R	>490 (1999-2019) (BDBSA, Birdlife)	3 (2000, 2018) Birdlife)	Likely in transmission line corridor. Records spread across the ESA. Records adjacent and in transmission line corridor and within HA 1082,1093, 1448, 1511 1543, 1544 , 383, 655, 669, 886, Chowilla (GR), Cooltong (CP), Hopkins Creek (CP), Mimbara (CP), Morgan (CP), Murray River (NP), and Pooginook (CP). Occurs in open forest, woodland, mallee here understorey is sparse and leaf litter is productive. Conspicuous mudbowl nest, occurs in family groups (5-20 birds). Recorded in SNI surveys (SKM 2002).
Mammals						
Chalinolobus picatus	Little Pied Bat		E	2 (2006)	No	Possible in Riverland Biosphere Reserve habitats. Although few records in the ESA, records in SA are primarily from Riverland Biosphere Reserve (northern Calperum Station) in the Chowilla (RR), which is at the southwestern extent of the range. Roosts in trees, caves, abandoned mines and buildings. Roosting trees include *Casuarina pauper*, Mulga, Bloodwoods and large eucalypts. Prefer hollows in large mature trees with dead limbs, or dead fallen trees with hollowed stump. Can roost in small or large colonies and have been known to travel 35 km round trip to foraging sites (Churchill 2008). Possible in E. gracilis to E. oleosa low woodland and / open woodland (SKM 2002).

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
Acrobates pygmaeus	Feathertail Glider		E	1 (2000)	No	Unlikely. Nocturnal, arboreal, nectar feeding species. Limited records in SA and ESA. Occurs in south-eastern Australia, from SE of SA to Vic to NSW. Occurs in rainforest, eucalypt forest and woodlands (Parish 2016). Likely to be one species in the SE and one along the River Murray (Owens and Graham 2009)
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat		R	1 (2008)	No	Possible, but unlikely given few records in SA, one record in ESA. Wide ranging through northern WA, NT, Qld, NSW, Vic and eastern SA. SA census suggests recent records form northern SA and MLR, but not in ESA. Prefers tropical habitats, but also extends into temperate areas. Roosts in large tree hollows or wet and dry sclerophyll forest to open woodland, Acacia shrubland, mallee, grasslands and desert (Churchill 2008).
Reptiles						
Chelodina expansa	Broad-shelled Turtle		V	7 (2003-20018)	No	Unlikely in TLC, possible in adjacent water habitats. River turtle, occurs in permanent streams and waterholes throughout its range (Cogger 2014). Records concentrated along the River Murray. Records in the SA from HA 1582, Morgan (CP), and Murray River (NP).
Emydura macquarii	Macquarie River Turtle		V	23 (2003-2018)	No	Unlikely in transmission line corridor, possible in adjacent water habitats. River turtle, restricted to larger river systems of the Murray-Darling River System (Cogger 2014). Records concentrated along the River Murray. Records in the ESA from Morgan, (CP), Loch Luna (GR) and Murray River (NP).
Morelia spilota	Carpet Python		R	52 (1995-2012)	No	Possible in transmission line corridor, but more likely in adjacent riverine environments. Occurs across multiple habitats from rainforest to semi-arid coastal and inland habitats. Often arboreal, but also lives in burrows made by other animals (Cogger 2014). ESA records in riverine habitats along the River Murray corridor, and within HA 1028, 1544, Chowilla (GR), Maize Island Lagoon (CP), Moorook (GR), Murray River (NP), Murray River (NP), and Ramco Point (CP). Potential vegetation association includes *E. largiflorens* and / or *E. calmaldulensis* woodlands / limestone cliffs (SKM 2002).
Varanus varius	Lace Monitor		R	2 (2003, 2004)	No	Unlikely in transmission line corridor, possible in adjacent riverine environments, very eastern end of transmission line corridor. Range is primarily east coast of Australia from QLD to Victoria, occurs in a variety of habitats (Cogger 2014). Multiple records in riverine habitats along the

Species name	Common name	AUS[1]	SA[1]	Records in ESA (year)[2]	Records in transmission line corridor (year)[2]	Likelihood of occurrence within transmission line corridor
						River Murray corridor, and within HA 1544), Loch Luna (GR) and Riverlands.
Frogs						
Pseudophryne bibronii	Brown Toadlet		R	3 (2005, 2008)	No	Unlikely in TLC. Records in SA are concentrated around the MLR. Records in the ESA are all from a location near the Chowilla homestead and near Brady Creek. Also recorded from *E. calmaldulensis, Myoporum montanum* habitat in Burra Hills Association (DEWNR fauna 2016). Occurs solitarily under rocks and logs in wet and dry sclerophyll forest, breeding congregations occur in inundated grassy areas beside gutters, small creeks, alpine grasslands and mossy bogs.

Note where there are large numbers of records there is potential for duplicate BDBSA / Birdlife records, records have not been checked for duplication, hence conservative numbers are provided

[1] Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory (M)

[2] South Australian National Parks and Wildlife Act 1972 Status: Endangered (E), Rare (R), Vulnerable (V)

[3] Records from Biological Database of South Australia (BDBSA) and Birdlife, Recordset number DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020; records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided; Protected Matters Search Tool (PMST) (species or species habitat potential unless stated, e.g. breeding, Atlas of Living Australia

[4] References generally from Menkhorst et al. 2017, Simpson and Day 2010, Geering et al . 2008, SPRAT profiles, Jacobs preliminary constraints report, Jacobs significant impact assessment

3.3 List of all threatened fauna (including regionally threatened species)

Table 7: Summary of threatened fauna with records in ESA (1995-present, <1km reliability)

Species name	Class	Common name	EPBC Act status	NPW Act status	Regional status
Pseudophryne bibronii	AMPHIBIA	Brown Toadlet		R	
Litoria raniformis	AMPHIBIA	Southern Bell Frog	VU	V	RA
Botaurus poiciloptilus	AVES	Australasian Bittern	EN, M	E	CR
Anhinga novaehollandiae novaehollandiae	AVES	Australasian Darter		R	RA
Spatula rhynchotis	AVES	Australasian Shoveler		R	RA
Ardeotis australis	AVES	Australian Bustard		V	CR
Rostratula australis	AVES	Australian Painted-snipe	EN, M	E	CR
Ceyx azureus azureus	AVES	Azure Kingfisher		E	0

Species name	Class	Common name	EPBC Act status	NPW Act status	Regional status
Cladorhynchus leucocephalus	AVES	Banded Stilt		V	RA
Falco subniger	AVES	Black Falcon		R	RA
Ixobrychus dubius	AVES	Black-backed Bittern (Australian Little Bittern)		E	CR
Melithreptus gularis	AVES	Black-chinned Honeyeater		ssp	CR
Manorina flavigula melanotis	AVES	Black-eared Miner	EN	E	EN
Oxyura australis	AVES	Blue-billed Duck		R	EN
Entomyzon cyanotis cyanotis	AVES	Blue-faced Honeyeater		R	RA
Neophema chrysostoma	AVES	Blue-winged Parrot		V	RA
Antigone rubicunda	AVES	Brolga		V	CR
Coturnix ypsilophora australis	AVES	Brown Quail		V	
Burhinus grallarius	AVES	Bush Stonecurlew		R	CR
Cereopsis novaehollandiae novaehollandiae	AVES	Cape Barren Goose		R	
Hydroprogne caspia	AVES	Caspian Tern	M		RA
Cinclosoma castanotum	AVES	Chestnut Quailthrush (Chestnut-backed Quailthrush)		R	LC
Tringa nebularia	AVES	Common Greenshank	M		CR
Actitis hypoleucos	AVES	Common Sandpiper	M	R	RA
Calidris ferruginea	AVES	Curlew Sandpiper	CR, M	E	
Stagonopleura guttata	AVES	Diamond Firetail		V	EN
Bubulcus ibis coromandus	AVES	Eastern Cattle Egret		R	RA
Pandion haliaetus cristatus	AVES	Eastern Osprey	M	E	CR
Neophema elegans elegans	AVES	Elegant Parrot		R	
Petroica phoenicea	AVES	Flame Robin		V	0
Apus pacificus	AVES	Fork-tailed Swift	M		
Stictonetta naevosa	AVES	Freckled Duck		V	VU

Species name	Class	Common name	EPBC Act status	NPW Act status	Regional status
Pachycephala inornata	AVES	Gilbert's Whistler		R	RA
Plegadis falcinellus	AVES	Glossy Ibis	M	R	RA
Podiceps cristatus australis	AVES	Great Crested Grebe		R	VU
Thinornis cucullatus cucullatus	AVES	Hooded Plover (eastern)	VU	V	
Melanodryas cucullata cucullata	AVES	Hooded Robin (YP, MN, AP, MLR, MM, SE)		R	RA
Microeca fascinans fascinans	AVES	Jacky Winter		ssp	RA
Gallinago hardwickii	AVES	Latham's Snipe	M	R	CR
Hieraaetus morphnoides	AVES	Little Eagle		V	VU
Egretta garzetta nigripes	AVES	Little Egret		R	RA
Philemon citreogularis citreogularis	AVES	Little Friarbird		R	RA
Sternula albifrons sinensis	AVES	Little Tern	M	E	
Calidris subminuta	AVES	Long-toed Stint	M	R	
Anseranas semipalmata	AVES	Magpie Goose		E	
Lophochroa leadbeateri	AVES	Major Mitchell's Cockatoo		R	EN
Leipoa ocellata	AVES	Malleefowl	VU	V	EN
Tringa stagnatilis	AVES	Marsh Sandpiper			CR
Biziura lobata menziesi	AVES	Musk Duck		R	
Oriolus sagittatus sagittatus	AVES	Olive-backed Oriole		R	RA
Pluvialis fulva	AVES	Pacific Golden Plover	M	R	0
Turnix varius varius	AVES	Painted Buttonquail		R	EN
Grantiella picta	AVES	Painted Honeyeater	VU	R	0
Calidris melanotos	AVES	Pectoral Sandpiper	M	R	
Falco peregrinus macropus	AVES	Peregrine Falcon		R	RA
Ardea intermedia plumifera	AVES	Plumed Egret		R	RA

Species name	Class	Common name	EPBC Act status	NPW Act status	Regional status
Lichenostomus cratitius occidentalis	AVES	Purple-gaped Honeyeater (mainland SA)		R	
Pachycephala rufogularis	AVES	Red-lored Whistler	VU	R	CR
Calidris ruficollis	AVES	Red-necked Stint	M		RA
Polytelis anthopeplus monarchoides	AVES	Regent Parrot	VU	V	
Myiagra inquieta	AVES	Restless Flycatcher		R	EN
Arenaria interpres interpres	AVES	Ruddy Turnstone		R	
Myiagra cyanoleuca	AVES	Satin Flycatcher	M	E	
Petroica boodang boodang	AVES	Scarlet Robin		R	CR
Neophema splendida	AVES	Scarlet-chested Parrot		R	EN
Calidris acuminata	AVES	Sharp-tailed Sandpiper	M		RA
Hylacola cauta cauta	AVES	Shy Heathwren (EP, YP, FR, MM, upper SE)		R	
Acanthiza iredalei	AVES	Slender-billed Thornbill		R	DD
Zapornia tabuensis	AVES	Spotless Crake		R	EN
Lophoictinia isura	AVES	Square-tailed Kite		E	CR
Amytornis striatus striatus	AVES	Striated Grasswren		R	VU
Plectorhyncha lanceolata	AVES	Striped Honeyeater		R	NT
Gerygone fusca	AVES	Western Gerygone		R	DD
Haliaeetus leucogaster	AVES	White-bellied Sea Eagle		E	CR
Climacteris affinis superciliosus	AVES	White-browed Treecreeper (FR, LNE, MM)		SP	
Corcorax melanorhamphos	AVES	White-winged Chough		R	RA
Tringa glareola	AVES	Wood Sandpiper	M	R	CR
Manorina flavigula	AVES	Yellow-throated Miner	ssp	ssp	LC
Trichosurus vulpecula	MAMMALIA	Common Brushtail Possum		R	NT

Species name	Class	Common name	EPBC Act status	NPW Act status	Regional status
Nyctophilus corbeni	MAMMALIA	Corben's Long-eared Bat	VU	V	
Acrobates pygmaeus	MAMMALIA	Feathertail Glider		E	DD
Chalinolobus picatus	MAMMALIA	Little Pied Bat		E	
Saccolaimus flaviventris	MAMMALIA	Yellow-bellied Sheath-tailed Bat		R	
Chelodina expansa	REPTILIA	Broad-shelled Turtle		V	RA
Morelia spilota	REPTILIA	Carpet Python		R	NT
Varanus varius	REPTILIA	Lace Monitor		R	NT
Emydura macquarii	REPTILIA	Macquarie River Turtle		V	NT
Tiliqua adelaidensis	REPTILIA	Pygmy Bluetongue	EN	E	EN

[1]Environment Protection and Biodiversity Conservation Act 1999 Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW)

[2] South Australian National Parks and Wildlife Act 1972 Status: Endangered (E), Rare (R), Vulnerable (V)

[3] Regional conservation ratings: Critically Endangered (CE), Endangered (E), Vulnerable (V), Rare (R), Near Threatened (NT), Least Concern (LC) and Data Deficient (DD).

List created from BDBSA records since 1995, with < 1km reliability unless stated otherwise, where transmission line corridor = 500 buffer on proposed alignment, ESA = 25 km buffer on preliminary alignment. Noting that for the vegetation clearance application species records to 5 km will be provided. Records are from BDBSA purchased BDBSA extract DEWNRBDBSA190902-2, September 2019; Recordset number DEWNRBDBSA201201-1, November 2020, Regional record range as per Naturemaps 2020.

4. EPBC Protected Matters Search Tool Results

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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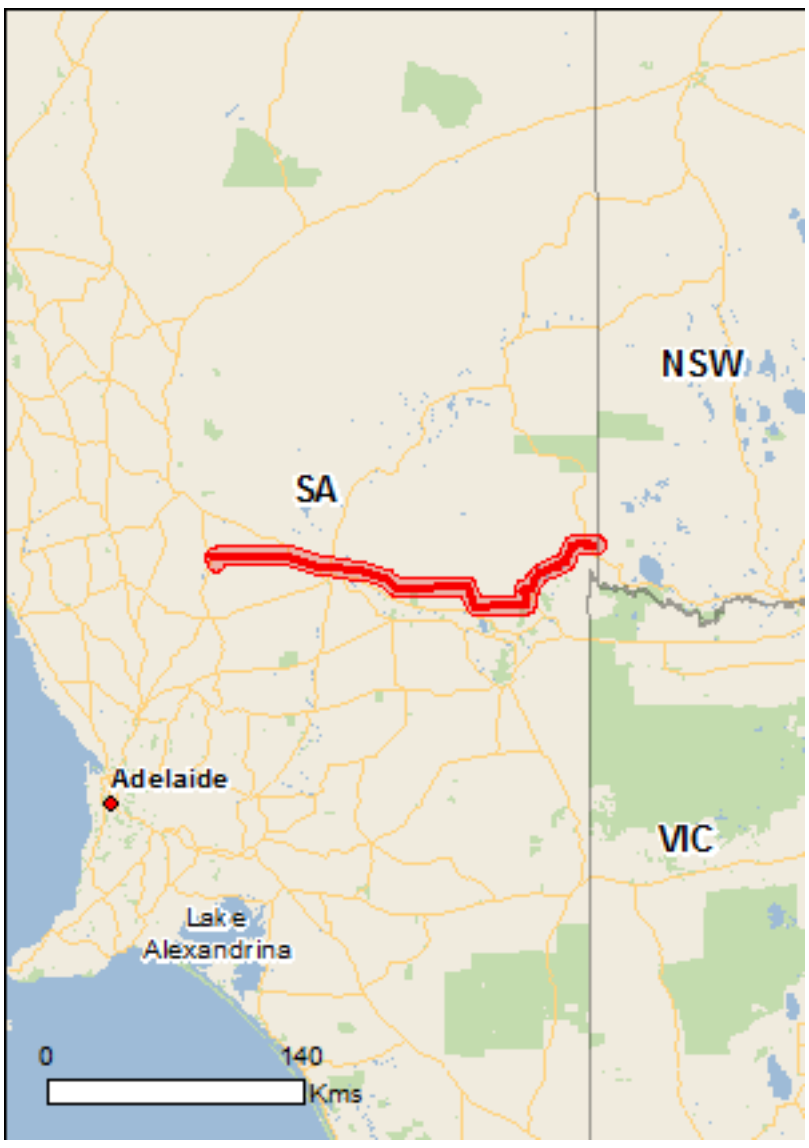

Coordinates

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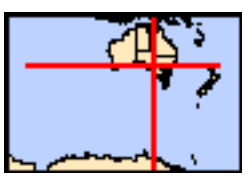

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	31
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	25
Whales and Other Cetaceans:	None
Critical Habitats:	1
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	20
Regional Forest Agreements:	None
Invasive Species:	36
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	Within 10km of Ramsar
Riverland	Within Ramsar site
The coorong, and lakes alexandrina and albert wetland	100 - 150km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Community may occur within area
Iron-grass Natural Temperate Grassland of South Australia	Critically Endangered	Community likely to occur within area
Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia	Critically Endangered	Community likely to occur within area
River Murray and associated wetlands, floodplains and groundwater systems, from the junction with the Darling River to the sea	Approval Disallowed	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Manorina melanotis Black-eared Miner [449]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachycephala rufogularis Red-lored Whistler [601]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Polytelis anthopeplus monarchoides Regent Parrot (eastern) [59612]	Vulnerable	Breeding likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Craterocephalus fluviatilis Murray Hardyhead [56791]	Endangered	Species or species habitat known to occur within area
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat known to occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Plants		
Acacia glandulicarpa Hairy-pod Wattle [8838]	Vulnerable	Species or species habitat may occur within area
Acacia menzelii Menzel's Wattle [9218]	Vulnerable	Species or species habitat may occur within area
Acacia spilleriana Spiller's Wattle [34123]	Endangered	Species or species habitat known to occur within area
Caladenia tensa Greencomb Spider-orchid, Rigid Spider-orchid [24390]	Endangered	Species or species habitat likely to occur within area
Caladenia xantholeuca White Rabbits, Flinders Ranges White Caladenia [55025]	Endangered	Species or species habitat may occur within area
Codonocarpus pyramidalis Slender Bell-fruit, Camel Poison [19507]	Vulnerable	Species or species habitat likely to occur within area
Dodonaea subglandulifera Peep Hill Hop-bush [11956]	Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Olearia pannosa subsp. pannosa Silver Daisy-bush, Silver-leaved Daisy, Velvet Daisy-bush [12348]	Vulnerable	Species or species habitat known to occur within area
Solanum karsense Menindee Nightshade [7776]	Vulnerable	Species or species habitat may occur within area
Swainsona pyrophila Yellow Swainson-pea [56344]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Aprasia pseudopulchella Flinders Ranges Worm-lizard [1666]	Vulnerable	Species or species habitat likely to occur within area
Tiliqua adelaidensis Pygmy Blue-tongue Lizard, Adelaide Blue-tongue Lizard [1270]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Calperum Station
Commonwealth Land - Taylorville Station

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Murray Mallee - Calperum Station and Taylorville Station	SA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Critical Habitats	[Resource Information]
Name	Type of Presence
Manorina melanotis (Black-eared Miner) - Gluepot Reserve, Taylorville Station and Calperum Station, excluding the area of Calperum Station south and east of Main Wentworth Road.	Listed Critical Habitat

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Chowilla	SA
Chowilla	SA
Cooltong	SA
Pooginook	SA
Unnamed (No.HA1060)	SA
Unnamed (No.HA1081)	SA
Unnamed (No.HA1322)	SA
Unnamed (No.HA1337)	SA
Unnamed (No.HA1386)	SA
Unnamed (No.HA1495)	SA
Unnamed (No.HA1511)	SA
Unnamed (No.HA1543)	SA
Unnamed (No.HA1544)	SA
Unnamed (No.HA1570)	SA
Unnamed (No.HA280)	SA
Unnamed (No.HA423)	SA
Unnamed (No.HA448)	SA
Unnamed (No.HA476)	SA
Unnamed (No.HA727)	SA
White Dam	SA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Austrocylindropuntia spp. Prickly Pears [85132]		Species or species habitat likely to occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Riverland Wetland Complex	SA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.955136 139.126317,-33.951036 139.125939,-33.937005 139.1205,-33.933996 139.119344,-33.931871 139.131418,-33.928271 139.143256,-33.927267 139.149343,-33.92775 139.154593,-33.927721 139.170452,-33.927722 139.17196,-33.928055 139.185765,-33.927979 139.187382,-33.927935 139.201472,-33.92777 139.378863,-33.92771 139.408497,-33.927693 139.414559,-33.927665 139.426,-33.927609 139.444262,-33.927524 139.476047,-33.971146 139.643156,-33.97109 139.674773,-33.987694 139.831857,-33.987697 139.831856,-33.987709 139.832001,-33.99772 139.873832,-34.016348 139.951566,-34.019693 139.965512,-34.057217 140.016055,-34.056796 140.053055,-34.056596 140.053478,-34.052546 140.361296,-34.052549 140.361296,-34.133457 140.406164,-34.131181 140.541318,-34.131216 140.541545,-34.131238 140.541854,-34.131002 140.555687,-34.130878 140.566059,-34.130647 140.577124,-34.129886 140.624941,-34.129856 140.625832,-34.129341 140.655652,-34.129339 140.656959,-34.129318 140.657077,-34.129307 140.657096,-34.129117 140.657142,-34.088777 140.657038,-34.087279 140.657088,-34.085469 140.657739,-34.085417 140.657735,-34.072686 140.643751,-34.071483 140.642479,-34.064016 140.646933,-34.063944 140.658457,-34.060351 140.662645,-34.05903 140.665024,-34.059403 140.674001,-34.060726 140.677825,-34.059879 140.679151,-34.058638 140.679277,-34.056865 140.680705,-34.041255 140.68682,-34.040161 140.687249,-34.034213 140.691199,-34.027667 140.69865,-34.019573 140.706207,-34.019287 140.706491,-34.012847 140.713362,-34.011605 140.714706,-34.011296 140.715042,-34.011202 140.715135,-34.011097 140.715228,-34.010665 140.715536,-34.003434 140.720053,-34.003196 140.720213,-34.00288 140.720484,-34.002588 140.720779,-34.002393 140.721022,-34.002234 140.72126,-34.002038 140.721615,-34.001836 140.72213,-34.00161 140.722771,-34.001299 140.723699,-34.00109 140.724352,-34.000963 140.724859,-34.000571 140.726894,-34.000474 140.727317,-34.000428 140.727492,-34.000364 140.727682,-34.000231 140.727983,-33.999322 140.729707,-33.999141 140.73005,-33.998912 140.730498,-33.998717 140.730921,-33.998405 140.731656,-33.986068 140.764076,-33.985917 140.764433,-33.980045 140.779829,-33.975635 140.791364,-33.969318 140.807921,-33.96863 140.809726,-33.963597 140.822807,-33.957866 140.837593,-33.955119 140.844549,-33.954771 140.845374,-33.954545 140.845813,-33.954363 140.846075,-33.954067 140.846422,-33.946311 140.853804,-33.946174 140.853928,-33.946107 140.853973,-33.945971 140.854044,-33.945805 140.8541,-33.944432 140.854406,-33.94193 140.854951,-33.941476 140.85508,-33.941233 140.855181,-33.940902 140.855326,-33.939135 140.856125,-33.934035 140.858494,-33.933788 140.858588,-33.931842 140.859511,-33.931842 140.859511,-33.931842 140.859511,-33.928685 140.86137,-33.890708 140.880248,-33.886169 140.883407,-33.883271 140.887767,-33.881212 140.921819,-33.881225 140.951136,-33.885012 140.959467,-33.884993 140.959681,-33.882927 140.982171,-33.882818 140.983622,-33.882755 140.985134,-33.882708 140.986735,-33.882716 140.988488,-33.882736 140.989598,-33.882775 140.990549,-33.882803 140.991101,-33.882866 140.992134,-33.88397 141.002812

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-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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EIS Volume 2 Appendix I-2

Vegetation Assessment Summary

JBS&G

project energy connect

EnergyConnect

Vegetation Assessment Summary

ElectraNet

29 March 2021

Jacobs

Project EnergyConnect

Vegetation Assessment Summary

Final | 0

25 March 2021

ElectraNet

409545

Document history and status

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B	05.12.19	Final Internal Draft	L Clive	S Croft	N Bull	N Bull
D	24.02.21	Addition of Jan 2021 BAM sites	S Croft	Z Bull	N Bull	Z Bull
F	23.0.21	Edits, consistency, appendices, maps	Z Bull	Z Bull	N Bull	Z Bull

Distribution of copies

Revision	Issue approve	Date issued	Issued to	Comments
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0	Z Bull	25.03.21	JBSG (for ENet)	Final issued to client

Project EnergyConnect

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Executive Summary

Project EnergyConnect has been proposed to strengthen the national electricity transmission network by providing a high voltage connection between South Australia and New South Wales. A number of investigations have been undertaken to understand the existing environment traversed by the alignment, so that potential impacts and risks as a result of the project can be better understood.

Jacobs was engaged by ElectraNet (and their project partner JBSG) to undertake assessment of native vegetation along the proposed alignment, between Robertstown substation and the SA-NSW state border. The assessment was undertaken in order to describe the existing vegetation associations present, and the condition of the vegetation. This report contains vegetation descriptions consolidated from four separate field surveys conducted along the length of the alignment between November 2018 and January 2021, along with Bushland Assessment Method (BAM) data for each site surveyed. The results of the four field surveys are summarised here and provide a comprehensive description of the native vegetation present along the alignment that will be used to inform parts of the project environmental impact assessment, as well as support a native vegetation clearance application associated with construction of the transmission line. This report is not intended to comprise an assessment of the area of clearance within each vegetation assemblage as a result of the proposed project, or to represent an impact assessment.

In total, 94 vegetation sites were assessed along the alignment, comprising 7 Bushland Condition Monitoring communities (13 sub-communities). Vegetation condition at the western end of the alignment was generally low (with cleared agricultural paddocks and heavily grazed shrublands subject to prolonged drought), as was vegetation at the far eastern end (due to prolonged drought, and disturbance within road reserves). Condition of vegetation within large patches of old growth Mallee found in the central portion of the alignment was of better condition, as portions of these areas are within land managed for conservation and contain intact remnant vegetation.

The alignment runs through White Dam Conservation Park, and adjacent to boundaries of other Conservation Parks including Pooginook and Cooltong. Calperum and Taylorville stations also represent substantial areas of land managed for conservation along the alignment; boundaries of these stations are also traversed.

No Threatened Ecological Communities (TECs) were identified along the alignment on any of the four surveys, during mobilisation between survey sites, or at any of the 94 BAM sites.

One Nationally threatened flora species (*Dodonaea subglandulifera*, Peep Hill Hopbush) was found along the current alignment. An estimated 50 – 100 individuals were recorded within an area of about 0. 5 ha, associated with rocky slopes and gullies near the western end of the alignment. Four existing database records of Peep Hill Hopbush, within 2 km of the alignment, suggest that this species may be widely scattered in this locality. These plants occur on the edge of the extent of an important known 'Robertstown' subpopulation for the species; includes over 5000 plants at 5 locations north to northeast of Robertstown (Moritz and Bickerton 2010).

One Rare state threatened flora species was recorded (*Geijera parviflora*) at two survey sites of mallee vegetation, in the western third of the project area, and approximately 1 km north of the current alignment, outside the transmission line corridor. One Rare state threatened fauna species (*Corcorax melanorhamphos*, White-winged Chough) was sighted at site 5a during the November 2018 survey and sites 3b and 4b during the June 2019 survey, within small isolated patches of remnant mallee vegetation.

There were two Declared weed species identified along the alignment: *Marrubium vulgare* (Horehound) and *Lycium ferocissimum* (African Boxthorn) which is also a Weed of National Significance (WoNS).

1. Introduction

Project EnergyConnect (the Project) is a high capacity electricity transmission line proposed to provide connection between the South Australian (SA) and New South Wales (NSW) electricity transmission networks, and to ultimately improve the stability of the national electricity grid. ElectraNet propose to develop the EnergyConnect line between the Robertstown substation and the SA-NSW border. From there, TransGrid will develop the line from the SA-NSW border through to the Buronga sub-station, and then ultimately to Wagga Wagga in NSW. This report concerns only the South Australian component of the project, from Robertstown to the SA-NSW border.

The Project is being assessed via an Environmental Impact Statement (EIS) where environmental impacts and risks which will arise, or may potentially arise, from the project are being considered. In addition, native vegetation within SA is protected under the *Native Vegetation Act,* 1991, and approval under this legislation will be required for any clearance of, or disturbance to, native vegetation along the alignment. As part of the project approval requirements, Jacobs were engaged by ElectraNet to undertake vegetation assessments along the proposed route of the EnergyConnect alignment within SA, in order to understand the extent, type, condition, habitat and landscape values of native vegetation along the alignment. The outcomes of these assessments are summarised in this report.

As planning for Project EnergyConnect progressed, constraints (environmental, social) along the alignment were identified and better understood, and a number of changes to the alignment were made over time to avoid high value areas or particular constraints. As a result, four separate field assessments of vegetation associations within the Project area were conducted between November 2018 and January 2021, covering preferred and alternative alignment options (at the time of assessment), as the route was refined over time. This report summarises vegetation type and condition, and threatened fauna habitat potential, along the January 2021 Project alignment, as well as from sites within the broader Project area which are considered representative of vegetation associations which are traversed by the alignment.

1.1 Study Objectives

The objective of this report is to provide baseline vegetation data along the length of the Project EnergyConnect 2021 alignment. To align with the requirements of the *Native Vegetation Act,* 1991, for clearance approval, the Bushland Assessment Method (BAM) (DEW 2020) was used for the site surveys, covering all major habitats present along the proposed alignment. Four separate field surveys were conducted as the alignment was refined over time and this report presents a summary of the vegetation described across those four assessments.

This report does not intend to calculate or consider the extent of impacts to vegetation as a result of Project EnergyConnect. The impact assessment will be undertaken in both the EIS for the Project and as part of the assessment to clear vegetation under Regulations to the *Native Vegetation Act*, 1991. These assessments will draw upon the BAM data collected and presented here.

1.2 Study Constraints

The surveys were conducted over a period of approximately two years (November 2019 to January 2021). The first three surveys conducted were undertaken during prolonged drought conditions in South Australia. As a result, the condition assessment of these sites, represented by the species detected and the site conditions reported, is likely to be at the lower end of long-term ranges in condition variability.

2. Methods

2.1 Initial Desktop Review

An initial desktop review was undertaken prior to each field mobilisation, to achieve the following:

- Review of aerial imagery to identify target survey locations along the alignment, to achieve good coverage of existing remnant vegetation and all major vegetation types, geographically, and within land access constraints (including existing tracks)
- Review of fire history data to identify target survey locations along the alignment, to achieve coverage across different fire classes (particularly relevant within the 'mallee habitat' towards the eastern extent of the alignment, within and around Calperum and Taylorville stations)
- Review of threatened species data (flora and fauna, as well as ecological communities) to determine prior to field mobilisation the potential threatened species (and ecological communities) which may be present along the alignment, to assist with focused searches in relevant areas for these species or their habitats. Data reviewed includes:
    - Biological Databases of South Australia (BDBSA) data via data request procedures
    - Environmental Protection and Biodiversity Conservation Act Protected Matters database, via the online search tool (PMST).

2.2 Field Assessments

Vegetation assessments were conducted along the preferred alignment routes (as at the time of survey) to classify the different vegetation associations present along the alignment and to gather field data about the vegetation condition and presence of potential habitat for threatened species. The field assessments were undertaken using the Bushland Assessment Method (BAM) outlined by DEW (2020) which assesses vegetation condition, landscape and conservation values by collecting field data on a variety of condition and habitat attributes. Four surveys were undertaken between November 2018 and January 2021, with each survey assessing vegetation at multiple sites along the length of the alignment. Surveys 2 – 4 aimed at filling in gaps in vegetation types surveyed as a result of previously inaccessible areas, and/or surveyed new alignments. In chronological order:

- Survey 1: 19-22 November 2018 (20 sites)
- Survey 2: 3-7 June 2019 (29 sites)
- Survey 3: 28-30 October 2019 (29 sites)
- Survey 4: 6 – 8 January 2021(16 sites)

Land access agreements for the surveys were negotiated by ElectraNet (and JBSG on behalf of ElectraNet) prior to entering any private land. All landholder requirements or requests were adhered to during the surveys (e.g. meeting land holder prior to undertaking work, phoning ahead before entering properties, using particular track).

2.2.1 Vegetation Classification

At each BAM survey site, an area of approximately one hectare, the vegetation association present was named based on a combination of: the dominant overstorey species, their height and projective foliage cover, and using the vegetation structural formation classification system in Heard and Channon (1997) (**Table 2-1**). For each BAM survey site, the corresponding Bushland Condition Monitoring Community (BCM) (BCM 2009a) was assigned.

A BCM community is an aggregate of vegetation associations with similar vegetation structural elements and flora richness, and which occur on similar landforms and rainfall zones. Hence a BCM community will provide habitat for a similar suite of fauna species. In determining the BCM community for each BAM survey site, it is the pre-European vegetation community thought most likely to have occurred on the site which is assigned. The potential habitat suitability of a BAM site will also be influenced by the condition of that site, at the time of survey.

Table 2-1: Vegetation Structural Formations (from Heard and Channon 1997)

LIFE FORM/ HEIGHT CLASS	PROJECTIVE FOLIAGE COVER OF TALLEST STRATUM			
	Dense (70-100%)	Mid-dense (30-70%)	Sparse (10-30%)	Very sparse (<10%)
Trees > 30m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10-30m	Closed forest	Open forest	Woodland	Open woodland
Trees 5-10m	Low closed forest	Low open forest	Low woodland	Low open woodland
Trees <5m	Very low closed forest	Very low open forest	Very low woodland	Very low open woodland
Mallee (>3m)	Closed mallee	Mallee	Open mallee	Very open mallee
Low Mallee (<3m)	Closed low mallee	Low mallee	Open low mallee	Very open low mallee
Shrubs > 2m	Tall closed shrubland	Tall shrubland	Tall open shrubland	Tall very open shrubland
Shrubs 1-2m	Closed shrubland	Shrubland	Open shrubland	Very open shrubland
Shrubs < 1m	Low closed shrubland	Low shrubland	Low open shrubland	Low very open shrubland
Mat plants	Closed mat plants	Mat plants	Open mat plants	Very open mat plants
Hummock grasses	Closed Hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland
Tussock grasses	Closed (tussock) grassland	(Tussock) grassland	Open (tussock) grassland	Very open (tussock) grassland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Ferns	Closed fernland	Fernland	Open fernland	Very open fernland

2.2.2 Vegetation Condition Score

The BAM datasheet provides a single, numerical 'Vegetation Condition Score' for each site assessed. This score represents an amalgamation for all of the vegetation condition attributes assessed, such as species diversity, structural diversity, weed threat rating, tree health and density. Vegetation Condition Scores were calculated for each of the survey sites assessed.

Each BAM Vegetation Condition Score (numerical) was then assigned to one of four qualitative condition categories (Very Low, Low, Medium, and High) to enable a means of summarising data, and to visually present vegetation condition along the alignment (**Table 2-2**). Scores assigned to Condition Categories were based on the BAM condition graphs (within the BAM electronic score sheet).

Table 2-2: Vegetation Condition Scores and corresponding Vegetation Condition Ratings

Vegetation Condition Category	BAM Vegetation Condition Score
Very Low	< 20
Low	20-35
Medium	36-55
High	> 55

2.2.3 Weeds

Declared weeds are plants that are regulated in South Australia under the *Landscape South Australia Act* 2019 with regards their movement, sale and control. At a National level, 32 Weeds of National Significance (WoNS) have been agreed upon by Australian governments based on their invasiveness, potential for spread and environmental, social and economic impacts (Australian Government 2021). The WoNS were selected as their control requires coordination among all levels of government, organisations and individuals with weed management responsibilities.

At each BAM survey site, any Declared weeds and/or Weeds of National Significance (WoNS) present, were included in the BAM datasheet, contributing to the overall Vegetation Condition Score.

2.3 Follow-up Desktop Components

2.3.1 Relative Unit Biodiversity Scores

The BAM considers the biodiversity value of each patch of vegetation assessed, through the calculation of 'Unit Biodiversity Scores' (UBS). The UBS build on the vegetation conditions scores by considering the conservation significance of the patch as well as the landscape context, and is part of the overall calculation of offset requirement for cleared vegetation. This work is ongoing and will be refined/completed once final disturbance footprints are known.

To calculate a 'relative' unit biodiversity score for each site assessed, a standard 1 ha site size is applied to each BAM data sheet. Desktop data of EPBC Act and state listed threatened species is applied to each site to review historic records of conservation significant species relevant to each site. The relative unit biodiversity scores calculated provides an indication of the relative difference between sites along the alignment.

It is noted that the patch size, and area of impact from the EnergyConnect project will impact the total biodiversity scores relevant to the native vegetation clearance application, but these are not considered here.

Summaries of UBS relative to the total length of corridor mapped to each BAM sheet will be provided in the NVC data report clearance application (Appendices). Summaries of associated UBS scores for broad habitat types are also provided in that document.

2.3.2 Habitat Comments

High level fauna assessments have been undertaken to inform BAM scoresheets and Unit Biodiversity Score calculation which are used for Significant Environmental Benefit offset calculations. Preliminary examples of species that may use the vegetation with the transmission line corridor as habitat are provided under each broad habitat type (Section 3.2 below). Further assessment was undertaken to inform BAM scoresheets, with approval from the Native Vegetation Management Unit (e.g. fauna listed as 'known to occur' in PMST outputs, fauna with records within 5 km of the habitat type / BAM sites as per NVC 2020b). For further detail refer NVC data report for EnergyConnect.

3. Field Results

Field assessments of vegetation associations along the proposed alignment route (as well as previously proposed alignment options) were undertaken across four field surveys. Data was collected to characterise the vegetation types along the alignment, and to identify at a high level any potential habitat for threatened species.

Vegetation was characterised at a total of 94 BAM sites across the four separate field surveys undertaken between November 2018 and January 2021. The breakdown of sites per survey is as follows:

- Survey 1: November 2018: 20 sites (numbers sites 1a - 20a)
- Survey 2: June 2019: 29 sites (numbered sites 1b - 29b)
- Survey 3: October 2019: 29 sites (numbered sites 1c - 29c)
- Survey 4: January 2021: 16 sites (numbered 101 – 117)

The location of the field survey sites in relation to the proposed alignment is shown on **Figure 3-1**.

3.1 Vegetation Communities

A total of 13 Bushland Condition Monitoring Vegetation Sub communities were identified along or near the alignment from the 94 BAM sites. A summary of the sub communities identified is provided below and in **Table 3-1**.

- MDBSA 1.1 Open Woodland with arid adapted shrubland on limestone
- MDBSA 1.2 Tall Shrubland with open arid adapted understorey on limestone Plains
- MDBSA 2.1 Open Mallee / Low Open Woodland with chenopod shrub understorey
- MDBSA 2.2 Chenopod open shrublands
- MDBSA 3.1 Mallee with very open sclerophyll / chenopod shrub understorey
- MDBSA 3.2 Mallee with open sclerophyll & chenopod shrub understorey on calcareous loams of flats/ swales
- MDBSA 4.1 Mallee with open shrub understorey on tall red-sand dunes or deep sand flats
- MDBSA 4.2 Mallee with understorey dominated by *Triodia* on moderate / low sand dunes
- MDBSA 4.3 Shrublands on low &/ or isolated red-sand dunes
- MDBSA 9.1 Woodlands with an open grassy understorey
- MDBSA 10.8 River Box Woodlands with saline tolerant chenopod understorey
- MDBSA 10.11 Low Woodlands/ Shrublands of river terraces /inland drainage lines
- MDBSA 11.6 Semi-saline Shrublands of river cliffs, floodplains, depressions and drainage lines

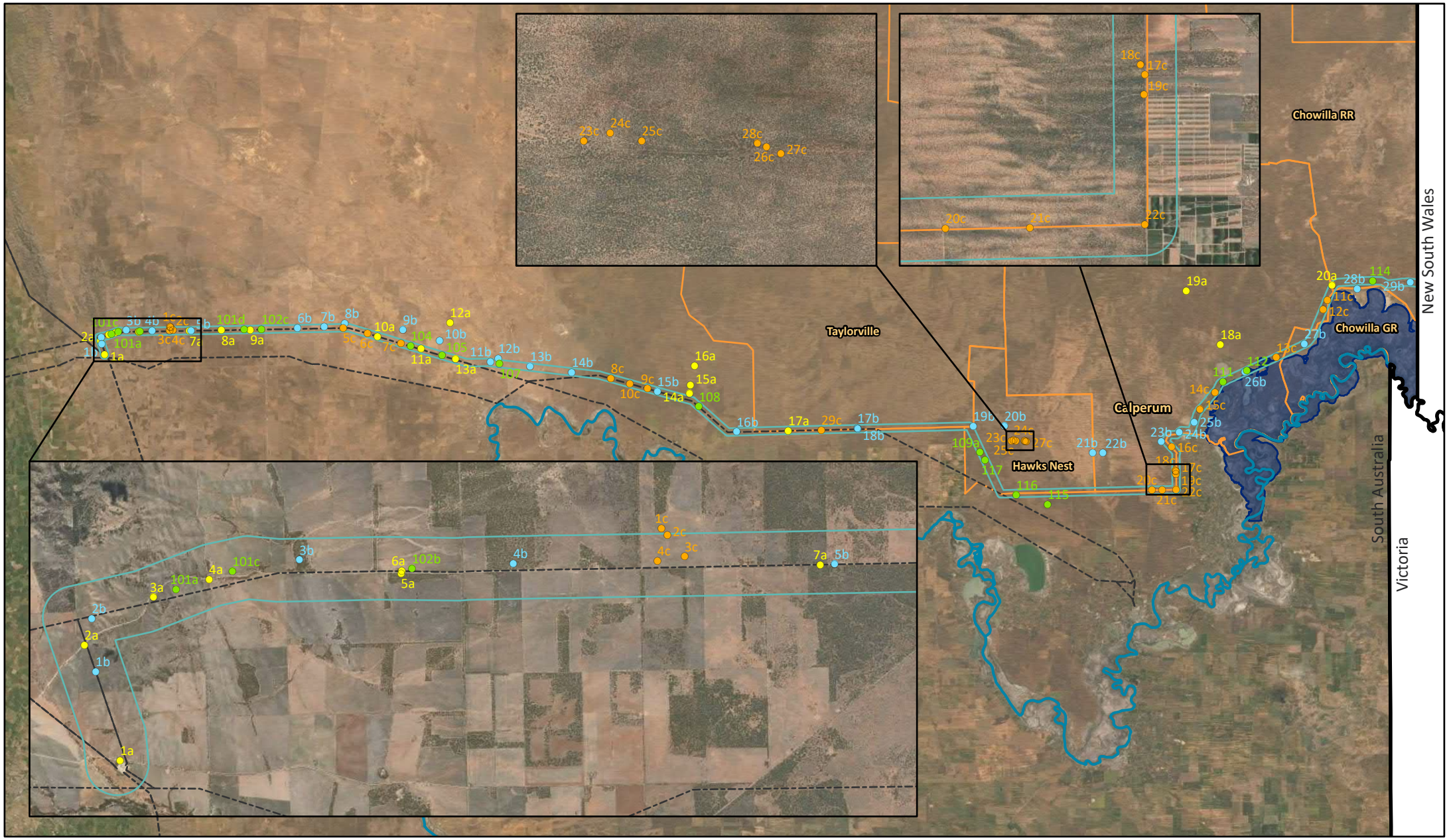


Figure 3-1

Vegetation assessment BAM sites

Table 3-1: Summary of BCM Sub Communities along the alignment, including the BAM sites and Vegetation Associations

BAM sites	Vegetation associations within BAM community
MDBSA 1.1 Open Woodland with arid adapted shrubland on limestone	
7a, 10c, 29b, 105	7a: *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over mixed shrubs 10c: *Casuarina pauper* (Black Oak) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Woodland with open tall shrub understorey 29b: *Casuarina pauper* (Black Oak) Open Woodland over chenopod and sclerophyll shrubs 105: *Casuarina pauper* (Black Oak) Low Open Woodland over chenopods and mixed tall shrubs
Degraded forms of MDBSA 1.1 (now *Austrostipa* sp grassland with emergent shrubs/trees)	
101d, 114	101d: *Austrostipa* sp. (Spear-grass) Open Grassland with emergent sclerophyll and chenopod shrubs 114 *Austrostipa* sp. (Spear-grass) Open Grassland - *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Casuarina pauper* (Black Oak) and/or *Callitris* spp. (Native Pines)
MDBSA 1.2 Tall Shrubland with open arid adapted Understorey on limestone plains	
117	117: Se*nna artemisioides* ssp. *filifolia* Open Shrubland with emergent *Eucalyptus gracilis* (Yorrell)
MDBSA 2.1 Open Mallee/ Low Open Woodland with chenopod shrub understorey	
4b, 5a, 5c, 6b, 8a, 8b, 8c, 9a, 9b, 10a, 11a, 14a, 15a, 20a	4b: *Eucalyptus oleosa* (Red Mallee) Mallee over mid-dense chenopod shrubs 5a: *Eucalyptus oleosa* (Red Mallee) Mallee over chenopod shrubs 5c: *Casuarina pauper* (Black Oak) Woodland over *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush) 6b: *Myoporum platycarpum* (False Sandalwood) - *Casuarina paup*er (Black Oak) +/- *Eucalyptus oleosa* (Red Mallee) Open Woodland mosaiced with *Maireana sedifolia* (Bluebush) Low Open Shrubland 8a: *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana sedifolia* (Bluebush) 8b: *Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush) 8c: *Eucalyptus gracilis* (Yorrell) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus brachycalyx* (Gilja) Open Mallee over low open sclerophyll and chenopod shrubs 9a: *Myoporum platycarpum* (False Sandalwood) Very Low Open Woodland over *Maireana sedifolia* (Bluebush) 9b: *Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush) and/or *Maireana sedifolia* (Bluebush) 10a: *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana pyramidata* (Black Bluebush) 11a: *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana sedifolia* (Bluebush) 14a: *Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll and chenopod shrubs 15a: *Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods 20a: *Maireana pyramidata* (Black Bluebush) Very Open Shrubland with emergent *Eucalyptus* species (Mallee species), *Casuarina pauper* (Black Oak) and *Myoporum platycarpum* (False Sandalwood)
MDBSA 2.2 Chenopod Shrublands	
6a, 6c, 7b, 10b, 12b, 13a, 13b, 14b, 14c, 25b, 26b, 102c, 107	6a: *Maireana pyramidata* (Black Bluebush) Low Very Open Shrubland 6c: *Maireana sedifolia* (Bluebush) Low Open Shrubland 7b: *Maireana sedifolia* (Bluebush) Very Open Shrubland with isolated trees/groves of *Casuarina pauper* (Black Oak) 10b: *Rhagodia ulicina* (Intricate Saltbush) - *Maireana sedifolia* (Bluebush) Open Shrubland +/- *Maireana aphylla* (Cottonbush) Open Shrubland 12b: *Maireana sedifolia* (Bluebush) Low Open Shrubland 13a: *Maireana sedifolia* (Bluebush) Low Open Shrubland 13b: *Maireana sedifolia* (Bluebush) +/- *Rhagodia ulicina* Low Open Shrubland 14b: *Maireana sedifolia* (Bluebush) +/- *Lawrencia squamata* (Thorny Lawrencia) +/- *Rhagodia ulicina* Open Shrubland 14c: *Maireana pyramidata* (Black Bluebush) Low Open Shrubland 25b: *Maireana pyramidata* (Black Bluebush) Open Shrubland

BAM sites	Vegetation associations within BAM community
	26b: *Maireana pyramidata* (Black Bluebush) Open Shrubland 102c: *Maireana sedifolia* (Bluebush) Open Shrubland 107: *Maireana sedifolia* (Bluebush) Low Very Open Shrubland
MDBSA 3.1 Mallee with very open sclerophyll/ chenopod shrub understorey	
1a, 1c, 2a, 3b, 5b, 12c, 15b, 15c, 18a, 18c, 19a,19c, 21c, 23b, 23c, 24b, 26c, 27b, 108, 116	1a: *Eucalyptus porosa* (Mallee Box) - *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Desert Senna) and chenopods. 1c: *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland with sparse emergent shrubs 2a: *Eucalyptus porosa* (Mallee Box) Mallee over *Senna artemisioides* (Desert Senna) and chenopods. 3b*: Eucalyptus oleosa* (Red Mallee) Mallee over a very sparse chenopod understorey 5b: *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over an open sclerophyll and chenopod shrub understorey 12c: *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Atriplex stipitata* (Bitter Saltbush) 15b: *Eucalyptus oleosa* (Red Mallee) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over sclerophyll shrubs and chenopods 15c: *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) Very Open Shrubland with emergent *Callitris gracilis* (Southern Cypress Pine) 18a: *Eucalyptus oleosa (*Red Mallee) - *Eucalyptus gracilis* (Yorrell) Mallee over *Senna artemisioides* (Senna) and chenopods 18c: *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) +/- *Eucalyptus brachycalyx* (Gilja) Mallee over tall sclerophyll shrubs 19a: *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Senna) and chenopods 19c: *Eucalyptus oleosa - Eucalyptus gracilis* (Yorrell) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a very open understorey 21c: *Eucalyptus socialis* (Beaked Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Mallee over *Senna artemisioides* ssp. *artemisioides* (Desert Senna) +/- *Senna artemisioides* ssp. *petiolaris* shrubland 23b: *Eucalyptus oleosa* (Red Mallee) – *Eucalyptus brachycalyx* (Gilja) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over chenopod and sclerophyll shrubs 23c: *Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus oleosa* (Red Mallee) Open Mallee over tall chenopod shrubs 24b: *Eucalyptus oleosa* (Red Mallee) – *Eucalyptus gracilis* (Yorrell) Mallee over chenopod and sclerophyll shrubs 26c: *Eucalyptus gracilis* (Yorrell) – *Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll shrub understorey 27b: *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana pyramidata* (Black Bluebush) and sclerophyll shrubs 108: *Eucalyptus gracilis* (Yorrell) Open Mallee over sparse chenopod and sclerophyll shrubland 116: *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) old growth Open Mallee over sclerophyll and chenopod shrubs
Degraded forms of MDBSA (now *Austrostipa* sp Open Grassland and/or *Maireana brevifolia* Low (very) Open Shrubland	
2c, 3a, 3c, 4a,101a, 101c, 102b	2c: *Roepera aurantiaca* (Shrubby Twinleaf) Low Very Open Shrubland +/- *Atriplex vesicaria* (Bladder Saltbush) with emergent shrubs 3a: *Maireana brevifolia* (Short-leaved Bluebush) / *Enchylaena tomentosa* (Ruby Saltbush) with scattered *Eucalyptus porosa* (Mallee Box) / *Eucalyptus oleosa* (Red Mallee). 3c: *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland 4a: *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland 101a: *Austrostipa* sp. (Spear-grass) Open Grassland with emergent shrubs including *Dodonaea subglandulifera* (Peep Hill Hopbush) and isolated mallee trees. 101c: *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland +/- patches of *Austrostipa* sp. (Spear-grass) 102b: *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland +/- patches of *Austrostipa* sp. (Spear-grass)
MDBSA 4.1 Mallee with open shrub understorey on tall red-sand dunes or deep sand flats	
21b, 22b	21b: *Eucalyptus dumosa* (White Mallee) - *Eucalyptus incrassata* (Ridge-fruited Mallee) – *Eucalyptus gracilis* (Yorrell) Low Open Mallee over *Leptospermum coriaceum* (Dune Tea-tree) 22b: *Eucalyptus dumosa* (White Mallee) - *Eucalyptus incrassata* (Ridge-fruited Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

BAM sites	Vegetation associations within BAM community
MDBSA 4.2 Mallee with understorey dominated by Triodia on moderate/ low sand dunes	
9c ,16a, 16b, 16c, 17a, 17b, 17c 18b, 19b, 20b, 20c, 22c, 24c, 25c, 27c, 28c, 29c, 109a, 115	9c: *Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland. 16a: *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland. 16b: *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland on a red sandy rise. 16c: *Eucalyptus dumosa* (White Mallee) - *Eucalyptus socialis* (Beaked Red Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland 17a: *Eucalyptus gracilis* (Yorrell) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland. 17b: *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland 17c: *Eucalyptus incrassata* (Ridge Fruited-Mallee) +/- *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) +/- *Eucalyptus socialis* (Beaked Red Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland 18b: *Eucalyptus incrassata* (Ridge-fruited Mallee) Open Mallee over *Triodia* Hummock Grassland and *Beyeria opaca* (Dark Turpentine Bush) 19b: *Eucalyptus oleosa* (Red Mallee) – *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus gracilis* (Yorrell) Open Mallee over an open understorey of sclerophyll shrubs and chenopods 20b: *Eucalyptus dumosa* (White Mallee)– *Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Mallee over *Triodia* Hummock Grassland 20c: *Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* (Spinifex) Hummock Grassland understorey 22c: *Eucalyptus incrassata* (Ridge-fruited Mallee) +/- *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland 24c: *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland 25c: *Eucalyptus dumosa* +/- *Eucalyptus leptophylla* Open Mallee over *Triodia* (Spinifex) Hummock Grassland 27c: *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus gracilis* (Yorrell) Low Very Open Mallee over *Triodia* (Spinifex) Open Hummock Grassland 28c: *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland 29c: *Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a *Triodia* (Spinifex) Hummock Grassland 109a: *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) - *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland 115. *Eucalyptus gracilis* (Yorrell) - *Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) - *Eucalyptus oleosa* (Red Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) and mixed shrubs.
11c, 13c, 28b	11c: *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush) Tall Very Op Shrubland 13c: *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush) 28b: *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)
Degraded forms of MDBSA 9.1 Woodlands with an open grassy understorey	
1b, 2b	1b: *Salsola australis* (Buckbush) Very Open Herbland with isolated *Eucalyptus porosa* (Mallee Box) 2b: *Salsola australis* (Buckbush) Very Open Herbland with emergent *Melaleuca brevifolia* (Short-leaved Bluebush)
MDBSA 10.8 River Box Woodlands with saline tolerant chenopod Understorey	
111	111: *Eucalyptus largiflorens* (River Box) - *Melaleuca lanceolata* (Dryland Teatree) Low Open Woodland over *Maireana pyramidata* (Black Bluebush)
MDBSA 10.11 Low Woodlands/ Shrublands of River Terraces /Inland Drainage Lines	
112	112: *Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)
Degraded form of MDBSA 10.11 Low Woodlands/ Shrublands of river terraces /inland drainage Lines	
4c	4c: *Austrostipa* sp. (Spear-grass) Open Grassland with emergent *Atriplex vesicaria* (Bladder Saltbush) and *Senna* species

BAM sites	Vegetation associations within BAM community
	MDBSA 11.6 semi-saline shrublands of river cliffs, floodplains, depressions and drainage lines
7c, 11b, 12a, 104	7c: *Lycium australe* (Australian Boxthorn) Open Shrubland +/- *Maireana aphylla* (Cottonbush) with emergent *Acacia nyssophylla* (Spine Bush) 11b: *Nitraria billardierei* (Nitrebush) – *Maireana pyramidata* (Black Bluebush) Very Open Shrubland 12a: *Nitraria billardierei* (Nitrebush) Low Open Shrubland 104: *Casuarina pauper* (Black Oak) +/- *Alectryon oleifolius (*Bullock Bush) Very Open Woodland over *Lycium australe* (Australian Boxthorn) shrubland

3.2 Site Descriptions Per BAM Site (Grouped by Habitat Type)

Vegetation descriptions for the 94 BAM sites are provided below. Sites have been grouped into similar habitat types, largely corresponding with different BCM communities and/or clearance histories.

3.2.1 Spear-grass (*Austrostipa* sp.) and/or sparse shrub regrowth of previously cropped paddocks– western end of alignment

At the western end of the alignment, 16.64 km has been mapped as sparse regrowth vegetation following clearance for cropping, possibly several years ago (**Figure 3-2**). Typically, *Maireana brevifolia* has been the dominant shrub regrowth, and *Austrostipa sp.* (Spear-grass), *Salsola australis* (Buckbush) and/or *Sclerolaena* (Bindyi) species, the dominant groundcovers. Other scattered shrubs included *Enchylaena tomentosa* and *Acacia nyssophylla* (Spine Bush). Species diversity is low, typically < 10 native plant species, and shrubs are widely spaced. Common weed species were *Medicago* species, *Carthamus lanatus* (Saffron Thistle), Onion Weed (*Asphodelus fistulosus*) and Heron's Bill (*Erodium* species). The BAM survey sites within this habitat type scored very low or low condition levels. These sites are now grasslands or open shrublands but are likely to have been mallee vegetation types prior to clearance, based on adjoining roadside vegetation.

Table 3-2 below lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat. Full descriptions of each BAM site are provided below.

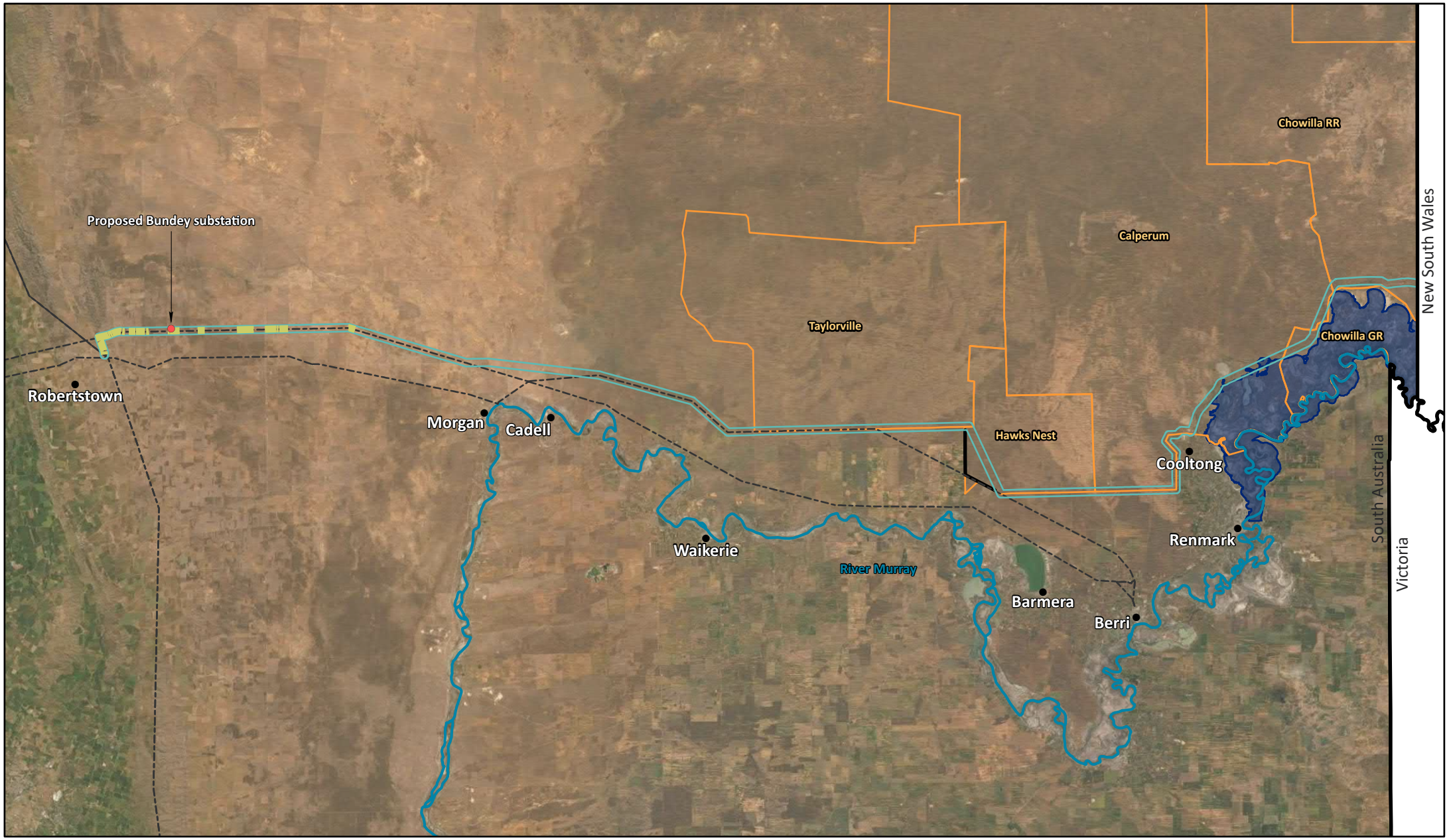
Table 3-2: *Austrostipa* and/or sparse shrub regrowth of previously cropped paddocks – western end of alignment – BAM sites

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
1b	*Salsola australis* (Buckbush) Very Open Herbland with isolated *Eucalyptus porosa* (Mallee Box)	7.5	1.86
1c	*Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland with sparse emergent shrubs	33.28	0.95
2b	*Salsola australis* (Buckbush) Very Open Herbland with emergent *Melaleuca brevifolia* (Short-leaved Bluebush)	5.9	1.71
2c	*Roepera aurantiaca* (Shrubby Twinleaf) Low Very Open Shrubland +/- *Atriplex vesicaria* (Bladder Saltbush) with emergent shrubs	21.37	Not mapped
3a	*Maireana brevifolia* (Short-leaved Bluebush) – *Enchylaena tomentosa* (ruby Saltbush) with scattered *Eucalyptus porosa* (Mallee Box) - *Eucalyptus oleosa* (Red Mallee).)	30.27	Not mapped
3c	*Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland	25.71	1.51
4a	*Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland	19.35	Not mapped
4c	*Austrostipa* (Spear-grass) species Open Grassland with emergent *Atriplex vesicaria* (Bladder Saltbush) and *Senna* spp.	41.43	0.07
101a	*Austrostipa* sp. (Spear-grass) Open Grassland with emergent shrubs including *Dodonaea subglandulifera* (Peep Hill Hopbush) and isolated mallee trees.	33.31	0.29
101c	*Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland +/- patches of *Austrostipa* sp. (Spear-grass)	16.63	1.81
101d	*Austrostipa* sp. (Spear-grass) Open Grassland with emergent sclerophyll and chenopod shrubs	23.63	6.02
102b	*Maireana brevifolia* Low Open Shrubland	18.29	2.37
		TOTAL =	16.64 km

[1]rounded to two decimal degrees

Habitat Use

This vegetation (sparse regrowth of previously cleared paddocks) is considered to primarily provide habitat for several common bird and reptile species, for example *Northiella haematogaster* (Bluebonnet)*, Lichenostomus virescens* (Singing Honeyeater)*, Anthus novaezeelandiae* (Australasian Pipit) and common reptile species. Due to the absence of trees, low plant species diversity and abundance, lack of plant life forms and absence of litter, this vegetation has only limited habitat potential for threatened fauna species. Although the vegetation occurs on previously cropped land, it may be suitable for EPBC listed *Tiliqua adelaidensis* (Pygmy Bluetongues) Flinders *Aprasia pseudopulchella* (Worm Lizard)*,* but it is noted that the sites are on the edge of both species range, there are no records and the vegetation / sites within the TLC would not provide optimal habitat given previous destruction of soil structure and lack of a sufficient stony surface. State threatened fauna that may utilises these areas for habitat include *Neophema chrysostoma* (Blue-winged parrot), *Neophema elegans* (Elegant parrot) and *Ardeotis australis* (Australian Bustard), although there are no records for these species within 5 km of areas to the TLC mapped as this habitat type relatively few records in the region.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Austrostipa and/or sparse shrub regrowth of previously cropped paddocks – western end of alignment

Figure 3-2
Spear-grass (Austrostipa sp.) and/or sparse shrub regrowth of previously cropped paddocks extent along the alignment

0 20
Kilometres
N

ElectraNet
energy connect
JBS&G

Site 1b – *Salsola australis* (Buckbush) Very Open Herbland with isolated *Eucalyptus porosa* (Mallee Box)

Site 1b is representative of cleared paddocks in the area with very sparse chenopod regrowth. Site 1b comprised past cropped land with very sparse native regrowth, primarily *Salsola australis* (Buckbush). Buckbush is often the first native species to appear on bare or cultivated soil after drought (Cunningham *et. all.* 1992). The only other native species recorded along the proposed alignment at this location were occasional *Maireana brevifolia* (Short-leaved Bluebush) and two isolated *Eucalyptus porosa* (Mallee Box).

No threatened flora or fauna were observed within this community. Four spider holes were noted under the alignment which were considered to be actively inhabited by spiders, and not to be potential habitat for the conservation-rated Pygmy Bluetongue. No hollows were evident within the two Mallee Box trees that were present.

Weeds recorded were: *Carthamus lanatus* (Saffron Thistle), *Moraea setifolia* (Thread Iris), *Erodium* sp. (numerous) and occasional *Asphodelus fistulosus* (Onion Weed). The area is grazed by sheep, with a high cover of sheep dung present during the inspection. No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-1: Site 1b, *Salsola australis* (Buckbush) Open Herbland recolonising cultivated paddocks with isolated *Eucalyptus porosa* (Mallee Box). One of the two Mallee Box recorded at site, under existing transmission line (facing south)

Site 1c – *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland with sparse emergent shrubs

This site contained very sparse chenopod regrowth, in this case dominated by *Atriplex vesicaria* with numerous droughted *Roepera aurantiaca* ssp. *aurantiaca* (Shrubby Twinleaf) and emergent *Acacia colletioides* (Veined Wait-a-while) (**Plate 3-2**). The palatable species present were heavily grazed by domestic stock and kangaroos, particularly *Atriplex vesicaria* (Bladder Saltbush), *Eremophila scoparia* (Broom Emubush) and *Maireana georgei* (Satiny Bluebush). The area is grazed by sheep and kangaroos with high density of kangaroo dung and very old sheep dung observed during the survey. The presence of a lone Mallee tree within the site, and Mallee on adjoining road reserves suggests that the area formerly supported a Mallee community with a chenopod-dominated understorey.

No threatened flora or fauna were observed at the site. Weeds recorded at the site included: *Medicago* sp. (Medic, fruit only), *Carthamus lanatus* (Saffron Thistle), *Onopordum acaulon* (Stemless Thistle) and *Bromus* sp. *Carthamus lanatus* was recorded only in a localised small depression. No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Low.

Plate 3-2: Site 1c, *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland with sparse emergent shrubs and a single Mallee (facing north)

Site 2c – *Roepera aurantiaca* (Shrubby Twinleaf) Low Very Open Shrubland +/- *Atriplex vesicaria* (Bladder Saltbush) with emergent shrubs

Site 2c is located on the proposed Bundey Substation. At the time of survey, it was dominated by *Roepera aurantiaca* (Shrubby Twinleaf) and *Atriplex vesicaria* (Bladder Saltbush) with emergent *Acacia nyssophylla* (Spine Bush) shrubs (**Plate 3-3**). The palatable plant species present were heavily grazed, particularly *Atriplex vesicaria* (Bladder Saltbush), *Templetonia egena* (Broombush Templetonia) and *Eremophila scoparia* (Broom Emubush). The area has been cleared, possibly for irregular cropping in the past. It may have supported an open Mallee community with a mix of chenopod and sclerophyll shrubs of varying densities.

No threatened flora or fauna were observed at the site. Only one weed (*Medicago* sp., Medic) was observed at the site. However, *Nicotiana glauca* (Tree Tobacco) was recorded just outside the quadrat with approximately 10-15 plants observed. No fire history has been recorded for the site and the BAM vegetation condition category for this site at the time of assessment was Low.

Plate 3-3: Site 2c, *Roepera aurantiaca* Roepera aurantiaca Low Open Shrubland +/- *Atriplex vesicaria* with sparse emergent shrubs (facing south)

Site 3c – *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland

Site was dominated by sparsely *Atriplex vesicaria* (Bladder Saltbush) on a slight stony rise on a calcareous sandy loam (**Plate 3-4**). Surface strew was about 20% cover. Other prominent native species included *Roepera aurantiaca* (Shrubby Twinleaf) and *Maireana trichoptera* (Hairy-fruit Bluebush). The palatable species present were heavily grazed, specifically *Atriplex vesicaria* (Bladder Saltbush) and *Maireana turbinata* (Top-fruit Bluebush). Mallee occurs on the adjoining road reserve and it is likely that the site also formerly supported a Mallee community.

No threatened fauna or flora were observed at the site. Weed species recorded at the site include *Nicotiana glauca* (Tree Tobacco), and the annual species: *Carthamus lanatus* (Saffron Thistle) and *Medicago* sp. (Medic) although none in high densities. *Carthamus lanatus* was widespread throughout the area but sparse in density. No fire history has been recorded for the site and the BAM vegetation condition category at the time of assessment was Low.

Plate 3-4: Site 3c, *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland (facing west)

Site 4c – *Austrostipa* (Spear-grass) species Open Grassland with emergent *Atriplex vesicaria* (Bladder Saltbush) and *Senna* spp.

The site followed a drainage line less than 50 m wide. Native grass tussocks were the dominant vegetation with very sparse emergent *Atriplex vesicaria* (Bladder Saltbush) (**Plate 3-5**). Due to lack of fruiting material, grass identification was difficult. The only few grass tussocks that did contain fruiting material were *Austrostipa eremophila*. Other native vegetation included *Sclerolaena patenticuspis* (Spear-fruit Bindyi) and *Senna artemisioides* ssp. *filifolia* and *Senna artemisioides* ssp. *artemisioides*. The vegetation was droughted and grazed,

particularly the *Senna* species. A highly concentrated patch of juvenile *S. artemisioides* ssp. x *artemisioides* and *S. artemisioides* ssp. x *filifolia* plants was observed within approximately 20m of the roadside but was also sparsely spread along the alignment. The site adjoins roadside vegetation supporting dense shrubs (particularly Senna species), and notably Mallees are absent in this section of road reserve only. For this reason, the corresponding BCM community is thought to be naturally treeless – perhaps a grassland or shrubland with grasses prominent.

No threatened flora or fauna were recorded at the site. Fairy wrens were heard nearby in a dense patch of *Acacia nyssophylla* (Spine Bush) to the south of the site, near the roadside, but were not observed. A dried-up dam to the north of the site was found to contain multiple weed species including *Erodium* sp. (Heron's-bill/ Crowfoot) and *Marrubium vulgare* (Horehound, Declared). Weed species across the survey site included sparse but widespread occurrences of *Medicago* sp. (Medic), *Onopordum acaulon* (Horse Thistle), *Bromus* sp. (Brome) with occasional records of *Nicotiana glauca* (Tree Tobacco) and *Carthamus lanatus* (Saffron Thistle). Horse thistle and Saffron Thistle were most frequent in micro-scale depressions across the site. No recorded fire history and the BAM vegetation condition category for this site at the time of assessment was Medium.

Plate 3-5: Site 4c, *Austrostipa* Open Grassland with emergent *Atriplex vesicaria* (Bladder Saltbush) (facing north)

Site 2b – *Salsola australis* (Buckbush) Very Open Herbland with emergent *Melaleuca brevifolia* (Short-leaved Bluebush)

Site 2b is representative of cleared paddocks in the area with very sparse chenopod regrowth, in this case dominated by *Salsola australis* (Buckbush) (**Plate 3-6**). The only other native species recorded along the proposed alignment were occasional *Maireana brevifolia* (Short-leaved Bluebush), frequent *Austrostipa* sp. (Spear-grass) and occasional *Maireana georgii* (Satiny Bluebush). Pre-European Vegetation: The area may have supported Mallee and/or Mallee Box with a mixed understorey of native grasses, chenopod and other shrubs. *Lomandra effusa* may have been numerous to dominant. Approximately 75 m from the proposed alignment, a cluster of four plants of *Lomandra effusa* were recorded in a rocky gully. The area is grazed by sheep, kangaroos and rabbits, with a high cover of sheep dung present during the inspection. Native grasses were present as butts only.

No threatened flora or fauna were observed within this community. One spider hole was noted under the alignment which was not considered to provide potential habitat for Pygmy Bluetongue (diameter of hole too small and cultivated land). Weeds recorded were: *Carthamus lanatus* (common), *Moraea setifolia* (Thread Iris), *Erodium* sp. (numerous), *Medicago* sp. (old fruits only present) and one *Marrubium vulgare* (Horehound, Declared). No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-6: Site 2b, Sparse *Salsola australis* (Buckbush) regrowth on previously cropped land (facing west)

Site 3a – *Maireana brevifolia* (Short-leaved Bluebush) / *Enchylaena tomentosa* (Ruby Saltbush) with isolated *Eucalyptus porosa* (Mallee Box) / *Eucalyptus oleosa* (Red Mallee)

This site was typical of paddocks on low hill slopes, cleared and cropped in the past, now with sparse regrowth, primarily *Maireana brevifolia* (Short-leaved Bluebush) and isolated Mallee present (**Plate 3-7**). Only four native species were recorded.

No threatened flora or fauna were present. Two weeds were recorded, (pasture species); *Hordeum vulgare* (Barley Grass) and *Avena fatua* (Wild Oat). No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Low.

Plate 3-7: Site 3a, *Maireana brevifolia* (Short-leaved Bluebush) / *Enchylaena tomentosa* (Ruby Saltbush) sparse regrowth with isolated Mallee (left) (note this does not include Mallee patch in background to the right)

Site 4a – *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland

Site 4a is representative of cleared paddocks in the area with chenopod regrowth, typically with *Maireana brevifolia* (Short-leaved Bluebush) the dominant shrub (**Plate 3-8**). Based on adjoining vegetation it is likely that this is a degraded from of mallee vegetation. Other dominant native species included *Maireana georgei* (Satiny Bluebush), *Sclerolaena patenticuspis* (Spear-fruit Bindyi) and *Gahnia* sp. (Saw Sedge).

No threatened flora or fauna were observed. Native fauna observed included *Merops ornatus* (Rainbow Bee-eater), *Gavicalis virescens* (Singing Honeyeater) and *Macropus* sp. *(*Kangaroos). Pest fauna species present at the site included *Vulpes vulpes* (Fox) and *Oryctolagus cuniculus* (Rabbit). Weeds present included exotic pasture, *Hordeum vulgare* (Barley Grass), and Weeds *Asphodelus fistulosus* (Onion Weed) and *Marrubium vulgare* (Horehound, Declared). The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-8: Site 4a, Chenopod Regrowth in cleared paddock (facing south)

Site 101a – *Austrostipa* sp. (Spear-grass) Open Grassland with emergent shrubs including *Dodonaea subglandulifera* (Peep Hill Hopbush) and isolated mallee trees.

This site is now a spear-grass grassland with emergent shrubs and mallees, most likely a result of past clearance of more intact mallee vegetation (**Plate 3-9**). The most common shrubs were *Maireana brevifolia* (Short-leaved Bluebush) and *Dodonaea subglandulifera* (Peep Hill Hopbush), the latter Nationally Endangered. The habitat was the footslopes of an east-facing rocky slope, with sandy loam soil. This is preferred habitat for *Dodonaea subglandulifera* and four subpopulations have been recorded from similar habitat within 2 km of this survey site (Moritz and Bickerton 2010). At survey site 101a, an estimated 50 – 100 individuals of *Dodonaea subglandulifera* occurred over approximately 0.5 ha. Individuals ranged from approximately 0.2 to 1 m high. Grazing pressure on the Peep Hill Hopbush was low and the plants appeared slightly droughted, otherwise in good health. No flowers or fruits were present. A further population of three bushes has also been recorded approximately 500 m east of site 101a. The three bushes were in similar habitat – rocky slope with Mallee, near an existing transmission line pole.

The site has no recorded fire history and was likely cleared for cropping, possibly several years ago. Seven weeds were recorded, with *Rostraria pumila* (Tiny Bristle Grass) and *Hordeum marinum* (Barley Grass) most common. Fauna recorded included *Eolophus roseicapilla* (Galah), *Corvus sp.* (Ravens) and *Tiliqua rugosa (*Sleepy Lizard). The BAM vegetation condition category for this site at the time of assessment was Low.

Plate 3-9: Site 101a, *Austrostipa sp.* (Spear-grass) Open Grassland with emergent shrubs including *Dodonaea subglandulifera* (Peep Hill Hopbush) and isolated mallee trees (facing west)

Site 101c – *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland +/- patches of *Austrostipa* sp. (Spear-grass)

This site was dominated by low chenopod shrubs *Maireana brevifolia* (Short-leaved Bluebush) and *Enchylaena tomentosa* (Ruby Saltbush), likely regrowth after clearance of mallee for a past cropping paddock (**Plate 3-10** shows Mallee on the adjoining road reserve). The groundcover layer was dominated by *Sclerolaena patenticuspis* (Spear-fruit Bindyi). Native plant species diversity was low – with only seven species recorded during the survey.

The site has no recorded fire history and was likely cleared for cropping, possibly several years ago. Weeds recorded were sparse *Hordeum marinum* (Barley Grass) and *Asphodelus fistulosus* (Onion Weed). Fauna recorded included *Anthus novaeseelandiae* (Richard's Pipit) and *Corvus sp.* (Ravens). The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-10: Site 101c, *Maireana brevifolia* (Short-leaved Bluebush) regrowth (facing south)

101d: *Austrostipa* sp. (Spear-grass) Open Grassland with emergent sclerophyll and chenopod shrubs

This site has been previously cropped and has regrown as an *Austrostipa* sp. (Spear-grass) Open Grassland with sparse emergent sclerophyll and chenopod shrubs (**Plate 3-11**). Shrub species recorded were *Acacia nyssophylla* (Spine Bush), *Rhagodia ulicina,* (Intricate Saltbush) *Lycium australe* (Australian Boxthorn) and *Enchylaena tomentosa* (Ruby Saltbush). The presence of adjoining road reserve vegetation with sparse trees suggest that the former native vegetation comprised sparse trees with a mix of shrubs.

The site has no recorded fire history and was likely cleared for cropping, possibly several years ago. No weeds were recorded. Opportunistic fauna recorded included *Northiella haematogaster* (Bluebonnet Parrot) and *Ocyphaps lophotes* (Crested Pigeon).

The BAM vegetation condition category for this site at the time of assessment was Low.

Plate 3-11: Site 101d, *Austrostipa* sp. (Spear-grass) Open Grassland (formerly cropped) (facing east)

102b: *Maireana brevifolia* (Short-leaved Bluebush) Low Open Shrubland

This site was very similar to 101C, namely comprising sparse *Maireana brevifolia* (Short-leaved Bluebush) and *Enchylaena tomentosa* (Ruby Saltbush), likely regrowth after clearance of Mallee for a past cropping paddock. (**Plate 3-12** shows Mallee on the adjoining road reserve). The groundcover layer was dominated by *Sclerolaena patenticuspis* (Spear-fruit Bindyi).

The site has no recorded fire history and was likely cleared for cropping, possibly several years ago. No weeds of fauna were recorded during the survey.

The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-12: Site 102b, *Maireana brevifolia* (Short-leaved Bluebush) shrubland (formerly cropped) (facing east)

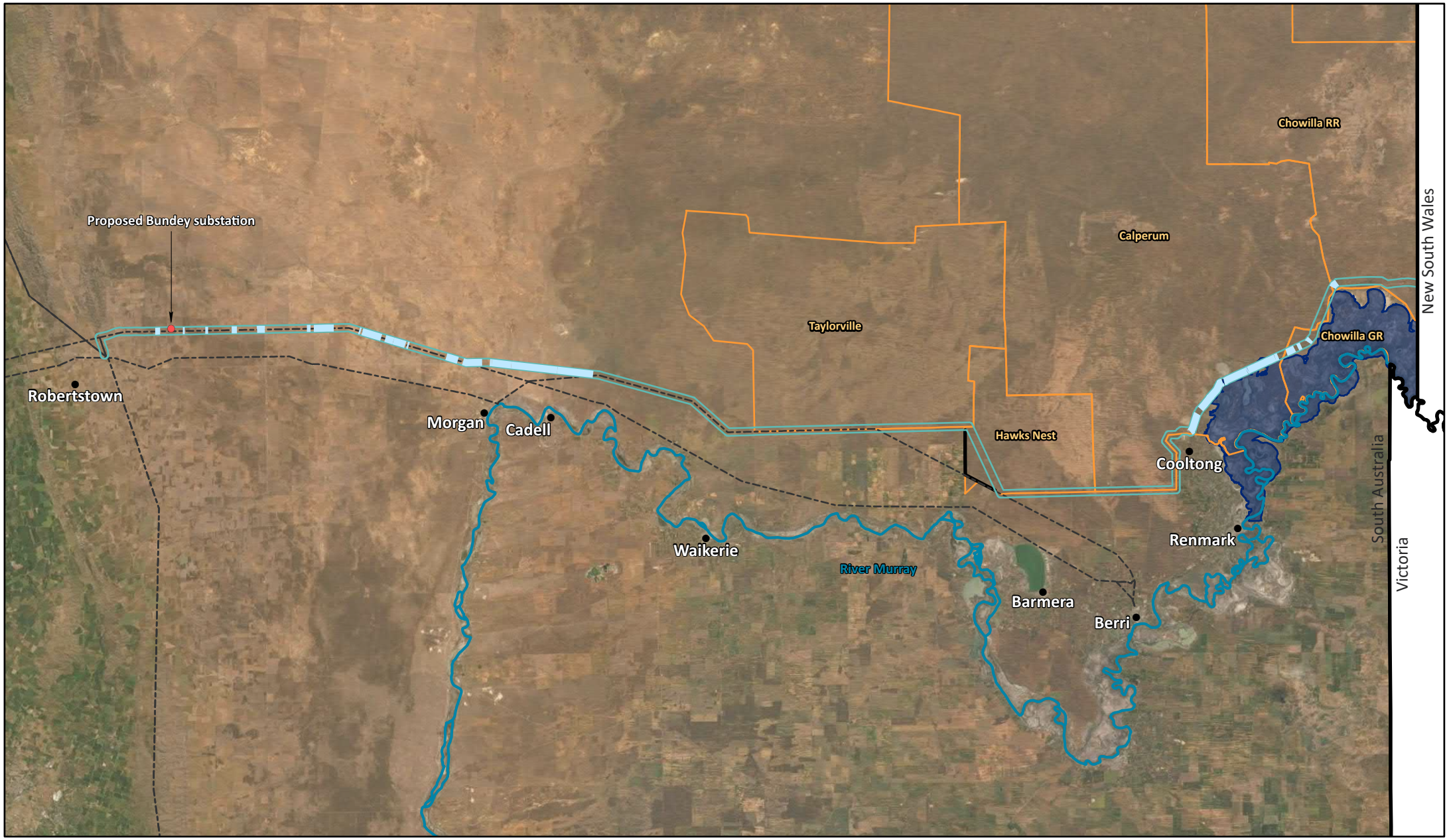
3.2.2 Chenopod Open Shrubland

Chenopod shrubland occurs in the western and eastern thirds of the proposed alignment, with a total of 49.12 km mapped as this habitat type (**Figure 3-3**). In the western third of the alignment, 30.94 km has been mapped as chenopod shrubland, dominated typically by Black Bluebush (*Maireana pyramidata*) and/or Bluebush (*Maireana sedifolia*). In localised areas of clay soil depressions, Nitrebush (*Nitraria billardierei*) or Australian Boxthorn (*Lycium australe*) are the dominant overstorey shrubs.

In the eastern third of the alignment, 18.19 km has been mapped as chenopod shrubland, all north-east of Renmark. Black Bluebush, *Maireana pyramidata* is typically the sole dominant. *Maireana pyramidata* is associated with heavier textured soils, but in the eastern third of the alignment, often transitions into *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaved Hopbush) shrubland on sandier rises.

These chenopod shrublands have no known mechanical clearance or fire history. However, all sites are grazed by domestic stock and/or native or pest herbivores. Grazing combined with prolonged below average rainfall prior to the surveys, has resulted in most sites having very low native plant species diversity, shrubs of reduced density, and with the litter layer sparse to absent. This is reflected in the low to moderate condition scores for the majority of BAM survey sites. Weeds were also sparsely present, with *Carrichtera annnua* (Ward's Weed), and *Medicago* species (Medics) the most common species recorded.

Table 3-3 lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat. Full descriptions of each BAM site are provided below.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Chenopod Open Shrubland

Figure 3-3
Chenopod Open Shrubland extent along the alignment

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G

Table 3-3: Chenopod Open Shrubland – BAM sites

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
Western Third of Alignment			
6a	*Maireana pyramidata* (Black Bluebush) Low Very Open Shrubland	16.03	0.91
6c	*Maireana sedifolia* (Bluebush) Low Open Shrubland	45.32	2.81
7b	*Maireana sedifolia* (Bluebush) Very Open Shrubland with isolated trees/groves of *Casuarina pauper* (Black Oak)	33.54	Not mapped
7c	*Lycium australe* (Australian Boxthorn) Open Shrubland +/- *Maireana aphylla* (Cottonbush) with emergent *Acacia nyssophylla* (Spine Bush)	65.4	1.86
10b	*Rhagodia ulicina* (Intricate Saltbush) - *Maireana sedifolia* (Bluebush) Open Shrubland +/- *Maireana aphylla* (Cottonbush) Open Shrubland	23.22	Not mapped
11b	*Nitraria billardierei* (Nitrebush) – *Maireana pyramidata* (Black Bluebush) Very Open Shrubland	25.8	0.25
12a	*Nitraria billardierei* (Nitrebush) Open Shrubland	10.32	Not mapped
12b	*Maireana sedifolia* (Bluebush) Low Open Shrubland	25.8	4.95
13a	*Maireana sedifolia* (Bluebush) Low Open Shrubland	25.8	4.52
13b	*Maireana sedifolia* (Bluebush) +/- *Rhagodia ulicina* Low Open Shrubland	28.38	6.10
14b	*Maireana sedifolia* (Bluebush) +/_ *Lawrencia squamata* (Thorny Lawrencia) +/- *Rhagodia ulicina* Open Shrubland	33.12	4.75
102c	*Maireana sedifolia* (Bluebush) Open Shrubland	41.93	1.07
107	*Maireana sedifolia* (Bluebush) Very Open Shrubland	39.35	2.61
		Sub-total	30.94
Eastern Third of Alignment			
13c	*Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush)	49.02	0.43
14c	*Maireana pyramidata* (Black Bluebush) Low Open Shrubland	30.57	8.56
20a	*Maireana pyramidata* (Black Bluebush) Very Open Shrubland with emergent *Eucalyptus* species (Mallees), *Casuarina pauper* (Black Oak) and *Myoporum platycarpum* (False Sandalwood)	35.86	0.87
25b	*Maireana pyramidata* (Black Bluebush) Open Shrubland	23.54	2.64
26b	*Maireana pyramidata* (Black Bluebush) Open Shrubland	24.48	5.5

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
112	*Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)	62.38	0.19
		Sub-total	18.19
		TOTAL	48.01 km

[1]rounded to two decimal degrees

Habitat Use

This vegetation type is considered to provide potential habitat for several common bird and reptile species, e.g. *Northiella haematogaster* (Bluebonnet), Australasian Pipit (*Anthus novaezeelandiae*) common reptiles, mammals and raptors. Given the absence of trees, reduced vegetation cover and density, this vegetation has only limited habitat potential for threatened fauna. For example the at the western end of the transmission line corridor the vegetation may provide habitat for state listed species such as *Neophema chrysostoma* (Blue-winged Parrot), *Neophema elegans* (Elegant Parrot), *Acanthiza iredalei* (Slender-billed Thornbill), *Falco peregrinus* (Peregrine Falcon) and *Acanthiza iredalei iredalei* (Slender-billed Thornbill). Similar vegetation at the eastern end of the corridor may provide non core habitat for *Litoria reniformis* (Southern Bell Frog) closer to riverine areas, if dispersing during wetter periods. State listed threatened species that may use the vegetation as non core roosting or foraging habitats include Elegant Parrot, Blue-wing Parrot, Peregrine Falcon, *Cinclosoma castanotum* (Chestnut Quailthrush (Chestnut-backed Quailthrush)), *Haliaeetus leucogaster* (White-bellied Sea Eagle), *Morelia spilota* (Carpet Python), *Varanus varius* (Lace Monitor) and *Burhinus grallarius* (Bush Stonecurlew).

3.2.2.1 Habitat Type Chenopod Shrubland – Western End

Site 6a – *Maireana pyramidata* (Black Bluebush) Low Very Open Shrubland

Site 6a vegetation comprised grazed low open chenopod shrublands, representative of a modified BCM community MDBSA 2.2 chenopod Open Shrubland. Dominant native shrubs were *Maireana pyramidata* (Black Bluebush) and *Atriplex stipitata* (Bitter Saltbush), with *Sclerolaena patenticuspis* (Spear-fruit Bindyi) a common groundcover (**Plate 3-13**). This site is north of a Mallee patch in the area and is also close to a dam.

No threatened flora or fauna were observed. One weed was observed to be sparsely present; *Asphodelus fistulosus* (Onion Weed). No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Very Low.

Plate 3-13: Site 6a, *Maireana pyramidata* (Black Bluebush) +/- *Atriplex stipitata* (Bitter Saltbush) low very open shrubland (facing east)

Site 6c – *Maireana sedifolia* (Bluebush) Low Open Shrubland

The dominant overstorey in this shrubland was *Maireana sedifolia* (Bluebush), with scattered groves of *Casuarina pauper* (Black Oak) (**Plate 3-14**). Due to prolonged below average rainfall, plant species diversity was relatively low, with only a further eight native species recorded in very low densities throughout the site. Substantial lichen cover was observed on areas of exposed ground between *Maireana sedifolia* plants. Grazing pressure was reduced at the site, due to absence of stock within the White Dam Conservation Park, although kangaroo dung was recorded during the survey. The prolonged dry conditions and possibly kangaroo grazing have contributed to approximately 25% canopy loss in individual Bluebush plants. Regeneration of perennial shrubs appeared absent or very sparse, and shrub density may be slightly below that in the corresponding BCM benchmark community.

No threatened flora or fauna were recorded at the site. Only two weed species were recorded at the site: *Carrichtera annnua* (Ward's Weed), which was only present on the 3-4 m wide access track, and *Medicago* sp. (Medic) (**Plate 3-15**). No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-14: Site 6c, *Maireana sedifolia* (Bluebush) Low Open Shrubland with scattered groves of *Casuarina pauper* (Black Oak) (facing north)

Plate 3-15: Site 6c, Cleared access track running underneath alignment (facing east.)

Site 7b – *Maireana sedifolia* (Bluebush) Very Open Shrubland with isolated trees/groves of *Casuarina pauper* (Black Oak)

Site 7b is representative of Bluebush Open Shrubland in the western third of the alignment. Due to prolonged drought and high total grazing pressure (kangaroos and sheep), the site has a very low species diversity, with groundcover typically soil crust/lichen. *Maireana sedifolia* (Bluebush) was the dominant shrub, approximately 1 m tall, but with a total cover of < 10% (**Plate 3-16**). Other species present were all highly grazed, including *Austrostipa* sp. (Spear-grass), *Maireana pyramidata* (Black Bluebush) and *Rhagodia ulicina* (Intricate Saltbush), the latter appearing to be almost dead. *Casuarina pauper* (Black Oak) and *Alectryon oleifolius* (Bullock Bush) were present as widely spaced trees or small clusters of trees. Eight native species were recorded in total.

No threatened flora or fauna observed at the site. No weed species were recorded. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-16: Site 7b, *Maireana sedifolia* (Bluebush) Very Open Shrubland with isolated trees/groves of *Casuarina pauper* (Black Oak) (facing north)

Site 7c – *Lycium australe* (Australian Boxthorn) Open Shrubland +/- *Maireana aphylla* (Cottonbush) with emergent *Acacia nyssophylla* (Spine Bush)

This site was representative of an area extending for approximately 2 km under the transmission line, and was associated with slightly heavier, possibly slightly saline soils. Hence, favouring conditions for *Lycium australe* (Australian Boxthorn), the dominant overstorey shrub at the site (**Plate 3-17**). *Lycium australe* occurred in locally dense patches, with patches of droughted *Maireana aphylla* (Cottonbush). The latter also favouring heavy soils, often in slight depressions. In addition, a total of 18 other native species were recorded, including two Mistletoe species found to be growing on *Acacia nyssophylla* (Spine Bush). The relatively high species diversity was in part due the area containing seasonally wet, heavy soils, supporting a higher diversity of annual and/or herbaceous species. Six native species at the site were found in a small localised area on an access track, in addition to an annual introduced species, *Plantago belardii* (Hairy Plantain). The vegetation association extends up to 1 km to the west and east of the site. The site has been benchmarked against the BCM Community MDBSA 2.2 chenopod Open Shrubland. Possibly the former abundance of *Maireana aphylla* and/or *Maireana pyramidata* (Black Bluebush) may have been higher than at present. Disturbance caused by construction of the existing transmission line may have facilitated *Lycium australe* becoming the dominant overstorey at this site. The site was heavily grazed by sheep, particularly *Rhagodia spinescens* (Spiny Saltbush), but which also showed signs of regeneration, as did *Enchylaena tomentosa* (Ruby Saltbush).

No threatened flora or fauna were recorded at the site. Two weed species were recorded during the survey: *Medicago* sp. (Medic) and *Heliotropium europaeum* (Common Heliotrope). No fire history recorded. The BAM vegetation condition category at the time of assessment was High.

Plate 3-17: Site 7c, *Lycium australe* (Australian Boxthorn) +/- *Maireana aphylla* (Cottonbush) and emergent *Acacia nyssophylla* (Spine Bush) (facing west.)

Site 10b – *Rhagodia ulicina* (Intricate Saltbush) - *Maireana sedifolia* (Bluebush) Open Shrubland +/- Maireana aphylla (Cottonbush) Open Shrubland

This site was characteristic of an extensive surrounding area of chenopod shrubland dominated by *Maireana sedifolia* (Bluebush) and *Rhagodia ulicina* (Intricate Saltbush) which has been subject to prolonged drought and grazing (**Plate 3-18**). The survey site, itself was centred on a small depression of about 40 m diameter in which all shrubs were long dead (thought to be *Maireana aphylla* (Cotton Bush)). The surrounding dominant shrubs *Maireana sedifolia* (Bluebush) and *Rhagodia ulicina* averaged about 90% dieback. Only four native species were recorded over a 1 ha area, the chenopods plus *Austrostipa* sp. (Spear-grass), the latter present as highly grazed ground-level butts. Sheep dung was widespread and abundant. Outside of the survey area, there were isolated groves of *Casuarina pauper* (Black Oak), *Lycium australe* (Australian Boxthorn) and/or *Senna artemisioides* ssp. *x coriacea* (Senna).

No threatened flora or fauna observed at the site. No weeds were present. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-18: Site 10b, the centre of this site contained only dead shrubs, likely to be *Maireana aphylla* (Cottonbush) (facing south)

Site 11b – *Nitraria billardierei* (Nitrebush) / *Maireana pyramidata* (Black Bluebush) Very Open Shrubland

Site 11b consists of a droughted representation of BCM vegetation community MDBSA 11.6 semi-saline shrublands of river cliffs, floodplains, depressions and drainage lines. *Nitraria billardierei* (Nitrebush) and *Maireana pyramidata* (Black Bluebush) were dominant (**Plate 3-19**). The site occurred in a brackish drainage line. Nitrebush is salt tolerant and non-palatable, hence is often prevalent on saline flats and flood plains of high grazing pressure. It favours clay or gypseous soils. In addition to prolonged drought stress, the area is also subject to sheep and kangaroo grazing.

No threatened flora or fauna observed. Weed cover was < 1%, and weed species were confined to *Moraea setifolia* (Thread Iris) and (dead) *Carrichtera annua* (Wards Weed). No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-19: Site 11b, *Nitraria billardierei* (Nitrebush) / *Maireana pyramidata* (Black Bluebush) Open Shrubland in drainage lines

Site 12a – *Nitraria billardierei* (Nitrebush) Open Shrubland

Nitraria billardierei (Nitrebush) was dominant, often prevalent in droughted areas subject to ongoing grazing, with *Atriplex vesicaria* (Bladder Saltbush) and *Austrostipa* sp. (Spear-grass) also present (**Plate 3-20**). Nitrebush is salt tolerant and non-palatable, hence is often prevalent on saline flats and flood plains of high grazing pressure. It favours clay or gypseous soils. In addition to prolonged drought stress, the area is also subject to sheep and kangaroo grazing.

No threatened flora or fauna observed. Whilst no weeds were observed the vegetation was heavily grazed and stock tanks were present. No fire history recorded. The BAM vegetation condition category at the time of assessment was Very Low.

Plate 3-20: Site 12a, *Nitraria billardierei* (Nitrebush) Low Open Shrubland (facing south)

Site 12b – *Maireana sedifolia* (Bluebush) Low Open Shrubland

This site was characteristic of an extensive surrounding area of chenopod shrubland dominated by *Maireana sedifolia* (Bluebush) which has been subject to prolonged drought and grazing (**Plate 3-21**). This has resulted in a much-reduced native plant species diversity and shrub health. Groundcover was primarily a soil and lichen crust. Only five native species were recorded; *Maireana sedifolia* (Bluebush) highly droughted and grazed, plus *Austrostipa* sp. (Spear-grass) dead/almost dead butts only present, *Myoporum platycarpum* (False Sandalwood) (one tree), hosting the mistletoe, *Lysiana exocarpi* (Harlequin Mistletoe), and *Maireana pyramidata* (Black Bluebush) (a few bushes only). No regeneration was recorded.

No threatened flora or fauna observed at the site. The only weed present was *Medicago* sp. (Medic) (dead fruit from 2018). No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-21: Site 12b, *Maireana sedifolia* (Bluebush) Low Open Shrubland (facing south).

Site 13a - *Maireana sedifolia* (Bluebush) Low Open Shrubland

Site 13a was a grazed representation of BCM community MDBSA 2.2 chenopod Open Shrublands. The dominant species was *Maireana sedifolia* (Bluebush) with good cover of *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) (**Plate 3-22**). Other native species present included emergent *Myoporum platycarpum* (False Sandalwood), *Lycium australe* (Australian Boxthorn), *Enneapogon* sp. (Bottlewasher Grasses) and *Acacia nyssophylla* (Spine Bush).

No threatened flora or fauna were observed. No weeds were observed, but there was evidence of grazing and Kangaroos (*Macropus* sp.) were present. No fire history recorded. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-22: Site 13a, *Maireana sedifolia* (Bluebush) Low Open chenopod Shrubland (facing north)

Site 13b – *Maireana sedifolia* (Bluebush) +/- *Rhagodia ulicina* (Intricate Saltbush) Low Open Shrubland.

This site was characteristic of an extensive surrounding area of chenopod shrubland dominated by *Maireana sedifolia* (Bluebush) and to a lesser extent, *Rhagodia ulicina* (Intricate Saltbush) which has been subject to prolonged drought and grazing (**Plate 3-23**). This has resulted in a much-reduced native plant species diversity and shrub health. Groundcover was primarily a soil and lichen crust and calcareous strew. In addition to the two dominant chenopods, four other native species were recorded; *Austrostipa* sp. (Spear-grass) (dead/almost dead butts only present); *Myoporum platycarpum* (False Sandalwood) (one tree), *Lawrencia squamata* (Thorny Lawrencia) (one shrub, almost dead), and one Mallee sp. (possibly *Eucalyptus oleosa*).

No threatened flora or fauna observed. No weeds were recorded during the survey. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-23: Site 13b, *Maireana sedifolia* (Bluebush) Open Shrubland (facing south).

Site 14b – *Maireana sedifolia* (Bluebush) +/- *Lawrencia squamata* (Thorny Lawrencia) +/- *Rhagodia ulicina* (Intricate Saltbush) Open Shrubland

This site was characteristic of an extensive surrounding area of chenopod shrubland dominated by *Maireana sedifolia* (Bluebush) and to a lesser extent, *Rhagodia ulicina* (Intricate Saltbush) and *Lawrencia squamata* (Thorny Lawrencia) which has been subject to prolonged drought and grazing (**Plate 3-24**). This has resulted in a reduced native plant species diversity and shrub health. However, at this site, Bluebush appeared to have been only moderately grazed, but Thorny Lawrencia, Intricate Saltbush, and the two juvenile *Casuarina pauper* (Black Oak) present, had been heavily grazed (both kangaroo and sheep dung were at high densities). Groundcover was primarily a soil and lichen crust and calcareous strew. In addition to the above species, five other native species were recorded including Black Oak (small groves interspersed with shrubland), *Sclerolaena patenticuspis* (Spear-fruit Bindyi) (< 1% cover) and a few individuals each of *Lycium australe* (Australian Boxthorn), *Atriplex stipitata* (Bitter Saltbush) and *Chenopodium curvispicatum* (Cottony Goosefoot). Limited regeneration was noted in Bluebush, Thorny Lawrencia, Black Oak, *Acacia stipitata* (Bitter Saltbush) and Intricate Saltbush.

No threatened flora or fauna observed. The only weeds recorded were very sparse and localised seedlings of *Carrichtera annua* (Wards Weed) and *Medicago* sp. (Medic). No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-24: Site 14b, *Maireana sedifolia* (Bluebush) +/- *Lawrencia squamata* +/- *Rhagodia ulicina* Open Shrubland (facing west)

102c: *Maireana sedifolia* (Bluebush) Open Shrubland

This site is dominated by widely spaced shrubs of Bluebush (*Maireana sedifolia*) with *Austrostipa* sp. (Spear-grass) dominating the groundcover (**Plate 3-25**). An additional five native species were recorded, all present as isolated plants. The low plant species diversity reflects that the site is in the early stages of recovering from prolonged drought. No weed species were present. No bird species were recorded during the survey. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-25: Site 102c, *Maireana sedifolia* Open Shrubland (facing south)

107 – *Maireana sedifolia* (Bluebush) Low Very Open Shrubland

Site 107 comprised widely spaced *Maireana sedifolia* (Bluebush) over relatively sparse *Austrostipa sp.* (Spear-grass) (**Plate 3-26**). The dominant groundcover was *Sclerolaena patenticuspis* (Spear-fruit Copperburr). Prolonged drought and grazing have reduced species diversity and abundance with a total of seven native species recorded, of which half were represented by isolated plants.

No weed species recorded during survey. No bird species were recorded during the survey. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-26: Site 107, Widely spaced *Maireana sedifolia* (Bluebush) (facing north)

3.2.2.2 Habitat Type Chenopod Shrubland – Eastern End

Site 13c – *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush)

The site was predominantly a *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima*. However, the vegetation association transitioned into a *Dodonaea. viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) shrubland to the north of the waypoint. It appears that Hopbush is increasing in this area, possibly due to its non-palatability, as native herbivores such as kangaroos and rabbits favour the more palatable *Maireana pyramidata*. A large, old and possibly disused rabbit warren was present at the site.

No threatened flora or fauna were recorded at the site. No weed species were found at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-27: Site 13c, *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima* (facing north)

Site 14c – *Maireana pyramidata* (Black Bluebush) Low Open Shrubland

This site was supported a by droughted *Maireana pyramidata* (Black Bluebush) Low Open Shrubland. Plant biodiversity was low with an additional six native species being recorded including *Sclerolaena obliquicuspis* (Oblique-spined Bindyi), *Maireana turbinata* (Top-fruit Bluebush) and *Rhagodia spinescens* (Spiny Saltbush), all at low densities.

No threatened flora or fauna were recorded at the site. Three weed species were recorded: *Medicago* sp. (Medic), *Salvia verbenaca* (Wild Sage) and *Carrichtera annua* (Ward's Weed) also at low density. No recorded fire history and the BAM vegetation condition category at the time of assessment was Low.

Plate 3-28: Site 14c, *Maireana pyramidata* Low Open Shrubland (facing north)

Plate 3-29: Site 14c, Highly droughted *Maireana pyramidata* (Black Bluebush) Low Open Shrubland (facing south)

Site 20a – *Maireana pyramidata* (Black Bluebush) Very Open Shrubland with emergent *Eucalyptus* species (Mallees), *Casuarina pauper* (Black Oak) and *Myoporum platycarpum* (False Sandalwood)

This site is on the boundary of Calperum Station, Chowilla Game Reserve and Chowilla Regional Reserve, north of the Wentworth Road. The site comprised scattered chenopod shrubs, primarily *Maireana pyramidata* (Black Bluebush) with emergent clusters of mallee (*Eucalyptus oleosa* Red Mallee*, E. gracilis* Yorell) and *Casuarina pauper* (Black Oak). Species diversity and abundance has been reduced by grazing. Other species present were *Atriplex stipitata* (Bitter Saltbush), *Lysiana exocarpi* (Harlequin Mistletoe), *Dissocarpus paradoxus* (Cannonball), with *Sclerolaena obliquicuspis* (Oblique-spined Bindyi), *Rhagodia spinescens* (Spiny Rhagodia) and *Enchylaena tomentosa* (Ruby Saltbush) well represented.

No threatened flora and fauna were recorded. One weed species was observed, *Salvia verbenaca* (Wild Sage), and there was evidence of heavy grazing from Sheep, Kangaroos and Rabbits. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-30: Site 20a, *Eucalyptus oleosa* (Red Mallee) / *Eucalyptus gracilis* (Yorrell) Very Open Mallee over chenopods (facing south)

Site 25b. *Maireana pyramidata* (Black Bluebush) Open Shrubland

This site comprised a large area of *Maireana pyramidata* (Black Bluebush) Open Shrubland on red clay loam to sandy loam soils, subject to possibly increasing soil salinity. The survey site contained patches of bare salt scolds, and small gypseous soil outcrops. Prolonged drought prior to the survey combined with kangaroo grazing pressure, and perhaps increasing surface soil salinity, has resulted in a very low plant species diversity and the dominant shrubs (*Maireana pyramidata*, Black Bluebush) being in poor health. Black Bluebush health was variable appearing to be very poor near the salt scalds, and moderate elsewhere. Native plant species other than *Maireana pyramidata* were extremely sparse (one to several individuals) and comprised: *Enchylaena tomentosa* (Ruby Saltbush), *Maireana brevifolia* (Short-leaved Bluebush), *Sclerolaena patenticuspis (Spear-fruit Bindyi)*, *Brachyscome* sp. (Daisy sp.) and *Dissocarpus paradoxus* (Cannonball).

No threatened flora or fauna were recorded at the site. Four weed species were recorded, including seedlings of *Medicago* sp. (Medics) and *Erodium* sp. (Stork-bills) (each < 1% cover), dead twigs of *Carrichtera annua* (Wards Weed) and also old flower heads of *Limonium lobatum* (Sea Lavender). The latter was widespread and prolific at the site, estimated to cover over 5%. A lichen crust was the dominant groundcover. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-31: Site 25b, *Maireana pyramidata* (Black Bluebush) Open Shrubland (facing west)

Site 26b. *Maireana pyramidata* (Black Bluebush) Open Shrubland

This site was a *Maireana pyramidata* (Black Bluebush) shrubland, part of a large area of similar shrubland between the riparian vegetation of the River corridor and the extensive tracts of Mallee vegetation to the north. As with other areas of *Maireana pyramidata* the soils are generally a loam texture. Prolonged drought prior to the survey combined with kangaroo grazing pressure, and perhaps increasing surface soil salinity, has resulted in a very low plant species diversity. Native plant species other than *Maireana pyramidata* were extremely sparse (1 to several individuals) and comprised: *Rhagodia ulicina* (Intricate Saltbush) *Enchylaena tomentosa* (Ruby Saltbush), *Sclerolaena* species. and *Dissocarpus paradoxus* (Cannonball).

No threatened flora or fauna were recorded. Four weed species were recorded: *Medicago* sp. (old fruit and seedlings) covered up to 25% of the ground cover, with *Carrichtera annua* (Wards Weed) also abundant (1 – 5% cover). *Erodium* sp. (Stork's Bill) and old flower heads of *Limonium lobatum* (Sea Lavender) were also plentiful, with the latter estimated to cover 1 – 5%. A lichen crust was the dominant groundcover. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-32: Site 26b, *Maireana pyramidata* (Black Bluebush) Open Shrubland (facing east)

112 – *Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)

A small area of *Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland occurred just north of the Wentworth Road in a sandy/clay run-on area. The understorey and slightly elevated boundaries of this association were dominated by *Maireana pyramidata* (Black Bluebush). *Sclerolaena decurrens* (Green Bindyi) was the most common native groundcover. Native plant species diversity was moderately high, with 20 native species recorded included several annual herbs. All but the three above-mentioned species, however, were of low abundance: present as isolated plants or isolated clusters.

Three weed species were recorded, all of relatively low cover. *Limonium* sp. (Sea Lavender sp.) was of highest cover, approximately 1- 5%). Kangaroos were the only fauna recorded. The BAM vegetation condition category at the time of assessment was High.

Plate 3-33: Site 112, *Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland over *Maireana pyramidata*. (Black Bluebush) (facing north)

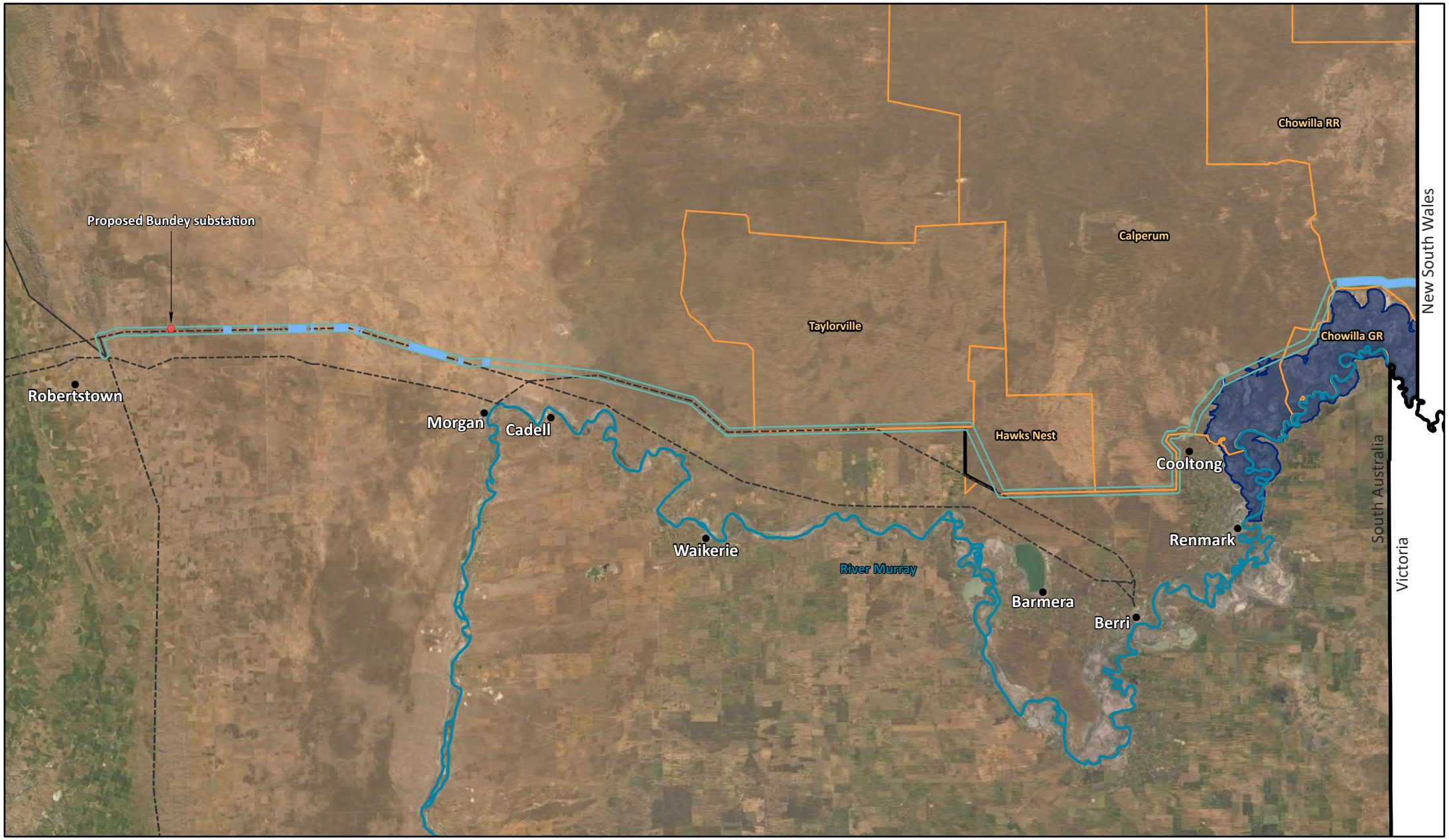
3.2.3 Low Open Woodland over chenopod understorey

This habitat occupies extensive plains of sandy loam, often calcareous soils. The dominant overstorey species is typically *Casuarina pauper* (Black Oak*).* with *Myoporum platycarpum* (False Sandalwood) occasionally the dominant species in the western third. *Alectryon oleifolius* (Bullock Bush) is often present as small groves.

In the western half of the alignment, 14.27 km has been mapped as Low Open Woodland over a chenopod shrubland dominated by *Maireana sedifolia* (Bluebush), and/or *Maireana pyramidata* (Black Bluebush), shrubland, or in heavier soil depressions*, Lycium australe* (Australian Boxthorn). At the eastern end of the alignment, 11 ha has been mapped as this habitat (**Figure 3-4**).

The overstorey trees are generally widely spaced but includes localised small groves. Hollows were generally absent. The surveyed areas had no known mechanical clearance or fire history. However, all sites are grazed with domestic stock and/or native or pest herbivores. Grazing combined with prolonged below average rainfall prior to the surveys resulted in most sites having a low plant species diversity, and a very sparse litter layer. Towards the eastern end of the alignment, tree and understorey density are also likely to have been reduced by long term grazing. An ephemeral channel supporting *Eucalyptus largiflorens* (Black Box), over chenopods has also been included in this habitat. This is the only mapped location of Black Box along the alignment.

Table 3-4 lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat. Full descriptions of each BAM site are provided below.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Low Open Woodland over chenopod understorey

Figure 3-4
Low Open Woodland over chenopod understorey extent along the alignment

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G

Table 3-4: Low Open Woodland over chenopod understorey – BAM sites

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
Western Third of the Alignment			
5c	*Casuarina pauper* (Black Oak) Woodland over *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush)	50.68	2.75
6b	*Myoporum platycarpum* (False Sandalwood) - *Casuarina paup*er (Black Oak) +/- *Eucalyptus oleosa* (Red Mallee) Open Woodland mosaiced with *Maireana sedifolia* (Bluebush) Low Open Shrubland	42.73	3.06
8b	*Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush)	38.03	1.13
9a	*Myoporum platycarpum* (False Sandalwood) Very Low Open Woodland over *Maireana sedifolia* (Bluebush)	33.79	1.30
9b	*Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush) and/or *Maireana sedifolia* (Bluebush)	30.32	Not mapped
10a	*Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana pyramidata* (Black Bluebush)	42.73	Not mapped
11a	*Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana sedifolia* (Bluebush)	40	3.57
104	*Casuarina pauper* (Black Oak) +/- *Alectryon oleifolius (*Bullock Bush) Very Open Woodland over *Lycium australe* (Australian Boxthorn) shrubland	74.66	0.39
105	*Casuarina pauper* (Black Oak) Low Open Woodland over chenopods and mixed tall shrubs	52.85	2.08
Eastern Third of Alignment			
29b	*Casuarina pauper* (Black Oak) Open Woodland over chenopod and sclerophyll shrubs	56.15	2.75
111	*Eucalyptus largiflorens* (River Box) - *Melaleuca lanceolata* (Dryland Teatree) Low Open Woodland over *Maireana pyramidata* (Black Bluebush)	49.49	0.23
114	*Austrostipa* sp. (Spear-grass) Open Grassland/ *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Casuarina pauper* (Black Oak) and/or *Callitris* spp. (Native Pines)	34.14	8.02
		TOTAL	25.27 km

[1]rounded to two decimal degrees

Habitat Use

In addition to those species for which chenopod shrubland (Section 3.2.2) provides potentially suitable habitat, the presence of trees provides extra habitat structure for some threatened larger bird species that done require a heavy litter layer or complex habitat structure (including dense shrub layer). This vegetation type provides potential habitat for a range for EPBC listed and state-listed threatened species, examples of some of these species are provided in Table 3-5below

Table 3-5: Examples of some fauna that may utilise low open woodland over chenopod in the TLC

Species Name	Common Name	Location along the corridor
Polytelis anthopeplus monarchoides	Regent Parrot	Occasional foraging habitats both ends
Neophema chrysostoma	Blue-winged parrot	Both ends
Neophema elegans	Elegant parrot	Both ends
Acanthiza iredalei	Slender-billed Thornbill	Western end
Plectorhyncha lanceolata	Striped Honeyeater	Both ends
Falco peregrinus	Peregrine Falcon	Western end
Burhinus grallarius	Bush Stonecurlew	Eastern end
Pachycephala inornata	Gilbert's Whistler	Eastern end
Petroica phoenicea	Flame Robin	Eastern, end
Melanodryas cucullata cucullata	Hooded Robin (YP, MN, AP, MLR, MM, SE)	Western end
Burhinus grallarius	Bush Stonecurlew	Eastern end

Site 5c – *Casuarina pauper* (Black Oak) Woodland over *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush)

Casuarina pauper (Black Oak) are the dominant overstorey trees, averaging about 6m tall, and with a total cover of about 20 -30%. *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush) are the co-dominant understorey shrubs (**Plate 3-34**). Due to prolonged below average rainfall, plant species diversity was relatively low, with only eight other native species recorded, in low densities and two Mistletoe species were observed: *Amyema linophylla* ssp. *orientalis* (Casuarina Mistletoe) growing on *Casuarina pauper* and *Lysiana exocarpi* ssp. *exocarpi* (Harlequin Mistletoe) growing on *Alectryon oleifolius* ssp. *canescens* (Bullock Bush). Sheep dung was recorded at the site and the *Atriplex vesicaria* (Bladder Saltbush) and juvenile *Casuarina pauper* were heavily grazed. *Maireana sedifolia*, a relatively palatable Bluebush appeared droughted and heavily grazed with an average canopy loss of >50%. No regeneration of Black Oaks was noted, and the density of the Black Oaks may be slightly below that expected in the benchmark BCM community. Similarly, the Bluebush and Blackbush shrubs were relatively widely spaced, perhaps due to non-regeneration and death of some adults. Vegetation has been cleared for a 3 m wide access track and additional past clearance of Black Oak up to 10m either side of the track (**Plate 3-35**).

No threatened flora or fauna were recorded at the site. Only one weed species was recorded at the site: *Mesembryanthemum crystallinum* (Common Iceplant) which was found in low density. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-34: Site 5c, *Casuarina pauper* Woodland with *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush) understorey (facing north)

Plate 3-35: Site 5c, three metre clearance for existing track plus additional past clearance of *Casuarina pauper* (Black Oak) up to 10m either side of track (facing west)

Site 6b – *Myoporum platycarpum* (False Sandalwood) - *Casuarina pauper* (Black Oak) +/- *Eucalyptus oleosa* (Red Mallee) Open Woodland mosaiced with *Maireana sedifolia* (Bluebush) Low Open Shrubland

Casuarina pauper (Black Oak) is generally dominant, and in the more open areas, *Myoporum platycarpum* (False Sandalwood) is dominant, with *Maireana sedifolia* (Bluebush) the dominant shrub throughout (**Plate 3-36**). Other shrubs included *Geijera linearifolia* (Sheep Bush), *Acacia nyssophylla* (Spine Bush) and *Rhagodia ulicina* (Intricate Saltbush). Tree and shrub health was generally poor due to prolonged drought and grazing. Most of the *Myoporum* trees were dead or in very poor health. The Bluebush were also highly grazed and in poor health.

No threatened flora or fauna observed at the site. No weeds were present. No known fire history. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-36: Site 6b, Patch of *Maireana sedifolia* (Bluebush) Low Open Shrubland with scattered *Myoporum platycarpum* (False Sandalwood), fringed by *Casuarina pauper* (Black Oak) Woodland (facing north)

Site 8b – *Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush)

Casuarina pauper (Black Oak) are the dominant overstorey trees, averaging about 5 m tall, and with a total cover of about 15%. *Maireana pyramidata* (Black Bluebush) are the dominant understorey shrub, covering about 10% of the area. Five other native species were recorded – all very sparse, including *Maireana sedifolia* (Bluebush). Prolonged drought, kangaroo and sheep grazing have resulted in very poor health of Black Bluebush and Bluebush, low plant diversity and a high cover of exposed soil crust.

No threatened flora or fauna observed at the site. Wards Weed (plentiful but < 1% cover) was the only weed species recorded. No recorded fire history. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-37: Site 8b, *Casuarina pauper* (Black Oak) Low Woodland (facing east)

Site 9a – *Myoporum platycarpum* (False Sandalwood) Very Low Open Woodland over *Maireana sedifolia* (Bluebush)

Site 9a comprises vegetation representative of BCM community MDBSA 2.1 open Mallee / Low Open Woodland with chenopod understorey. The dominant overstorey species was *Myoporum platycarpum* (False Sandalwood), with *Alectryon oleifolius* ssp. *canescens* (Bullock Bush), *Casuarina pauper* (Black Oak), *Exocarpos aphyllus* (Leafless Cherry) and emergent *Eucalyptus oleosa* (Red Mallee) also present (**Plate 3-38**). The dominant understorey species was *Maireana sedifolia* (Bluebush), with *Sclerolaena patenticuspis* (Spear-fruit Bindyi) and *Scaevola spinescens* (Spiny Fanflower) also present.

No threatened flora or fauna observed. No weeds were present. No fire history recorded. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-38: Site 9a, *Myoporum platycarpum* (False Sandalwood) Very Low Open Woodland over *Maireana sedifolia* (Bluebush) Shrubland (facing south)

Site 9b – *Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush) and/or *Maireana sedifolia* (Bluebush)

The centre of the survey site was in a patch of Black Bluebush surrounded by larger areas of *Casuarina pauper* (Black Oak) Low Woodland. Prolonged drought and grazing have considerably reduced shrub health and resulted in very low native plant species diversity (**Plate 3-39**). Species that were present included *Myoporum platycarpum* (False Sandalwood), *Rhagodia spinescens* (Spiny Saltbush), *Rhagodia ulicina* (Intricate Saltbush) and *Alectryon oleifolius ssp. canescens* (Bullock Bush).

No threatened flora or fauna observed at the site. At the time of survey, only old fruit and stalks of *Medicago* (Medic) and *Carrichtera annua* (Ward's Weed) were present. These species are likely to germinate given significant rainfall. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-39: Site 9b, *Casuarina pauper* (Black Oak) low woodland mosaiced with *Maireana pyramidata* (Black Bluebush) Open Shrubland (facing south)

Site 10a – *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana pyramidata* (Black Bluebush)

The dominant overstorey species was *Casuarina pauper* (Black Oak), with tall shrubs such as *Exocarpos aphyllus* (Leafless Cherry) and *Alectryon oleifolius ssp. canescens* (Bullock Bush) also sparsely present (**Plate 3-40**). The understorey was dominated by *Maireana pyramidata* (Black Bluebush) and *Rhagodia ulicina* (Intricate Saltbush) with extensive cover of *Maireana sedifolia* (Bluebush), *Atriplex stipitata* (Bitter Saltbush), *Sclerolaena obliquicuspis* (Oblique-spined Bindyi). Other native species that were sparsely present included *Rhagodia spinescens* (Spiny Saltbush), *Scaevola spinescens* (Spiny Fanflower) and *Maireana aphylla* (Cotton-bush).

No threatened flora or fauna observed at the site. Whilst no weeds were present, there was evidence of heavy grazing. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-40: Site 10a, *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana pyramidata* (Black Bluebush) Open Shrubland (facing south)

Site 11a - *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana sedifolia* (Bluebush)

The dominant overstorey species was *Casuarina pauper* (Black Oak), with tall shrubs such as *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) also sparsely present. Other shrubs included *Acacia oswaldii* (Umbrella Wattle), *Acacia nyssophylla* (Spine Bush), *Lysiana exocarpi* (Harlequin Mistletoe) and *Templetonia egena* (Broombush Templetonia) (**Plate 3-41**). The understorey was dominated by *Maireana sedifolia* (Bluebush) with *Rhagodia ulicina* (Intricate Saltbush). *Maireana pyramidata* (Black Bluebush) was also sparsely present.

No threatened flora or fauna observed at the site. No weeds were present. No fire history was recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-41: Site 11a, *Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana sedifolia* (Bluebush) Low Open Shrubland (facing west)

104: *Casuarina pauper* (Black Oak) +/- *Alectryon oleifolius* (Bullock Bush) Very Open Woodland over *Lycium australe* (Australian Boxthorn) Shrubland

This site is part of a large clay-soil depression. The vegetation assemblage is unique along the alignment. The vegetation is dominated by *Lycium australe* (Australian Boxthorn) shrubs, but with widely spaced *Maireana sedifolia* (Bluebush) also present (**Plate 3-42**). The overstorey comprises emergent *Casuarina pauper* (Black Oak) and *Alectryon oleifolius* (Bullock Bush) trees. This area will hold water after rain and is typical of vegetation communities of BCM 11.6 -semi-saine shrublands of clay soil depressions. Similar depressions are found in the north-western Murray Flats. The site comprises preferred habitat for Australian Boxthorn, namely slightly saline, clay depressions.

An existing high voltage transmission line and maintenance track dissects the site. Groups of *Pomatostomus superciliosus* (White-browed Babbler) and *Artamus personatus* (Masked Woodswallow) were opportunistically observed during the survey. The BAM vegetation condition category at the time of assessment was High.

Plate 3-42: Site 104, *Lycium australe* (Australian Boxthorn) shrubland with emergent *Casuarina pauper* (Black Oak) / *Alectryon oleifolius* (Bullock Bush) (facing west)

105 – *Casuarina pauper* (Black Oak) Low Open Woodland over chenopods and mixed tall shrubs

This site occurred in White Dam Conservation Park. The overstorey comprised widely spaced *Casuarina* (Black Oak) scattered trees or small clusters (**Plate 3-43**). The open shrub understorey contained a mix of chenopods and tall sclerophyll shrubs. Prominent shrubs were Bluebush, which appear to have died back in the recent prolonged drought, along with *Lycium australe* (Australian Boxthorn) and *Rhagodia ulicina* (Intricate Saltbush). Other species were present largely as isolated individuals. The only weed recorded was *Carrichtera annua* (Ward's Weed), which was sparsely present. No bird species were observed during the survey.

The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-43: Site 105, *Casuarina pauper* (Black Oak) over mixed sclerophyll and chenopod shrubs (facing north)

HABITAT TYPE WOODLAND OVER CHENOPOD UNDERSTOREY – EASTERN END OF ALIGNMENT

Site 29b: *Casuarina pauper* (Black Oak) Open Woodland over chenopod and sclerophyll shrubs

This site was a *Casuarina pauper* (Black Oak) Woodland over an open shrub understorey with both chenopods and sclerophyll shrubs prominent (**Plate 3-44**). The site occurred on a red loam soil flat. The canopy intactness of *Casuarina pauper* was variable. A high lichen crust cover was present. Moderate to heavy grazing pressure was observed with rabbit, kangaroo and very old goat dung being present. *Exocarpos aphyllus* (Leafless Cherry) and *Acacia colletioides* (Veined Wait-a-while) were heavily grazed.

No threatened flora or fauna were recorded at the site. No weed species were found at the site. No recorded fire history. The BAM vegetation condition category at the time of assessment was High.

Plate 3-44: Site 29b, *Casuarina pauper* (Black Oak) Open Woodland over chenopod and sclerophyll shrub understorey on red loam flat (facing east)

111 – *Eucalyptus largiflorens* (River Box) / *Melaleuca lanceolata* (Dryland Teatree) Low Open Woodland over *Maireana pyramidata* (Black Bluebush)

Eucalyptus largiflorens (River Box) occurs along the drainage line in only one location. It occurs over approximately 150 m in a sandy drainage line, west of Lake Meretti, and adjoining the Wentworth Road. The BAM site is approximately 7 km north of the main channel of the River Murray.

River Box dominates the centre of the drainage line, with *Melaleuca lanceolata* (Dryland Teatree) on the slightly higher margins. The River Box trees are old growth, with large and small hollows present, and averaging > 30% dieback.

The understorey is dominated by *Maireana pyramidata* (Black Bluebush), with the sub-shrub *Dissocarpus paradoxus* (Cannonball) widespread and common (**Plate 3-45**). The presence of *Tecticornia* species (Samphire) (isolated plants) suggest the soil is semi-saline.

Being relatively close to the Wentworth Road, there were signs of household rubbish. The site has no recorded fire history. Five weed species were recorded, all of relatively low cover and environmental threat, with *Carrichtera annua* (Ward's Weed), *Sisymbrium sp.* (Mustard) and *Rostraria pumila* (Tiny Bristle Grass) of highest cover.

Opportunistic fauna observations included presence of an inactive rabbit warren, *Cracticus torquatus* (Grey Butcherbird) and *Varanus gouldii* (Sand Goanna). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-45: Site 111, *Eucalyptus largiflorens* (River Box) over *Maireana pyramidata* (Black Bluebush) (facing north)

114 Austrostipa sp. (Spear-grass) Open Grassland and/or *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Casuarina pauper* (Black Oak) and/or *Callitris* spp. (Native Pines))

Past clearance, combined with grazing has reduced the overstorey density and the diversity of understorey plants at this site (**Plate 3-46**). Overstory included emergent *Casuarina pauper* (Black Oak) and/or *Callitris spp*. (Native Pines)The most common groundcover plants were *Sclerolaena obliquicuspis* (Oblique-spined Bindyi), *Roepera ovata* (Dwarf Twinleaf) and *Sclerolaena diacantha* (Grey Bindyi). All other species were present at isolated plants.

The BAM vegetation condition category at the time of assessment was Low. Weeds present included *Medicago spp.* (Medic), *Salvia verbenaca var*. (Salvia), *Sisymbrium spp*. (Mustard), *Limonium sp*. (Sea Lavender) and *Carrichtera annua* (Ward's Weed).

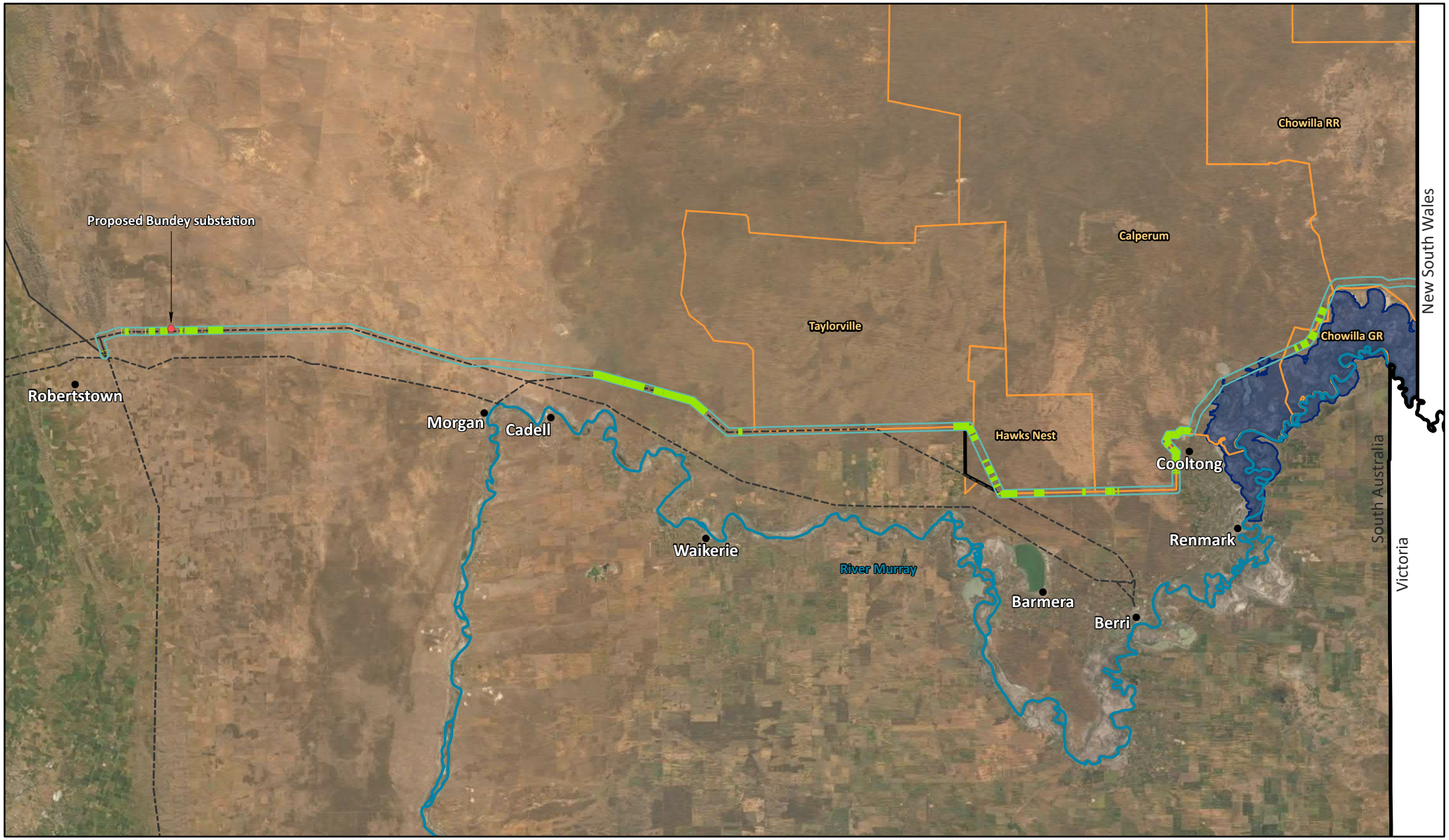
Plate 3-46: Site 114, *Austrostipa* grassland with scattered *Casuarina pauper* (facing east)

3.2.4 Old Growth Mallee over open sclerophyll and chenopod understorey

This is one of the major habitats along the alignment, with 46.71 km being mapped (**Figure 3-5**). The habitat is characterised by large older mallee trees (no recent fire history), typically with *Eucalyptus oleosa* (Red Mallee) and/or *Eucalyptus gracilis* (Yorrell) the dominant mallees. Most sites contain at least small hollows, with patchy to continuous litter layer. The understorey is generally quite open, with medium to tall shrubs widely spaced. Common shrub species include *Senna artemisioides* ssp (Senna) species, *Enchylaena tomentosa* (Ruby Saltbush), *Atriplex stipitata* (Bitter Saltbush), *Acacia nyssophylla* (Spine Bush) and *Rhagodia ulicina* (Intricate Saltbush). Common herbs and small shrubs included *Roepera* sp. (Twin-leaf species), *Sclerolaena* sp. (Bindyis) and *Maireana pentatropis* (Erect Mallee Bluebush).

Table 3-6 lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat.

Full descriptions of each BAM site are provided below.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Old growth mallee over open sclerophyll and chenopod shrub understorey

Figure 3-5
Old growth mallee over open sclerophyll and chenopod understorey extent along the alignment

0 20
Kilometres
N

ElectraNet
energy connect
JBS&G

Table 3-6: Old growth mallee over open sclerophyll and chenopod shrub understorey

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
Western end of the alignment (7.03km)			
1a	*Eucalyptus porosa* (Mallee Box) - *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Desert Senna) and chenopods	40.5	0.13
2a	*Eucalyptus porosa* (Mallee Box) over *Senna artemisioides* (Desert Senna) and chenopods	40.16	Not mapped
3b	*Eucalyptus oleosa* (Red) Mallee) Mallee over a very sparse chenopod understorey.	44.72	0.68
4b	*Eucalyptus oleosa* (Red Mallee) Mallee over mid-dense chenopod shrubs	59.13	1.58
5a	*Eucalyptus oleosa* (Red Mallee) Mallee over chenopod shrubs	40.74	0.07
5b	*Eucalyptus oleosa* (Red Mallee) Very Open Mallee over open sclerophyll and chenopod shrub understorey	36.78	2.29
7a	*Eucalyptus oleosa* (Red Mallee) Very Open Mallee over mixed shrubs	36.12	0.30
8a	*Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana sedifolia* (Bluebush)	47.2	1.98
Central and Eastern end of alignment (39.68)			
8c	*Eucalyptus gracilis* (Yorrell) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus brachycalyx* (Gilja) Open Mallee over low open sclerophyll and chenopod shrubs	65.25	4.23
10c	*Casuarina pauper* (Black Oak) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Woodland with open tall shrub understorey	59.63	2.78
12c	*Eucalyptus oleosa* (Red Mallee) Open Mallee over *Atriplex stipitata* (Bitter Saltbush)	50.7	1.59
14a	*Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll and chenopod shrubs	53	Not mapped
15a	*Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods	53.5	Not mapped
15b	*Eucalyptus oleosa* (Red Mallee) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over sclerophyll shrubs and chenopods	53.44	1.82
18a	*Eucalyptus oleosa* (Red Mallee) / *Eucalyptus gracilis* (Yorrell) Mallee over *Senna artemisioides* (Senna) and chenopods	61	Not mapped
18c	*Eucalyptus leptophylla* (Narrow-leaf Red Mallee) +/- *Eucalyptus brachycalyx* (Gilja) Mallee over tall sclerophyll shrubs	60	0.36
19a	*Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Senna) and chenopods	50	Not mapped
19b	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus gracilis* (Yorrell) Open Mallee over an open understorey of sclerophyll shrubs and chenopods	49.19	2.10
19c	*Eucalyptus oleosa - Eucalyptus gracilis* (Yorrell)/ *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a very open understorey	40.74	0.27
23b	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus brachycalyx* (Gilja) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over chenopod and sclerophyll shrubs	56.64	5.42
23c	*Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus oleosa* (Red Mallee) Open Mallee over tall chenopod shrubs	60.45	4.14

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
24b	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus gracilis* (Yorrell) Mallee over chenopod and sclerophyll shrubs	56.64	3.27
26c	*Eucalyptus gracilis* (Yorrell) – *Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll shrub understorey	48.75	Not mapped
27b	*Eucalyptus oleosa* (Red Mallee) open Mallee over sparse *Maireana pyramidata* (Black Bluebush) and sclerophyll shrubs	62.56	1.50
108	*Eucalyptus gracilis* (Yorrell) Open Mallee over sparse chenopod and sclerophyll shrubland	52.65	6.36
116	*Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Mallee over sclerophyll and chenopod shrubs	66.3	4.15
117	S*enna artemisioides* ssp. *filifolia* Open Shrubland with emergent *Eucalyptus gracilis* (Yorrell)	42.22	1.69
		TOTAL	46.71 km

[1] rounded to 2 decimal degrees

Habitat Use

The Old Growth Mallee vegetation occurs at several locations along the corridor where it is considered to provide habitat for range of common and threatened fauna. At the centre and eastern end of the corridor the vegetation is contiguous with larger blocks of remnant mallee and includes a mosaic of fire history. At the western end the vegetation is more fragmented than the central and eastern portion of the alignment, with smaller blocks of mallee remaining. Examples of some of the threatened species that may be expected to use this vegetation as habitat are provided in Table 3-7 below.

Table 3-7: Examples of some of the threatened fauna that may use Old Growth Mallee in the TLC as habitat

Species Name	Common Name	Location with the corridor
Cinclosoma castanotum	Chestnut-backed Quailthrush	Western, central and eastern ends
Melanodryas cucullata cucullata	Hooded Robin	Western, central and eastern ends
Myiagra inquieta	Restless Flycatcher	Western, central and eastern ends
Plectorhyncha lanceolata	Striped Honeyeater	Western, central and eastern ends
Corcorax melanorhamphos	White-winged Chough	Western, central and eastern ends
Manoria flavigula melanotis	Black-eared Miner	Central and eastern ends
Polytelis anthopeplus monarchoides	Regent Parrot	Central and eastern ends
Leipoa ocellata	Malleefowl	Central and eastern ends
Pachycephala rufogularis	Red-lored Whistler	Central and eastern ends
Burhinus grallarius	Bush Stonecurlew	Central and eastern ends
Pachycephala inornata	Gilbert's Whistler	Central and eastern ends
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Central and eastern ends

3.2.4.1 Western End of Alignment

Site 1a - *Eucalyptus porosa* (Mallee Box) - *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Desert Senna) and chenopods

Site 1a comprised roadside vegetation consistent with BCM community MDBSA 3.1 Mallee with Very Open Sclerophyll / chenopod Shrub understorey. Dominant overstorey species included *Eucalyptus porosa* (Mallee Box) and *Eucalyptus oleosa* (Red Mallee). The midstorey was dominated by *Senna artemisioides* ssp. *coriacea* (Broad-leaf Desert Senna), *Atriplex stipitata* (Bitter Saltbush) and *Rhagodia parabolica* (Mealy Saltbush) (**Plate 3-47**). Other native species that were present included *Acacia ligulata* (Umbrella Bush), *Grevillea huegelii* (Comb Grevillea), *Maireana brevifolia* (Short-leaved Bluebush) and *Lomandra effusa* (Scented Mat-rush).

Not threatened flora or fauna were observed within this community. Minimal hollows were evident with the Mallee trees that were present. No weeds were present. No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Medium.

Plate 3-47: Site 1a, *Eucalyptus porosa* (Mallee Box) / *E. oleosa* (Red Mallee) over *Senna artemisioides* (Desert Senna) and chenopods (facing north)

Site 2a - *Eucalyptus porosa* (Mallee Box) over *Senna artemisioides* (Desert Senna) and chenopods.

Site 2a comprised roadside vegetation consistent with BCM community MDBSA 3.1. At this site *Eucalyptus porosa* (Mallee Box) was the dominant overstorey species and *Rhagodia parabolica* (Mealy Saltbush) was the dominant midstorey species (**Plate 3-48**). Other native species present included *Acacia* sp. (Wattles), *Enchylaena tomentosa* (Ruby Saltbush), *Einadia nutans* (Climbing Saltbush), *Maireana brevifolia* (Short-leaved Bluebush) and grasses *Austrostipa* sp., (Spear-grass) and *Rytidosperma setaceum* (Small-flowered Wallaby-grass).

No threatened flora or fauna were observed. Weeds that were sparsely present included *Marrubium vulgare* (Horehound) and *Lycium ferocissimum* (African Boxthorn). Both of these weeds are Declared under the NRM Act, Boxthorn is also a Weed of National Significance (WoNS). No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Medium.

Plate 3-48: Site 2a, *Eucalyptus porosa* (Mallee Box Box) over *Senna artemisioides* (Desert Senna) and chenopods (facing east)

Site 3b – *Eucalyptus oleosa* (Red) Mallee) Mallee over a very sparse chenopod

This site comprised old regrowth Mallee (*Eucalyptus oleosa*) on a slight rise with stony calcareous loam soil. The understorey was very sparse, dominated by a heavy litter (leaves and twigs) layer (**Plate 3-49**). *Enchylaena tomentosa* (Ruby Saltbush) was the most common understorey shrub (1 to 5% cover). With the exception of a few individuals of *Panicum* sp. (Panic grass), the four other understorey species recorded were all chenopods. - namely *Salsola australis* (Buckbush), *Atriplex stipitata* (Bitter Saltbush), *Maireana pentatropis* (Erect Mallee Bluebush) and *Maireana brevifolia* (Short-leaved Bluebush). These species are all relatively unpalatable.

No threatened flora or fauna were observed. A flock of White-winged Choughs (*Corcorax melanorhamphos melanorhamphos,* rated Rare SA) was present during the assessment. These birds feed on insects and seeds found in the litter layer. Hence, the heavy litter layer at this site provides good feeding habitat. Nests are large bowls of mud built on horizontal branches. Given the relatively small diameter branches (trees were multi-stemmed regrowth to 5 m tall), the site is not considered to provide optimal nesting habitat for White-winged Choughs.

Sparse *Medicago* (Medic) seedlings were the only weeds recorded. No fire history recorded. The BAM vegetation condition category for this site at the time of assessment was Medium.

Plate 3-49: Site 3b, *Eucalyptus oleosa* (Red) Mallee) Mallee over an open very sparse chenopod understorey (facing west)

Site 4b – *Eucalyptus oleosa* (Red Mallee) Mallee over mid-dense chenopod shrubs

Site 4b vegetation comprised old re-growth Mallee on a sandy loam flat, with a relatively diverse chenopod-dominated understorey. The dominant overstorey species was *Eucalyptus oleosa* (Red Mallee) (**Plate 3-50**). The understorey was dominated by *Atriplex stipitata* (Bitter Saltbush), *Enchylaena tomentosa* (Ruby Saltbush) and *Maireana pentatropis* (Erect Mallee Bluebush). Other native species present included *Maireana radiata* (Radiate Bluebush), *Maireana pyramidata* (Black Bluebush) *and Maireana sedifolia* (Bluebush). No recent domestic stock grazing was evident. Grazing impact was moderate to low, with obvious grazing noted only on *Eremophila scoparia* (Broom Emubush).

No threatened flora species were observed. One state threatened fauna species was present (*Corcorax melanorhamphos*, White-winged Chough, State Rare). Sparse Wards Weed (*Carrichtera annua*) was the only weed species recorded. No recorded fire history. The BAM vegetation condition category for this site at the time of assessment was High.

Plate 3-50: Site 4b, *Eucalyptus oleosa* (Red Mallee) Mallee over mid-dense chenopod shrubs (facing north)

Site 5a - *Eucalyptus oleosa* (Red Mallee) low Mallee over chenopod shrubs

Site 5a vegetation comprised old growth Mallee representative of BCM community MDBSA 2.1 open Mallee / Low Open Woodland with chenopod shrub understorey. The dominant overstorey species was *Eucalyptus oleosa* (Red Mallee) (**Plate 3-51**). The understorey was dominated by *Maireana sedifolia* (Bluebush), *Atriplex stipitata* (Bitter Saltbush) and *Maireana pentatropis* (Erect Mallee Bluebush). Other native species present included *Maireana radiata* (Radiate Bluebush), *Sclerolaena patenticuspis* (Spear-fruit Bindyi), *Roepera aurantiaca* (Shrubby Twinleaf) and *Enchylaena tomentosa* (Ruby Saltbush).

No threatened flora species were observed. One state threatened fauna species was present (*Corcorax melanorhamphos*, White-winged Chough, State Rare). No weeds were present. The BAM vegetation condition category for this site at the time of assessment was Medium.

Plate 3-51: Site 5a, *Eucalyptus oleosa* (Red Mallee) low Mallee over chenopod shrubs (facing south)

Site 5b – *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over open sclerophyll and chenopod shrub understorey

This site was observed from the road reserve only. It comprised old regrowth Mallee, and seemingly at reduced natural tree density (**Plate 3-52**). The site was a stony red sandy loam (calcareous) plain. Sheep dung was prevalent with shrubs such as *Maireana sedifolia* (Bluebush) *Scaevola spinescens* (Spiny Fanflower) and *Rhagodia ulicina* (Intricate Saltbush) selectively grazed. *Eucalyptus oleosa* (Red Mallee) was the dominant Mallee, to 6 m tall. The understorey was a mix of sclerophyll and chenopod shrubs.

No threatened flora or fauna were observed during the inspection. No weeds were recorded. No recorded fire history. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-52: Site 5b, *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over mid-dense chenopod shrubs and sparse sclerophyll shrubs (facing north from road reserve)

Site 7a - *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over mixed shrubs

Site 7a vegetation comprised Very Low Open Mallee representative of BCM community MDBSA 1.1 open Mallee/ Low Open Woodland with a mixed shrub understorey. The dominant overstorey species was *Eucalyptus oleosa* (Red Mallee) and the dominant understorey species was *Atriplex stipitata* (Bitter Saltbush) (**Plate 3-53**). Other native species that are present include *Roepera aurantiaca* (Shrubby Twinleaf), *Grevillea huegelii* (Comb Grevillea), *Maireana sedifolia* (Bluebush), *Cratystylis conocephala* (Bluebush Daisy) *Acacia nyssophylla* (Spine Bush) and *Sclerolaena patenticuspis* (Spear-fruit Bindyi).

No threatened flora or fauna were observed. No weeds were present. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-53: Site 7a, *Eucalyptus oleosa* (Red Mallee) Very Open Mallee over chenopods (facing north)

Site 8a - *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana sedifolia* (Bluebush)

Site 8a vegetation comprised semi old growth Mallee representative of BCM community MDBSA 2.1 Open Mallee / Low Open Mallee with chenopod shrub understorey. The dominant overstory species was *Eucalyptus oleosa* (Red Mallee) and the dominant understorey species was *Maireana sedifolia* (Bluebush) (**Plate 3-54**). Other native species present included *Atriplex stipitata* (Bitter Saltbush), *Maireana brevifolia* (Short-leaved Bluebush), *Exocarpos aphyllus* (Leafless Cherry), *Rhagodia ulicina* (Intricate Saltbush), *Roepera aurantiaca* (Shrubby Twinleaf), *Enchylaena tomentosa* (Ruby Saltbush), *Acacia nyssophylla* (Spine Bush), *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) and *Myoporum platycarpum* (False Sandalwood). *Amyema miquelii* (Box Mistletoe) was also present.

No threatened flora or fauna were observed. No weeds were present. No fire history was recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-54: Site 8a, *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana sedifolia* (Bluebush) Shrubland

Site 8c – *Eucalyptus gracilis* (Yorrell) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus brachycalyx* (Gilja) Open Mallee over low open sclerophyll and chenopod shrubs

This site comprised old growth mallee representative of BCM community MDBSA 2.1 (Open Mallee/ low open Mallee with chenopod shrub understorey). Hollows were recorded in the mallees. The three co-dominant Mallee species forming the overstorey were *Eucalyptus gracilis* (Yorrell), *Eucalyptus oleosa* (Red Mallee) and *Eucalyptus brachycalyx* (Gilja), with scattered Myoporum *platycarpum* (False Sandalwood) (**Plate 3-55**). Prominent understorey species were low shrubs, *Maireana pentatropis* (Erect Mallee Bluebush) and *Enchylaena tomentosa* (Ruby Saltbush), and the herb, *Roepera ovata* (Dwarf Twinleaf). An additional 12 native species were recorded, all in low densities. The property was grazed by sheep and dung was recorded at the site. Several understorey shrub species appeared droughted. However, regeneration of *Maireana pentatropis* (Erect Mallee Bluebush), *Roepera ovata* (Dwarf Twinleaf), and *Myoporum platycarpum* (False Sandalwood) was noted. A 3 m wide access track ran underneath the alignment with an additional clearance of Mallee up to 10m either side of the track. (**Plate 3-56**).

No threatened flora or fauna were recorded at the site. Only two weeds were recorded at the site: *Carrichtera annua* (Ward's Weed) and *Asphodelus fistulosus* (Onion Weed), both in low density. No fire history was recorded. The BAM vegetation condition category at the time of assessment was High.

Plate 3-55: Site 8c, Old growth Mallee (*Eucalyptus gracilis, E. oleosa, E. brachycalyx*) over chenopod (*Maireana pentatropis* (Erect Mallee Bluebush) understorey (facing north)

Plate 3-56: Site 8c, Access track with additional clearance of Mallee either side (facing east)

Site 10c – *Casuarina pauper* (Black Oak) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Woodland with open tall shrub understorey

The site comprised a *Casuarina pauper* (Black Oak) */ Eucalyptus oleosa* (Red Mallee) */ Eucalyptus gracilis* (Yorell) Open Woodland with an Open Tall Shrub understorey including *Acacia nyssophylla* (Spine Bush) and *Maireana sedifolia* (Bluebush), and scattered trees of *Alectryon oleifolius* ssp. *canescens* (Bullock Bush), and *Myoporum platycarpum* (False Sandalwood) (**Plate 3-57**). The combination of Black Oak and mallee species as dominants, reflects the location of this site as a transition zone between Black Oak Open Woodlands to the west and extensive mallee tracts to the east. The understorey also contained smaller shrubs and herbs such as *Enchylaena tomentosa* (Ruby Saltbush) and *Eriochiton sclerolaenoides* (Woolly-fruit Bluebush). Recent grazing pressure appears to be relatively low as reflected in the low density of dung observed. However, the perennial species were droughted and in poor condition. The Mallee either side of the access track appeared to have been previously cleared about 10m back from the track (**Plate 3-58**).

No threatened flora or fauna were recorded at the site. No weed species were observed at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was High.

Plate 3-57: Site 10c, Mallee Open Woodland with Tall Shrub understorey (facing north)

Plate 3-58: Site 10c, Clearance of Mallee either side of the track up to 10m back (facing east)

Site 12c – *Eucalyptus oleosa* (Red Mallee) Open Mallee over *Atriplex stipitata* (Bitter Saltbush)

The site was on a low dune, as per site 11c, and has been benchmarked against the BCM Community MDBSA 3.1 with multi-stemmed *Eucalyptus oleosa* (Red Mallee) over an *Atriplex stipitata* (Bitter Saltbush) */ Maireana pentatropis* (Erect Mallee Bluebush) shrubland on red sandy loam (**Plate 3-59**). Shrub density appears to have been reduced, although the site retains a relatively high number of plant species, with 18 additional native species recorded including: *Myoporum platycarpum* (False Sandalwood), *Alectryon oleifolius* ssp. *canescens* (Bullock Bush) and five *Maireana* species.

No threatened flora or fauna were recorded at the site. There were small hollows only in the *Eucalyptus oleosa.* No weed species were found at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-59: Site 12c, *Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods *Atriplex stipitata* (Bitter Saltbush) */ Maireana pentatropis* (Erect Mallee Bluebush) (facing north)

Site 14a – *Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll and chenopod shrubs

Site 14a vegetation consists of old regrowth and scattered old growth Mallee representative of BCM community MDBSA 2.1 Open Mallee / Low Open Mallee with chenopod shrub understorey. This site is north of Hogwash Bend Conservation Park. The dominant overstory species was *Eucalyptus oleosa* (Red Mallee) with sparse cover of tall shrub *Acacia nyssophylla* (Spine Bush) (**Plate 3-60**). There was a high level of species diversity in the midstorey and understory with a mix of chenopods dominant including *Atriplex stipitata* (Bitter Saltbush), *Maireana pentatropis* (Erect Mallee Bluebush), *Maireana radiata* (Radiate Bluebush), *Sclerolaena diacantha* (Grey Bindyi), *Atriplex vesicaria* (Bladder Saltbush), *Enchylaena tomentosa* (Ruby Saltbush), *Chenopodium curvispicatum* (Cottony Goosefoot), *Maireana trichoptera* (Hairy-fruit Bluebush) and *Maireana sedifolia* (Bluebush). Other native species present included *Roepera apiculata* (Pointed Twinleaf), *Roepera aurantiaca* (Shrubby Twinleaf) and *Eremophila scoparia* (Broom Emubush).

No threatened fauna were observed, a number of common fauna species were opportunistically observed; *Colluricincla harmonica* (Grey Shrike-thrush), *Merops ornatus* (Rainbow Bee-eater), *Barnardius zonarius barnardi* (Mallee Ringneck), *Artamus cyanopterus* (Dusky Woodswallow), *Anthochaera carunculate* (Red Wattlebird) and *Acanthagenys rufogularis* (Spiny-cheeked Honeyeater). Large hollows were present and there was good coverage of leaf litter (**Plate 3-61**). No weeds were observed, but there was evidence of moderate to hard grazing. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-60: Site 14a, *Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods (facing east)

Plate 3-61: Site 14a, Large hollows and leaf litter present at this site provide suitable habitat for fauna, including threatened species

Site 15a – *Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods

Site 15a consists of similar vegetation to site 14a, with *Atriplex stipitata* (Bitter Saltbush) dominant in the mixed chenopod understorey (**Plate 3-62**). *Rhagodia ulicina* (Intricate Saltbush) was also present. This site is north of Hogwash Bend Conservation Park.

No threatened fauna species were observed. No weeds were observed, but there was evidence of moderate grazing. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-62: Site 15a, *Eucalyptus oleosa* (Red Mallee) Open Mallee over chenopods (facing north)

Site 15b – *Eucalyptus oleosa* (Red Mallee) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over sclerophyll shrubs and chenopods

This site was characterised by large old growth Mallee trees (averaging 10 m tall), with habitat hollows present. Areas of lower Mallee tree density naturally occur, these sites have a higher density of *Myoporum platycarpum* (False Sandalwood) and higher shrub cover (**Plate 3-63**). As is typical of this habitat type, the site occurred on a red loam flat. *Atriplex stipitata* (Bitter Saltbush) was the dominant shrub in the mixed chenopod and sclerophyll shrub understorey. The site appeared to be only light to moderately grazed and species diversity was moderately high. Regeneration was observed in at least seven native species. Other prominent shrubs were Senna species, *Rhagodia ulicina* (Intricate Saltbush), *Templetonia egena* (Broombush Templetonia) and *Enchylaena tomentosa* (Ruby Saltbush).

No threatened flora or fauna were recorded at the site. Weed species were sparsely present and comprised: *Carrichtera annua* (Ward's Weed) (common but < 1% cover), *Moraea setifolia* (Thread Iris) (not many, < 1% cover) and *Asphodelus fistulosus* (Onion Weed) (not many, < 1% cover). No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-63: Site 15b, *Eucalyptus oleosa* (Red Mallee) Old Growth Open Mallee over sclerophyll shrubs and chenopods (facing west)

Site 18a – *Eucalyptus oleosa (*Red Mallee) - *Eucalyptus gracilis* (Yorrell) Mallee over *Senna artemisioides* (Senna) and chenopods

Site 18a, located within Heritage Agreement Area 1544 (Calperum Station), consists of long unburnt Mallee representative of BCM vegetation community MDBSA 3.1 Open Mallee / low open Mallee with chenopod shrub understorey. The dominant overstory species were *Eucalyptus oleosa* (Red Mallee) and *Eucalyptus gracilis* (Yorrell) with *Myoporum platycarpum* (False Sandalwood) and *Exocarpos aphyllus* (Leafless Cherry) present in the midstorey (**Plate 3-64**). The dominant understorey species were *Senna artemisioides petiolaris* (Desert Senna) and *Senna artemisioides coriacea* (Broad-leaf Desert Senna) with *Senna artemisioides filifolia* (Fine-leaf Desert Senna) and *Olearia pimeleoides* (Pimelea Daisy-bush) also present. There was a high diversity of other native species and chenopods present in the understorey including three species of *Maireana*, two species of *Roepera,* two species of *Sclerolaena*, *Rhagodia ulicina* (Intricate Saltbush), *Einadia nutans* (Climbing Saltbush), C*henopodium curvispicatum* (Cottony Goosefoot) and *Pimelea microcephala* (Shrubby Riceflower).

No threatened flora and fauna were present. Common fauna that were observed included *Merops ornatus* (Rainbow Bee-eater), *Lichenostomus ornatus* (Yellow-plumed Honeyeater), *Acanthiza uropygialis* (Chestnut-rumped Thornbill), *Acanthagenys rufogularis* (Spiny-cheeked Honeyeater), *Colluricincla harmonica* (Shrike-thrush) and *Rhipidura leucophrys* (Willie Wagtail). No weeds were present, but there was evidence of light grazing from kangaroos and goats. No fire history recorded. The BAM vegetation condition category at the time of assessment was High.

Plate 3-64: Site 18a, *Eucalyptus oleosa* (Red Mallee) / *Eucalyptus gracilis* (Yorrell) Mallee over *Senna artemisioides* (Senna) and chenopods (facing north)

Site 18c – *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) +/- *Eucalyptus brachycalyx* (Gilja) Mallee over tall sclerophyll shrubs

The site was in a shallow interdune swale with old growth Mallee (*E. leptophylla* (Narron-leaf Mallee) +/- *E. brachycalyx* (Gilja)) over tall shrubs (**Plate 3-65**). The site was characterised by naturally shrub-dominated areas with trees sparse or absent. Prominent shrubs were *Dodonaea viscosa* ssp*. angustissima* (Narrow-leaf Hopbush), *Acacia nyssophylla* (Spine Bush), *Senna artemisioides* ssp*. coriacea* (Broad-leaf Desert Senna), *Senna artemisioides* ssp*. Petiolaris* (a Senna), *Olearia pimeleoides* (Pimelea Daisy-bush), *Roepera aurantiaca* (Shrubby twinleaf) and *Maireana pentatropis* (Erect Mallee Bluebush).

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was High.

Plate 3-65: Site 18c, Old Growth Mallee shallow interdune swale on loamy red sand over *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop Bush) (facing north)

Site 19a – *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Senna) and chenopods

Site 19a consists of long unburnt Mallee vegetation representative of BCM community MDBSA 2.1 Open Mallee/ low open Mallee with chenopod shrub understorey. This site is within Heritage Agreement 1544, also known as Calperum Station. The dominant overstory species were *Eucalyptus oleosa* (Red Mallee) with *Acacia nyssophylla* (Spine Bush), *Acacia calamifolia* (Wallowa) and *Myoporum platycarpum* (False Sandalwood) was present in the midstorey (**Plate 3-66**). Dominant species in the understorey included *Senna artemisioides filifolia* (Fine-leaf Desert Senna), *Westringia rigida* (Stiff Westringia), *Maireana pentatropis* (Erect Mallee Bluebush), *Roepera aurantiaca* (Shrubby Twinleaf) and *Sclerolaena diacantha* (Grey Bindyi). Other native species present included C*henopodium curvispicatum* (Cottony Goosefoot), *Maireana georgei* (Satiny Bluebush), *Austrostipa* spp., *Olearia muelleri* (Mueller's Daisy-bush) and *Cassytha* sp. (Dodder-laurel species).

No threatened flora or fauna were recorded. Common fauna that were opportunistically recorded included *Pomatostomus superciliosus* (White-browed Babbler), *Acanthiza uropygialis* (Chestnut-rumped Thornbill), Dusky Woodswallow, *Colluricincla harmonica* (Grey Shrike-thrush) and *Barnardius zonarius barnardi* (Mallee Ringneck). No weeds present, some evidence of previous pruning / cutting of vegetation. No fire history recorded. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-66: Site 19a, *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Senna) and chenopods (facing north)

Site 19b – *Eucalyptus oleosa* (Red Mallee) / *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus gracilis* (Yorrell) Open Mallee over an open understorey of sclerophyll shrubs and chenopods

This site comprised Mallee on red sandy loam flats/swales. The naturally open understorey of this mature Mallee community was dominated by very large old *Triodia* (Spinifex) plants and a dense litter layer (**Plate 3-67**). Other common shrubs were *Dodonaea viscosa* ssp. *Angustissima* (Narrow-leaf Hopbush), *Beyeria opaca* (Dark Turpentine Bush) and *Senna* species. The site was on the edge of a fire scar, as characterised by the presence of *Condonocarpus cotinifolius* (Poplar Bell-fruit), which germinates after fire, on the edge of the site. The Mallee present was very old re-growth but no hollows were observed. Obvious grazing was noted only on *Acacia oswaldii* (Umbrella Wattle) (one plant present).

No threatened flora or fauna were recorded at the site. No weeds were observed. Fire history shows 13-year-old post-fire regrowth in the area although the site itself was unburnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-67: Site 19b, Old Growth *Eucalyptus oleosa* (Red Mallee)) Open Mallee over sclerophyll shrubs and chenopods (facing west)

Site 19c – *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell)/ *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a very open understorey

The overstorey was dominated by *Eucalyptus gracilis* (Yorell) and *Eucalyptus oleosa* (Red Mallee) with *Eucalyptus leptophylla* (Narrow-leaf Mallee) in slightly lower density (**Plate 3-68**). The understorey comprised *Maireana pentatropis* (Erect Mallee Bluebush) and *Roepera aurantiaca* (Shrubby Twinleaf) with a heavy leaf litter. A total of 11 native species was recorded. Being relatively old growth Mallee with a heavy litter layer, this lower diversity is considered natural and the site was in relatively good condition.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-68: Site 19c, Old Growth *Eucalyptus oleosa* (Red Mallee) and *E. gracilis* (Yorell) Mallee with understorey dominated by leaf litter (facing north)

Site 23b: *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus brachycalyx* (Gilja) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over chenopod and sclerophyll shrubs

The site was typical of old growth Mallee on red sandy-loam flats. *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus brachycalyx* (Gilja) were the dominant Mallees, approximately 8 m tall and with small hollows present (**Plate 3-69**). Senna species were dominant in the open sclerophyll understorey. *Myoporum platycarpum* (False Sandalwood) trees were also common, especially in small areas where Mallees were largely absent. These areas had a higher density of shrubs, particularly Senna species.

No threatened flora or fauna were recorded at the site. No weeds were recorded, nor obvious grazing impact and the site had a well-developed litter layer. No recorded fire history. The BAM vegetation condition category at the time of assessment was High.

Plate 3-69: Site 23b, Old Growth *Eucalyptus oleosa* (Red Mallee) – *Eucalyptus brachycalyx* (Gilja) Mallee +/- *Myoporum platycarpum* (False Sandalwood) over chenopod and sclerophyll (facing east)

Site 23c – *Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus oleosa* (Red Mallee) Open Mallee over tall chenopod shrubs

The Mallee overstorey of *Eucalyptus gracilis* and *Eucalyptus oleosa* was over a moderately diverse understorey including *Roepera aurantiaca* (Shrubby Twinleaf), *Olearia muelleri* (Mueller's Daisy-bush), *Maireana pentatropis* (Erect Mallee Bluebush), *Acacia nyssophylla* (Spine Bush) and *Maireana georgei* (Satiny Bluebush) (**Plate 3-70**). Feral goats were seen near the site and palatable plant species were heavily grazed, particularly *Rhagodia ulicina* (Intricate Saltbush), *Alectryon oleifolius* (Bullock Bush) and *Lawrencia squamata* (Thorny Lawrencia). Regeneration of the Senna species was observed, including *S. artemisioides* ssp. *coriacea* (Broad-leaf Desert Senna), *S. artemisioides* ssp. *artemisioides* (Desert Senna), *S. artemisioides* ssp. *filifolia* (Fine-leaf Desert Senna) and *S. artemisioides* ssp. *petiolaris*.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was High.

Plate 3-70: Site 23c, *Eucalyptus gracilis* (Yorell) and *Eucalyptus oleosa* (Red Mallee) Open Mallee with localised patches of sclerophyll and chenopods (facing north)

Site 24b: *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus gracilis* (Yorrell) Mallee over chenopod and sclerophyll shrubs

The site was typical of old growth Mallee on red sandy-loam flats. *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus gracilis* (Yorrell) with the dominant Mallees being approximately 7 m tall (**Plate 3-71**). However, no hollows were observed. Senna species were the dominant shrub the open sclerophyll understorey, whilst *Maireana pentatropis* (Erect Mallee Bluebush)*, Roepera aurantiaca* (Shrubby Twinleaf) and *Sclerolaena patenticuspis* (Spear-fruit Bindyi) and *Sclerolaena obliquicuspis* (Oblique-spined Bindyi) were the most common groundcovers. The areas of Mallee were interspersed with smaller area of shrubland, particularly with *Acacia colletioides* (Veined Wait-a-while)*, Senna* species, and *Alectryon oleifolius* (Bullock Bush) common in these areas. *Myoporum platycarpum* (False Sandalwood) trees were also common, especially in small areas where Mallee trees were largely absent. These areas had a higher density of shrubs, particularly Senna species.

No threatened flora or fauna were recorded at the site. No weeds were recorded, nor obvious grazing impact and the site had a well-developed litter layer. No recorded fire history. The BAM vegetation condition category at the time of assessment was High.

Plate 3-71: Site 24b, Old Growth *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus gracilis* (Yorrell) Mallee over chenopod and sclerophyll shrubs (facing north)

Site 26c – *Eucalyptus gracilis* (Yorrell) */ Eucalyptus oleosa* (Red Mallee) Open Mallee over sclerophyll shrub understorey

The site was a patch of widely spaced Mallee with an overstorey dominated by *Eucalyptus gracilis* (Yorrell) +/- *E. oleosa* (**Plate 3-72**). As is typical of *Eucalyptus oleosa* (Red Mallee) and *E. gracilis* (Yorell) dominated communities the soil was a sandy loam. The understorey was dominated by *Senna artemisioides ssp. artemisioides* (Desert Senna) and *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) with other native species in slightly lower density such as *S. artemisioides* spp. *petiolaris* and *S. artemisioides* ssp. *coriacea* (Broad-leaf Desert Senna) and *Beyeria opaca* (Dark Turpentine Bush). Diversity at the site was relatively low with only 11 native species being recorded, but this is considered to representative of the perennial plant diversity for the benchmarked BCM community.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth in the area although this site did not show signs of being burnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-72: Site 26c, Old Growth Mallee over Sclerophyll Shrub understorey (facing south)

Site 27b: *Eucalyptus oleosa* (Red Mallee) open Mallee over sparse *Maireana pyramidata* (Black Bluebush) and sclerophyll shrubs

This site contained relatively open large old *Eucalyptus oleosa* (Red Mallee) over an open sclerophyll and chenopod shrub understorey, on a red sandy rise. The area was fringed by a *Myoporum platycarpum* (False Sandalwood) Open Woodland over *Maireana pyramidata* (Black Bluebush) shrubland, with several dead Myoporum trees present (**Plate 3-73**). Although the survey area contained a relatively high plant species diversity, most species contained only one to few individuals. Kangaroo dung density was also high, and the palatable species present were highly grazed (*Pimelea microcephala* (Shrubby Riceflower), *Acacia oswaldii* (Umbrella Wattle) and *Exocarpos aphyllus* (Leafless Cherry)). The Mallee comprised large old growth trees, averaging about 9 m tall, and containing both large and small hollows.

No threatened flora or fauna were recorded at the site. No weed species were found at the site. No recorded fire history. The BAM vegetation condition category at the time of assessment was High.

Plate 3-73: Site 27b, *Eucalyptus oleosa* (Red Mallee) Open Mallee (facing north)

108: *Eucalyptus gracilis* (Yorrell) Open Mallee over sparse chenopod and sclerophyll shrubland

This site characterises open older growth *Eucalyptus gracilis* (Yorrell) Open Mallee over an open chenopod and sclerophyll shrub understorey (**Plate 3-74**). Some additional species recorded included *Eremophila scopara* (Broom Emubush), *Maireana pentatropis* (Erect Mallee Bluebush), *Acacia nyssophylla* (Spine Bush), *Atriplex stipitata* (Bitter Saltbush), *Roeper aurantiaca* (Shrubby Twinleaf), *Enchylaena tomentosa* (Ruby Saltbush).

The site has no known fire history. There has been some past clearance associated with the existing transmission line easement. No weeds were recorded during the survey. A *Barnardius zonarius barnardi* (Mallee Ringneck) was observed opportunistically during the survey. The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-74: Site 108, *Eucalyptus oleosa* (Red Mallee) and *Eucalyptus gracilis* (Yorell) Open Mallee over an open mixed shrub understorey (facing east)

116: *Eucalyptus oleosa* (Red Mallee) / *Eucalyptus gracilis* (Yorrell) Open Mallee over sclerophyll and chenopod shrubs

This site comprises old growth *Eucalyptus oleosa* (Red Mallee) / *Eucalyptus gracilis* (Yorrell) Open Mallee over a sclerophyll and chenopod shrub understorey, in swales (**Plate 3-75**). Dominant medium/tall shrubs were *Dodonaea viscosa ssp angustissima* (Narrow-leaf Hop-bush), *Atriplex stipitata* (Bitter Saltbush) and *Senna artemisioides ssp filifolia* (Fine-leaf Desert Senna). Dominant small shrubs/ groundcovers that were present included *Maireana erioclada* (Rosy Bluebush), *Roepera apiculata* (Pointed Twinleaf) and *Sclerolaena diacantha* (Grey Bindyi). The mallee trees averaged about 6 m tall at this site, however no hollows were noted.

The site has no known fire history. No weeds were recorded during the survey. *Smicrornis brevirostris* (Weebill), were opportunistically recorded during the survey. The BAM vegetation condition category at the time of assessment was High.

Plate 3-75: Site 116, Old Growth *Eucalyptus oleosa* (Red Mallee) / *E. gracilis* (Yorrell) Open Mallee over sclerophyll and chenopods (facing west)

117: *Senna artemisioides* ssp. *filifolia* (Senna) Open Shrubland with emergent *Eucalyptus gracilis* (Yorrell)

BAM site 117 characterised the naturally open areas of tall Open Shrubland, surrounded by mallee. The dominant shrubs recorded were Senna spp (**Plate 3-76**). The surveyed site was near a dam, hence grazing pressure would have been historically high, resulting in reduced species diversity and abundance. A total of 13 native species were recorded, however, all but *Senna, Aristida contorta* and *Roepera apiculata* were present as isolated plants or isolated clumps.

The site has no known fire history. Four weed species were recorded, all of very low cover. *Microeca fascinans* (Jacky Winter), and *Smicrornis brevirostris* (Weebill) were opportunistically recorded during the survey.

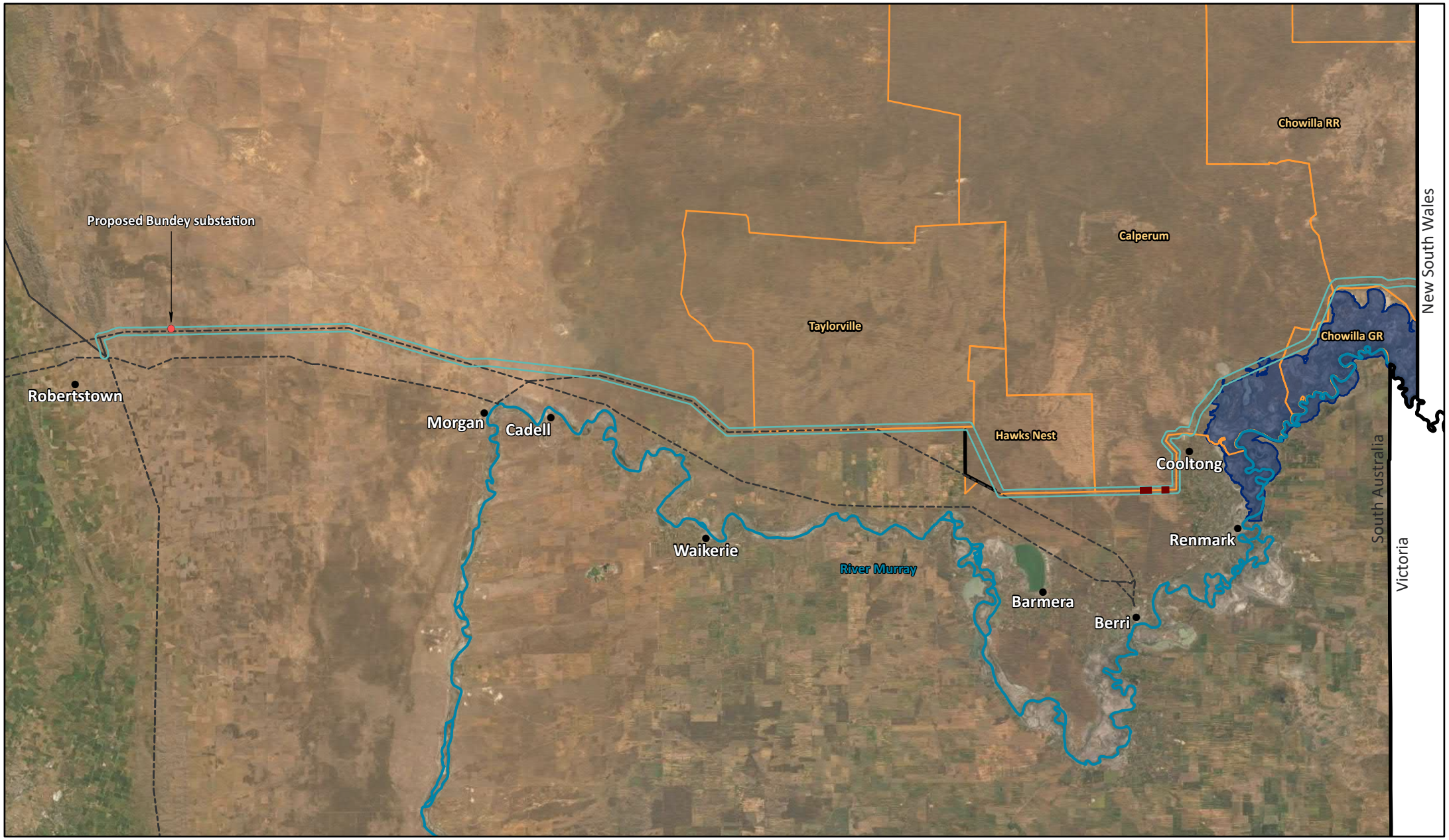
The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-76: Site 117, Open Plains likely to have supported tall Open Shrubland merging into Open Mallee (Left facing south, right facing west)

3.2.5 Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey

This community comprises mallee regrowth following bush fires in about 2014. The description is based on one BAM site, where there was vigorous mallee regrowth from basal epicormic shoots to about 3 - 4 m tall. A high diversity and abundance of understorey species were regenerating following the fire, either vegetatively or from seed. Understorey species comprised a mix of sclerophyll and chenopod shrubs, with Triodia naturally absent or very sparse, reflecting the relatively shallow sand layer. 2.64 km of this community was mapped along the alignment (**Figure 3-6**).

Table 3-8 lists the BAM site within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey

Figure 3-6
Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey extent along the alignment

0 20
Kilometres
N

ElectraNet
energy connect
JBS&G

Table 3-8: Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey – BAM sites

BAM site	BAM Association	Last Fire	Vegetation Condition Score	Length mapped (km)[1]
21c	*Eucalyptus socialis* (Beaked Red Mallee)/ *E. gracilis* (Yorrell) Open Mallee over *Senna artemisioides* ssp. *artemisioides* (Desert Senna) +/- *S. artemisioides* ssp. *petiolaris* Shrubland	2014	56.15	2.64

[1] rounded to two decimal degrees

Site 21c – *Eucalyptus socialis* (Beaked Red Mallee)/ *E. gracilis* (Yorrell) Open Mallee over *Senna artemisioides* ssp. *artemisioides* (Desert Senna) +/- *S. artemisioides* ssp. *petiolaris*

This site was on the northern boundary of Cooltong Conservation Park. It was on shallow sand at the base of a dune slope and comprised regenerating mallee following the 2014 Calperum bushfire. The overstorey was dominated by *Eucalyptus socialis* (Beaked Red Mallee) and *E. gracilis* (Yorrell), with basal epicormic regrowth about 3 m tall at the time of survey (**Plate 3-77**). The understorey was very diverse with 17 native species including two *Senna* spp. present at higher densities, and other species including *Myoporum platycarpum* (False Sandalwood), *Acacia nyssophylla* (Spine Bush), *Eremophila glabra* (Tar Bush), and more palatable species such as *Maireana georgei* (Satiny Bluebush) and *Maireana turbinata* (Top-fruit Bluebush). There appeared to have been previous clearance up to about 10m back from the access track which was now being recolonised by vegetation.

No threatened flora or fauna were recorded at the site. Only one weed was recorded at the site, *Salvia verbenaca* (Wild Sage) at very low density. Fire history shows 5-year-old post-fire regrowth (Calperum bushfire 2014). The BAM vegetation condition category at the time of assessment was High.

Plate 3-77: Site 21c, *Eucalyptus socialis* (Beaked Red Mallee) +/- *E. gracilis* (Yorell) with diverse understorey (facing west)

Habitat Use

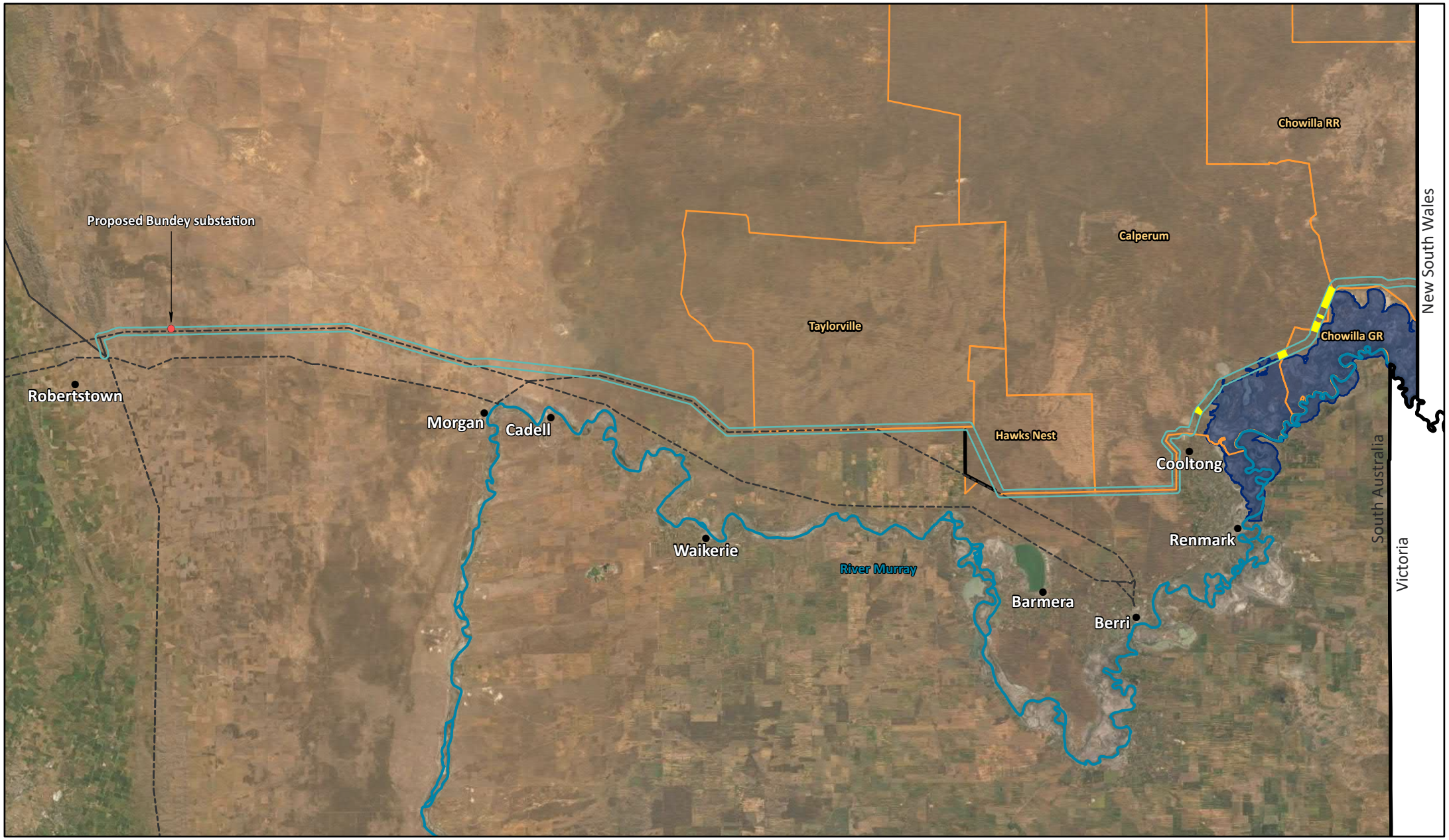
This vegetation is considered to provide potentially suitable habitat for common and threatened fauna that require a dense shrub understorey, moderate to heavy leaf litter, and but do not rely on presence of hollows or large trees. Examples of threatened species that may use this habitat as it is regenerating include: *Leipoa ocellata* (Malleefowl), *Pachycephala rufogularis* (Red-lored Whistler), *Cinclosoma castanotum* (Chestnut (Chestnut-backed) Quailthrush), *Myiagra inquieta* (Restless Flycatcher), *Neophema splendida* (Scarlet-chested Parrot), *Hylacola cauta* (Shy Heathwren), *Amytornis striatus striatus* (Striated Grasswren). Whilst not optimal, post-fire regenerating mallee of 5-10 years or older may provide occasional foraging habitat for EPBC listed *Manorina flavigula melanotis* Black-eared Miner and *Polytelis anthopeplus monarchoides* (Regent Parrot).

3.2.6 Mallee over Triodia dominated understorey

This broad habitat group occurs in approximately the central third of the alignment, on sandy soils of varying depth, and with Triodia (Spinifex) dominant in the understorey. It is a major habitat type along the alignment, with 57.59 km mapped as this habitat type (**Figure 3-7**). Occurring on sandy soils, the mallee trees tend to be multi-stemmed and of smaller habit (5 – 6 m tall) than mallees occurring on the heavier textured soils (up to 8 - 10 m tall on sandy loams or loams soils). Hollows were sparse to absent in the mallees occurring on sand over Triodia. This broad habitat group comprises vegetation with different fire histories, ranging from most recently burnt in 2014 to long unburnt. The majority of mallees in the recently burnt vegetation sites were regenerating from basal epicormic growth. In addition to regenerating Triodia, the understorey plants were represented by a variety of life forms, although of relatively moderate species diversity. The condition of this community (as indicated by the BAM site condition scores) ranged from moderate to high.

Table 3-9 lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat.

Full descriptions of each BAM site are provided below.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Cultural heritage avoidance alignment
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Broad habitat type
Hopbush (Dodonaea viscosa ssp angustissima) Tall Open Shrubland - eastern half of alignment

Figure 3-8
Hopbush (Dodonaea viscosa ssp. angustissima) Tall Open Shrubland mapped extent along the alignment

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G

Table 3-9: Mallee over Triodia dominated understorey – BAM sites

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
9c	*Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	47.7	1.28
16a	*Eucalyptus dumosa* Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	38.5	Not mapped
16b	*Eucalyptus dumosa* Low Mallee over *Triodia* sp. Hummock Grassland	45.34	18.13
16c	*Eucalyptus dumosa* / *Eucalyptus socialis* (Beaked Red Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland	56.64	0.46
17a	*Eucalyptus gracilis* (Yorrell) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	48.5	Not mapped
17b	*Eucalyptus dumosa* Open Mallee over *Triodia* sp. Hummock Grassland	48	3.78
17c	*Eucalyptus incrassata* (Ridge-Fruited Mallee) +/- *E. leptophylla* +/- *E. socialis* (Beaked Red Mallee) over *Triodia* (Spinifex) Hummock Grassland	49.24	0.32
18b	*Eucalyptus incrassata* (Ridge-fruited Mallee) Open Mallee over *Triodia* Hummock Grassland	46.21	1.48
20b	*Eucalyptus dumosa / Eucalyptus gracilis +/- Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Mallee over *Triodia* Hummock Grassland	47.78	Not mapped
20c	*Eucalyptus dumosa* Low Open Mallee over *Triodia* (Spinifex) Hummock Grassland	55.15	1.93
21b	*Eucalyptus dumosa* / *Eucalyptus incrassata* / *Eucalyptus gracilis* Low Open Mallee over *Leptospermum coriaceum* (Dune Tea-tree)	58.63	Not mapped
22b	*Eucalyptus dumosa* / *Eucalyptus incrassata* Low Open Mallee (young post-fire regrowth) over regrowth *Triodia* Hummock Grassland	56.55	2.43
22c	*Eucalyptus incrassata* +/- *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus dumosa* Mallee over *Triodia* (Spinifex) Hummock Grassland		2.26
24c	*Eucalyptus dumosa* +/- *E. leptophylla* Open Mallee over *Triodia* Hummock Grassland	43.23	0.24
25c	*Eucalyptus dumosa* +/- *Eucalyptus leptophylla* Open Mallee over *Triodia* Hummock Grassland	51	Not mapped
27c	*Eucalyptus socialis* +/- *Eucalyptus gracilis* Low Very Open Mallee over *Triodia* Open Hummock Grassland	41.24	Not mapped
28c	*Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland	42.73	Not mapped
29c	*Eucalyptus dumosa* / *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a *Triodia* (Spinifex) Hummock Grassland	63.1	12.95
109a	*Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) - *Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	52.65	5.17
115	*Eucalyptus gracilis* / *Eucalyptus dumosa* / *Eucalyptus leptophylla* - *Eucalyptus oleosa* (Red Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) and mixed shrubs.	64.59	7.18
		TOTAL	57.59 KM

[1] Rounded to two decimal places

Habitat Use

This vegetation is considered to provide potentially suitable habitat for common and threatened fauna that require a dense ground layer, and in particular, areas with understory dominate by Triodia; and don't require hollows or large trees. All habitat along the transmission line is at least 7 years post fire but ranges through to Old Growth mallee with no recorded fire history and areas of 13 year regrowth. Even 5+ year regrowth mallee may provide suitable foraging and roosting habitat for some species. Examples of species that may use Mallee over Triodia as habitat include: *Manorina flavigula melanotis* (Black-eared Miner), *Leipoa ocellata* (Malleefowl), *Pachycephala rufogularis* (Red-lored Whistler), Regent Parrot, (*Amytornis striatus striatus*) Striated Grasswren, Chestnut (Chestnut-backed) Quailthrush, *Myiagra inquieta* (Restless Flycatcher), *Neophema splendida* (Scarlet-chested Parrot), *Hylacola cauta* (Shy Heathwren), *Pachycephala inornata* (Gilbert's Whistler), *Nyctophilus corbeni* (South-eastern Long-eared Bat) and *Turnix varius varius* (Painted Buttonquail).

Site 16a – *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland.

Site 16a comprises vegetation that is representative of BCM community MDBSA 4.2. *Eucalyptus dumosa* (White Mallee) is dominant in the overstorey (**Plate 3-78**). This site is north of Hogwash Bend Conservation Park. *Triodia* sp. (Spinifex) is dominant in the understory with good cover of *Eremophila crassifolia* (Thick-leaf Emubush) and *Maireana pentatropis* (Erect Mallee Bluebush). Other native species present include *Eremophila glabra* (Tar Bush), *Westringia rigida* (Stiff Westringia), *Sclerolaena diacantha* (Grey Bindyi), *Acacia ligulata* (Umbrella Bush), *Atriplex stipitata* (Bitter Saltbush) and *Myoporum platycarpum* (False Sandalwood).

No threatened flora or fauna were observed. Common fauna included *Acanthiza uropygialis* (Chestnut-rumped Thornbill), *Acanthagenys rufogularis* (Spiny-cheeked Honeyeater), Spotted Pardalote (*Pardalotus punctatus*) and (*Lichenostomus leucotis*) White-eared Honeyeater. No weeds recorded. Fire history shows 13 year regrowth post fire (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-78: Site 16a, *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland (facing east)

Site 16b – *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

Site 16 was characteristic of extensive tracts of vegetation in this region, which is a recurring pattern of sandy red rises (to different elevations) and inter dune swales (heavier soils). The survey site was representative of the low to moderately high sandy rises, with *Eucalyptus dumosa* (White Mallee) the dominant Mallee (**Plate 3-79**). At the time of survey, the Mallee regrowth averaged 2.5 m tall. *Triodia* sp. was dominant in the understory (> 26% cover), with *Westringia rigida* (Stiff Westringia), *Maireana pentatropis* (Erect Mallee Bluebush) and *Myoporum platycarpum* (False Sandalwood). Perennial species diversity is considered to be naturally relatively low. Selective grazing was noted on *Westringia rigida* (Stiff Westringia) and *Acacia rigens* (Nealie).

No threatened flora or fauna were observed. No weeds were recorded at this site. Fire history shows 13 year regrowth post fire (Bookmark bushfire 27/11/2006) and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-79: Site 16b, *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland (facing east)

Site 16c – *Eucalyptus dumosa* (White Mallee)/ *Eucalyptus socialis* (Beaked Red Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland

The site was on the lower slopes of a deep red sand dune where the overstorey was dominated by *Eucalyptus dumosa* (White Mallee) and *Eucalyptus socialis* (Beaked Red Mallee) with other Mallee species present at lower densities, including *E. brachycalyx* (Gilja)*, E. cyanophylla* (Blue-leaf Mallee) *and E. incrassata* (Ridge-fruited Mallee) (**Plate 3-80**). The understorey was dominated by *Triodia* (Spinifex) with additional slightly less abundant native species including *Eremophila deserti* (Turkey Bush), *Maireana pentatropis* (Erect Mallee Bluebush), *Maireana turbinata* (Top-fruit Bluebush) and *Dodonaea stenozyga* (Desert Hop-bush). Where it occurs as the overstorey dominant, *Eucalyptus cyanophylla* Mallee is listed as a regionally Rare Ecosystem in South Australia (DEWNR, 2019) although this is an unofficial rating outside of any legislation.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was High.

Plate 3-80: Site 16c, Old Growth *Eucalyptus dumosa* (White Mallee) + / -*E. socialis* (Beaked Red Mallee) Mallee over *Triodia* Hummock Grassland (facing west)

Site 17a – *Eucalyptus gracilis* (Yorrell) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland.

The site is adjacent the Pooginook Conservation Park, with the alignment traversing an access tracks along the northern boundary of the park. *Eucalyptus gracilis* (Yorrell) is dominant in the overstorey with *Eucalyptus dumosa* (White Mallee) also present and *Acacia wilhelmiana* (Dwarf Nealie), *Eremophila crassifolia* (Thick-leaf Emubush) and *Acacia calamifolia* (Wallowa) are present in the midstorey. *Triodia* sp. (Spinifex) is dominant in the understory with good coverage of *Maireana pentatropis* (Erect Mallee Bluebush) and *Sclerolaena diacantha* (Grey Bindyi) (**Plate 3-81**). Other native species present include *Eremophila glabra* (Tar Bush), *Podolepis capillaris* (Wiry Podolepis), *Lomandra leucocephala* (Woolly Mat-rush) *Codonocarpus cotinifolius* (Desert Poplar) and *Grammosolen dixonii* (Star Flower)

No threatened flora and fauna were present. No weeds were present, but there was evidence of low to moderate grazing. Fire history shows 13 year regrowth post fire (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-81: Site 17a, *Eucalyptus gracilis* (Yorrell) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland (facing south)

Site 17c – *Eucalyptus incrassata* (Ridge Fruited-Mallee) +/- *E. leptophylla* (Narrow-leaf Red Mallee) +/- *E. socialis* (Beaked Red Mallee) over *Triodia* (Spinifex) Hummock Grassland

The site was at the crest of an unburnt tall dune on deep sand and considered to be in relatively natural condition compared to its benchmarked BCM community. The overstorey was dominated by *Eucalyptus incrassata* (Ridged-fruited Mallee) with *E. leptophylla* (Narrow-leaf Mallee), and *E. socialis* (Beaked Red Mallee) in lower densities. The understorey comprised a *Triodia* (Spinifex) Hummock Grassland with additional natives such as *Leptospermum coriaceum* (Dune Tea-tree) which is generally only recorded from tall dunes (**Plate 3-82**). An additional four native species were found on the access track outside the surveyed area, including *Beyeria opaca* (Dark Turpentine Bush), *Calotis hispidula* (Hairy Burr-daisy), *Chrysocephalum semipapposum* (Clustered Everlasting) and *Acacia rigens* (Nealie). There was a fire break next to the access track with evidence of sparse regrowth 5-10 metres back from the track (**Plate 3-83**).

No threatened flora or fauna were recorded at the site. Only one weed was recorded, *Salvia verbenaca* (Wild Sage), which was at low density, and associated with the nearby vehicle track. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-82: Site 17c, Unburnt dune crest with Mallee species and a *Triodia* Hummock Grassland understorey (facing west)

Plate 3-83: Site 17c, Fire break next to access track with sparse regrowth

Site 20b – *Eucalyptus dumosa* (White Mallee) / *Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Mallee over *Triodia* Hummock Grassland

Site 20b comprised vegetation characteristic of extensive tracts of vegetation in this region, which is a recurring pattern of sandy rises (to different elevations) and inter dune swales (heavier soils). The survey site was representative of the swale vegetation. At the time of survey, the Mallee regrowth averaged 2.5 m tall. *Triodia* sp. (Spinifex) was dominant in the understory (> 26% cover), with *Senna* species also common (**Plate 3-84**). Other shrubs were present at very low densities and included: *Grevillea huegelii* (Comb Grevillea), *Acacia nyssophylla* (Spine Bush), *Eremophila glabra* (Tar Bush), *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) and *Olearia pimeleoides* (Pimelea Daisy-bush). Perennial species diversity is considered to be naturally relatively low in this vegetation type. Kangaroo dung was of moderate density and sparse very old goat dung was also noted.

No threatened flora or fauna were observed. Weeds were very sparsely present *Erodium sp.* (Stork's Bill species) and *Brassica* (Wild Turnip) were present as sparse seedlings. Fire history shows 13-year-old post-fire regrowth (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-84: Site 20b, Post-fire Regrowth *Eucalyptus dumosa* (White Mallee) / *Eucalyptus gracilis* (Yorell) +/- *E. leptophylla* (Narrow-leaf Red Mallee) Low Mallee over *Triodia* (Spinifex) Hummock Grassland on loamy sand swale (facing north)

Site 21b: *Eucalyptus dumosa* (White Mallee) / *Eucalyptus incrassata* (Ridge-fruited Mallee) / *Eucalyptus gracilis* (Yorrell) Low Open Mallee over *Leptospermum coriaceum* (Dune Tea-tree)

This site characterises an extensive area of sand dunes that were burnt by the Calperum bushfire in January 2014. The *Eucalyptus dumosa* (White Mallee) / *E. incrassata* (Ridge-fruited Mallee) / *E. gracilis* (Yorrell) Low Open Mallee regrowth averaged about 1.5 m with a projective foliage cover of approximately 20% (**Plate 3-85**). Site 21b was one of the taller dunes in the region, with a corresponding decline in Triodia. As is typical of deep sand dunes, species diversity was relatively high for this region (17 perennial species recorded). Species largely confined to deep sand were also present, particularly *Leptospermum coriaceum* (Dune Tea-tree), *Schoenus subaphyllus* (Desert Bog-rush), and *Grevillea pterosperma* (Desert Grevillea), not recorded at any other sites during the current survey. Other plants associated with deeper sand, that were recorded at the site were: *Lomandra leucocephala* (Woolly Mat-rush), *Podolepis capillaris* (Wiry Podolepis) and *Grammosolen dixonii* (Star Flower). Desert Poplar (*Codonocarpus continifolius)* was numerous at the site, averaging 2 – 4 m tall. This slender tree requires fire for germination and is relatively short-lived. Being young regrowth, bare ground was estimated to be greater than 20%. Grazing pressure appeared relatively light (only low density kangaroo dung was noted), and most species were regenerating well.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 5-year-old post-fire regrowth (Calperum bushfire 2014). The BAM vegetation condition category at the time of assessment was High.

Plate 3-85: Site 21b, *Eucalyptus dumosa* (White Mallee) / *Eucalyptus incrassata* (Ridge-fruited Mallee) / *Eucalyptus gracilis* (Yorell) Low Mallee (young post-fire regrowth) over *Leptospermum coriaceum* (Dune Tea-tree) on red sandy rise/dune (facing south)

Site 22b: *Eucalyptus dumosa* (White Mallee) / *Eucalyptus incrassata* (Ridge-fruited Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland.

This site characterises an extensive area of sand dunes that were burnt by the Calperum bushfire in January 2014. The *Eucalyptus dumosa* (White Mallee) / *Eucalyptus incrassata* (Ridge-fruited Mallee) Low Open Mallee regrowth averaged about 1.5 m with a projective foliage cover of approximately 30% (**Plate 3-86**). *Triodia* were prolifically regenerating (although plants were still 30 cm diameter or less). As is typical of deep sand dunes, species diversity was relatively high for this region (17 perennial species recorded). Species largely confined to deep sand were also present, namely, *Lomandra leucocephala* (Woolly Mat-rush), *Podolepis capillaris* (Wiry Podolepis) and *Grammosolen dixonii* (Star Flower). Being young regrowth, bare ground was estimated to be greater than 20%. Grazing pressure appeared relatively light (only low density kangaroo dung was noted), and most species were regenerating well.

No threatened flora or fauna were recorded at the site. No weeds were recorded, and the site was considered to be in very good condition. Fire history shows 5-year-old post-fire regrowth (Calperum bushfire 2014) (**Plate 3-87**). The BAM vegetation condition category at the time of assessment was High.

Plate 3-86: Site 22b, *Eucalyptus dumosa* (White Mallee) / *Eucalyptus incrassata* (Ridge-fruited Mallee) Low Mallee (young post fire regrowth) over *Triodia* (Spinifex) Hummock Grassland on red sandy rise/dune (facing west)

Plate 3-87: Site 22b, Five-year-old regrowth with *Triodia* (Spinifex) regenerating prolifically (facing south)

Site 20c – *Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* (Spinifex) Hummock Grassland

On the dune slope, the overstorey of *Eucalyptus dumosa* (White Mallee) +/- *E. leptophylla* (Narrow-leaf Mallee) *+/- E. socialis* (Beaked Red Mallee) was 1.5-2 m tall regrowth following fire activity as evidenced by the dead branches protruding above the post-fire foliage (Plate 3-88). On the dune crest, *Eucalyptus incrassata* (Ridge-fruited Mallee) was also present, a species associated with deep sand. There were no buds or fruit on the Eucalypt species resulting in identification being unconfirmed and based largely on leaf characteristics. The Mallee had been previously cleared up to about 10m back from the access track which is now being recolonised (**Plate 3-89**). The understorey was dominated by *Triodia* (Spinifex) with other native species including *Lomandra leucocephala* (Woolly Mat-rush), *Myoporum platycarpum* (False Sandalwood), *Maireana pentatropis* (Erect Mallee Bluebush), *Acacia ligulata* (Umbrella Bush). Following the fire, regeneration has been prolific in most species. *Codonocarpus cotinifolius* (Desert Poplar) was also present which has a regional rating for the South Olary Plains IBRA sub-region of the Murray Darling Depression IBRA region of South Australia. This is a relatively short-lived species which requires disturbance such as fire, to germinate.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 5-year-old post-fire regrowth (Calperum bushfire 2014). The BAM vegetation condition category at the time of assessment was High.

Plate 3-88: Site 20c, *Eucalyptus dumosa* (White Mallee) over *Triodia* (Spinifex) Hummock Grassland understorey on deep red sand, Recent fire regrowth (facing north)

Plate 3-89: Site 20c, Cleared Mallee about 10m back from access track (facing east)

Site 22c – *Eucalyptus incrassata* (Ridge-fruited Mallee) +/- *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus dumosa* (White Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland

The site was on the south facing slope of a sand dune in deep red sand (**Plate 3-90**). The overstorey was dominated by *Eucalyptus incrassata* (Ridge-fruited) with lower densities of *E. socialis* (Beaked Red Mallee) and *E. dumosa* (White Mallee). *Callitris verrucosa* (Scrub Cypress Pine) was also present. *Triodia* (Spinifex) was the dominant understorey species with high diversity of other native species in lower densities including *Senna artemisioides* spp. *petiolaris* (Desert Senna subspecies), *Lomandra leucocephala* (Woolly Mat-rush), *Acacia ligulata* (Umbrella Bush, *Dodonaea viscosa* (Narrow-lead Hop-bush) *Pimelea microcephala* (Shrubby Riceflower) and *Beyeria opaca* (Dark Turpentine Bush). Vegetation had been cleared up to 10 m back from the track with some regrowth evident (**Plate 3-91**).

No threatened flora or fauna were recorded at the site. Only one weed was recorded at the site, *Salvia verbenaca* (Wild Sage) at very low density on the access track. No fire history was recorded. The BAM vegetation condition category at the time of assessment was High.

Plate 3-90: Site 22c, *Eucalyptus incrassata* (Ridge-fruited Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland and sclerophyll shrubs, (facing north)

Plate 3-91: Site 22c. Up to 10m clearance next to existing access track (facing north-west)

Site 24c – *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland

The site was on shallow sand. The overstorey was dominated by *Eucalyptus dumosa* (White Mallee) and *E. leptophylla* (Narrow-leaf Red Mallee) with an understorey dominated by *Triodia* (Spinifex) (**Plate 3-92**). Diversity at this site was naturally low with an additional five native species including *Beyeria opaca* (Dark Turpentine Bush), *Acacia wilhelmiana* (Dwarf Nealie) and *Grevillea huegelii* (Comb Grevillea). *Codonocarpus cotinifolius* (Desert Poplar) was present on the northern edge of the BAM site, and has a regional rating for the South Olary Plains IBRA sub-region of the Murray Darling Depression IBRA region of South Australia.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-92: Site 24c, *Eucalyptus dumosa* (White Mallee) +/- *E. leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland burnt in 2006 (facing west)

Site 25c – *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus leptophylla* (Narrow-lead Red Mallee) Open Mallee over Triodia (Spinifex) Hummock Grassland

The site was along a very long dune slope that contained older growth Mallee. The overstorey was dominated by *Eucalyptus dumosa* (White Mallee) +/- *E. leptophylla* (Narrow-leaf Red Mallee) with one tree of *Callitris verrucosa* (Scrub Cypress Pine) observed. Regeneration of *E. dumosa* was observed (**Plate 3-93**, **Plate 3-94**).

No weeds were recorded at the site. No threatened flora or fauna were recorded at the site. Fire history shows 13-year-old post-fire regrowth in the area although this site did not show signs of being burnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-93: Site 25c, Unburnt old growth Mallee over *Triodia* (Spinifex) (facing north)

Plate 3-94: Site 25c, *Callitris verrucosa* (Scrub Cypress Pine) at the site suggesting a lack of recent fire (facing south)

Site 28c – *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland

The site represented unburnt Mallee over a *Triodia* (Spinifex) dominated understorey. The overstorey comprised *Eucalyptus dumosa* (White Mallee) and *E. oleosa* (Red Mallee) (**Plate 3-95**). The diversity of the site was naturally low with 10 native species in total. The understorey, while dominated by *Triodia*, also contained natives such as *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush), *Acacia wilhelmiana* (Dwarf Nealie), *Beyeria opaca* (Dark Turpentine Bush) and *Senna artemisioides* ssp. *artemisioides* (Desert Senna).

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth in the area although this site did not show signs of being burnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-95: Site 28c, Old growth Mallee with large Triodia hummocks (facing west)

Site 29c – *Eucalyptus dumosa* (White Mallee) / *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a *Triodia* (Spinifex) Hummock Grassland

The site comprised an area of *Eucalyptus dumosa* (White Mallee) / *E. leptophylla* (Narrow-leaf Red Mallee) +/- *E. incrassata* (Ridge-fruited Mallee)) over a *Triodia* (Spinifex) understorey (**Plate 3-96**). The site was on deep sand in a sandy flat next to the access track running along the alignment. There was up to 5m of vegetation clearance back from the access track (**Plate 3-97**). Diversity was moderate at this site, with a total of 17 native species recorded including *Prostanthera serpyllifolia* ssp. *microphylla* (Small-leaf Mintbush), *Beyeria opaca* (Dark Turpentine Bush), *Acacia rigens* (Nealie), *Eremophila crassifolia* (Thick-leaf Emubush), *Westringia rigida* (Stiff Westringia) and *Grammosolen dixonii* (Star Flower).

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was High.

Plate 3-96: Site 29c, Regrowth Mallee (from a wildfire in 2006) over *Triodia* (Spinifex) u (facing north)

Plate 3-97: Site 29c, Up to 5 m clearance back from the access track (facing east.)

Site 17b – *Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

This site was representative of the extensive areas of shallow loamy sand in swales in this region. *Eucalyptus dumosa* (White Mallee) are the dominant Mallees, averaging 5 m tall, with a projective foliage cover of about 25 – 30%. *Triodia* sp. were the dominant understorey species with a cover of up to about 25%. *Beyeria opaca* (Dark Turpentine Bush) were common and widespread. All other shrubs were of low abundance and there was a high leaf litter cover (**Plate 3-98**).

No threatened flora or fauna were recorded at the site. No weeds were present. Fire history shows 13-year-old post-fire regrowth in the area although the site itself was unburnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium

Plate 3-98: Site 17b, *Eucalyptus dumosa* (White Mallee) Mallee (Old Growth) over *Triodia* sp. (Spinifex) Hummock Grassland

Site 18b – *Eucalyptus incrassata* (Ridge-fruited Mallee) Open Mallee over *Triodia* Hummock Grassland and *Beyeria opaca* (Dark Turpentine Bush)

This site adjoined site 17b and was on deeper sand. Hence the dominant Mallee was *Eucalyptus incrassata* (Ridge-fruited Mallee) averaging about 5 m tall (**Plate 3-99**). *Triodia* and *Beyeria opaca* (Dark Turpentine Bush) were equally dominant understorey plants, with *Maireana pentatropis* (Erect Mallee Bluebush) also being common. Other shrub species were sparsely present and there was a substantial litter layer.

No threatened flora or fauna were recorded at the site. No weed species were recorded. Fire history shows 13-year-old post-fire regrowth in the area although the site itself was unburnt (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-99: Site 18b, *Eucalyptus incrassata* (Ridge-fruited Mallee) over *Beyeria opaca* (Dark Turpentine Bush) and *Triodia* (Spinifex) on dune/sandy rise (facing west)

Site 9c – *Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

The site was representative of the BCM Community MDBSA 4.2 Mallee with understorey dominated by *Triodia* on moderate/ low red-sand dunes or flats. The dominant overstorey species were *Eucalyptus dumosa* and *E. leptophylla* with other less abundant native species such as *Myoporum platycarpum* (False Sandalwood) and *Callitris verrucosa* (Scrub Cypress Pine) (**Plate 3-100**). There were an additional seven native species recorded in low densities such as *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush), *Maireana pentatropis* (Erect Mallee Bluebush) and *Sclerolaena diacantha* (Grey Bindyi). There was an access track running underneath the alignment with Mallee regrowth 1-2 m tall about 10-20m back from the track (**Plate 3-101**). Behind that was Mallee regrowth 6-8m tall.

No threatened flora or fauna were recorded at the site. No weed species were observed at the site. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-100: Site 9c, Old Mallee regrowth with *Triodia* (Spinifex) understorey on deep sand (facing south)

Plate 3-101: Site 9c, Existing access track running along the transmission line showing various stages of Mallee regrowth adjacent to the access track (facing east)

Site 27c – *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus gracilis* (Yorrell) Low Very Open Mallee over *Triodia* (Spinifex) Open Hummock Grassland

The site was on shallow compact sand in an area of Mallee. The overstorey was dominated by *Eucalyptus socialis* (Beaked Red Mallee) +/- *E. gracilis* (Yorrell). *Triodia* was the dominant understorey species with all other natives in very low density including *Beyeria opaca* (Dark Turpentine Bush), *Acacia nyssophylla* (Spine Bush) and *Olearia muelleri* (Mueller's Daisy Bush) (**Plate 3-102**). There were several annual species recorded at the site including *Angianthus tomentosus* (Hairy Angianthus), *Podolepis capillaris* (Wiry Podolepis), *Calotis* sp. (Burr-daisy) and *Daucus glochidiatus* (Native Carrot). *Codonocarpus cotinifolius* (Desert Poplar) was present and has a regional rating for the South Olary Plains IBRA sub-region of the Murray Darling Depression IBRA region of South Australia.

No threatened flora or fauna were recorded at the site. No weeds were recorded at the site. Fire history shows 13-year-old post-fire regrowth (Bookmark bushfire 27/11/2006). The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-102: Site 27c, Mallee over *Triodia* (Spinifex) Hummock Grassland (regrowth after a fire in 2006) (facing west)

109a – *Eucalyptus oleosa* (Red Mallee) */ Eucalyptus gracilis* (Yorrell) */ Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

This site is typical of much of the alignment in Hawks nest, namely relatively small mallees on sandy soil with a *Triodia*(Spinifex) dominated understorey and high litter cover (**Plate 3-103**). The mallees average about 2.5 m tall and lack hollows.

Fire history mapping suggest this area is long unburnt (> 40 years). No weeds were recorded during the survey.

Fauna opportunistically recorded included *Merops ornatus* (Rainbow Bee-eater), *Smicrornis brevirostris* (Weebills).

The BAM vegetation condition category at the time of assessment was Medium.

Plate 3-103: Site 109, Multi-stemmed mallees on shallow sand with a *Triodia* (Spinifex) dominated understorey. (facing north)

115. *Eucalyptus gracilis* (Yorrell) */ Eucalyptus dumosa* (White Mallee) */ Eucalyptus leptophylla* (Narrow-leaf Red Mallee) */ Eucalyptus oleosa* (Red Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) and mixed shrubs.

Site 115 characterised mallee over *Triodia* (Spinifex) on sandy soils that was burnt in 2006, along the east-west traversing alignment through Hawks Nest (**Plate 3-104**).

The site contained a relatively high native plant diversity (29 species) and no weeds. In addition to *Triodia*, *Beyeria opaca* (Dark Turpentine Bush) and *Senna artemisioides ssp. filifolia* (Fine-leaf Desert Senna) were common species. *Grammosolen dixonii* (Star Flower) was present as scattered clumps. This species is often common after fire, particularly in mallee/spinifex vegetation.

Mallee trees appeared to be of natural density. No hollows were noted. No weeds were recorded during the survey. *Smicrornis brevirostris* (Weebill) were opportunistically recorded during the survey.

The BAM vegetation condition category at the time of assessment was High.

Plate 3-104: Site 115, Mallee over Triodia, burnt in 2006 (facing west)

3.2.7 Hopbush (*Dodonaea viscosa* ssp. *angustissima*) Tall Open Shrubland - eastern half of alignment

At the eastern end of the alignment, 6.69 km has been mapped as *Dodonaea viscosa* ssp. *angustissima* (Hopbush) Tall Open Shrubland (

Figure 3-8). This vegetation occurred on sandy soils, often associated with, or intergrading with *Maireana pyramidata* (Black Bluebush), shrubland. In other locations, there were scattered *Callitris sp.* (Native Pine species). The dominance of Hopbush in this habitat type is likely to have become more pronounced following a long history of grazing, reducing the abundance and diversity of more palatable species, allowing the unpalatable Hopbush to colonise new areas. Species diversity was generally low to moderate, as reflected in the mapped BAM site condition scores.

Table 3-10 lists the BAM sites within this habitat group, the vegetation condition score and the length of the alignment mapped as this habitat.

Full descriptions of each BAM site are provided below.

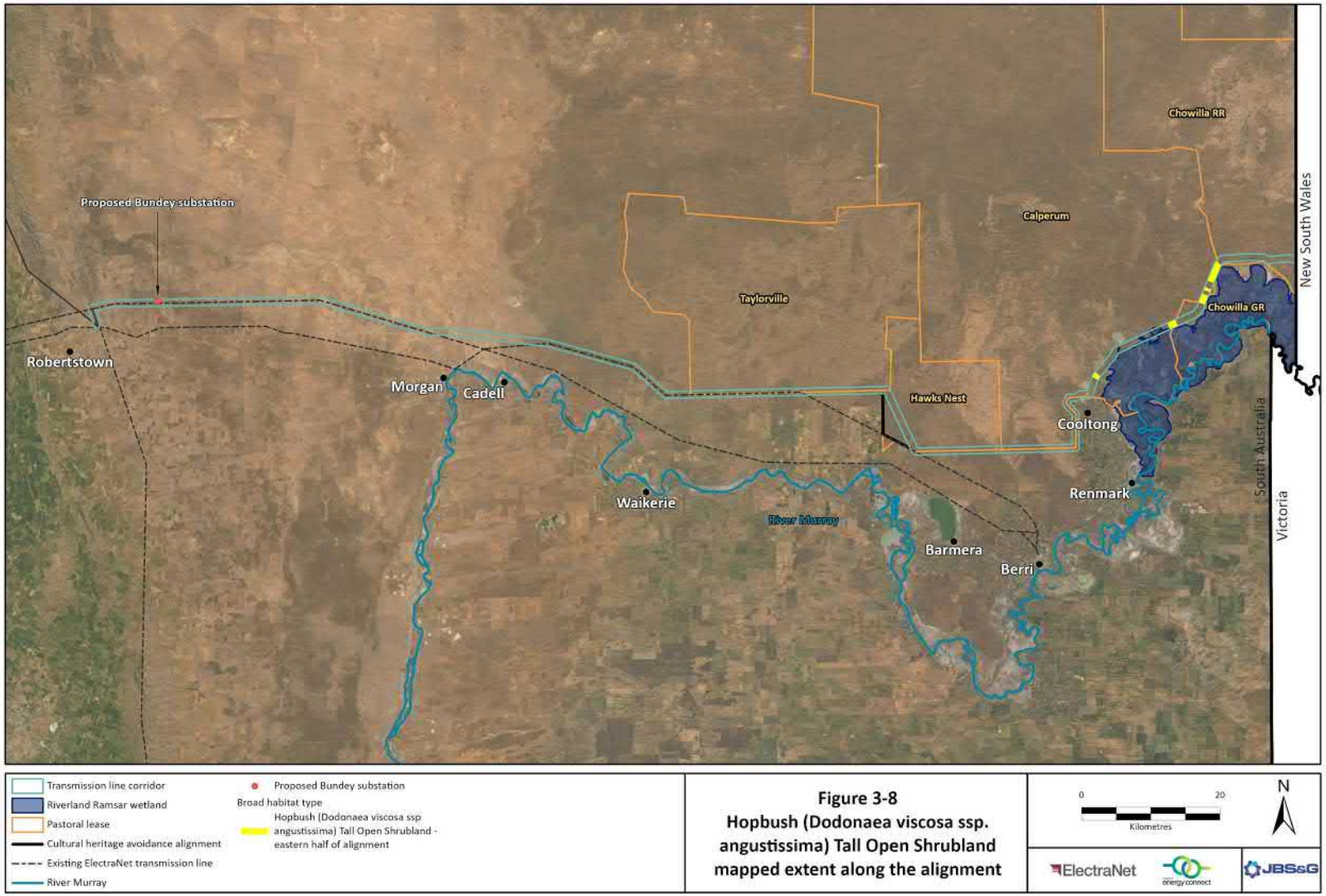


Figure 3-8: Hopbush (*Dodonaea viscosa* ssp. *angustissima*) Tall Open Shrubland extent along the alignment (

Table 3-10: *Hopbush* (*Dodonaea viscosa* ssp. *angustissima*) Tall Open Shrubland - eastern half of alignment– BAM sites

BAM site	BAM Association	Vegetation Condition Score	Length mapped (km)[1]
11c	*Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush) Tall Very Open Shrubland	63.21	Not mapped
15c	*Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) Tall Very Open Shrubland with emergent *Callitris gracilis* (Southern Cypress Pine)	40.08	0.75
28b	*Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)	33.12	5.94
		TOTAL	6.69 km

[1] rounded to two decimal degrees

Habitat Use

This vegetation is considered to provide potentially suitable habitat for common and threatened fauna that require a tall open shrub structure; and do not rely on or require, a moderate to heavy litter layer, hollows or large trees. An example of threatened species that may utilise this vegetation as habitat includes; *Morelia spilota* (Carpet Python), Neophema chrysostoma Blue-winged Parrot), *Neophema chrysostoma* (Elegant Parrot), *Lophochroa leadbeateri* (Major Mitchell), *Falco peregrinus* (Peregrine Falcon), *Lophoictinia isura* (Square-tailed Kite) and potentially *Litoria reniformis* (Southern Bell Frog) when dispersing during wet periods.

Site 11c – *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush) Tall Very Open Shrubland

The site was on deep red sand on the slope of a dune where the dominant overstorey species was *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush) which graded, in a southerly direction, into localised patches of *Maireana georgei* (Satiny Bluebush) low shrubland with emergent *D. viscosa* ssp. *Angustissima* (**Plate 3-105**, **Plate 3-106**). The understorey also included *Maireana pentatropis* (Erect Mallee Bluebush) and *Sclerolaena diacantha* (Grey Bindyi) in a similar density to *M. georgei* with an additional 10 native species including *Maireana pyramidata* (Black Bluebush) which became the dominant overstorey species at site 14c, south of this site. The observed vegetation was droughted and moderately grazed by kangaroos, with individuals observed near the site. Stock however were excluded from the site by a fence and regeneration was observed in both *Maireana pyramidata* and *Maireana georgei*, the latter species being relatively palatable.

No threatened flora or fauna were recorded at the site. Only one weed species was found, *Medicago* sp. (Medic). No recorded fire history and the BAM vegetation condition category at the time of assessment was High.

Plate 3-105: Site 11c, *Dodonaea viscosa* ssp. *angustissima* Tall Very Open Shrubland (facing south)

Plate 3-106: Site 11c, *Maireana georgei* (Satiny Bluebush) with *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) (facing north)

Site 15c – *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) Tall Very Open Shrubland with emergent *Callitris gracilis* (Southern Cypress Pine)

The site represents an atypical example of BCM community 3.1 – Mallee with very open sclerophyll & chenopod shrub understorey. *Callitris gracilis* (Southern Cypress Pine) would previously have been the dominant overstorey species, but death of many of the *C. gracilis* trees, and a lack of regeneration, has allowed *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) to become dominant (Plate 3-107). There was also evidence of some *C. gracilis* being felled (Plate 3-107) possibly for use as fence posts. Regeneration of *C. gracilis* would likely have been prevented through grazing of the palatable seedlings by kangaroos, rabbits and/or stock, allowing for a relative increase in dominance of *Dodonaea viscosa* ssp. *angustissima*. *Maireana pyramidata* (Black Bluebush) is the dominant understorey species to Narrow-leaf Hop Bush. Other shrubs present were *Senna artemisioides* ssp. *coriacea* (Broad-leaf Desert Senna), *Maireana turbinata* (Top-fruit Bluebush) and *Maireana pentatropis* (Erect Mallee Bluebush).

No threatened flora or fauna were recorded at the site. Only one weed was recorded at the site, *Salvia verbenaca* (Wild Sage) at very low density. No recorded fire history and the BAM vegetation condition category at the time of assessment was Medium.

Plate 3-107: Site 15c, *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) Very Open Shrubland with emergent *Callitris gracilis* (Southern Cypress Pine) (facing north)

Plate 3-108: Site 15c, Evidence of previously felled *Callitris gracilis* (Southern Cypress Pine)

Site 28b: *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)

This site characterises shrubland on red sand dunes either side of the Wentworth road, with tall old D*odonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) the dominant shrub (3 – 4 m tall) and *Maireana pyramidata* (Black Bluebush) the dominant understorey shrub (**Plate 3-109**, **Plate 3-110**). Kangaroo and rabbit dung were at high densities, suggesting moderate to high grazing pressure.

No threatened flora or fauna were recorded at the site. No weed species were found at the site. No recorded fire history. The BAM vegetation condition category at the time of assessment was Low.

Plate 3-109: Site 28b, *Dodonaea viscosa* ssp. *angustissima* Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush) (facing east)

Plate 3-110: Site 13c. *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) Shrubland encroaching on *Maireana pyramidata* (Black Bluebush) Shrubland (facing north)

3.3 Vegetation Condition Summary

A summary of the vegetation condition recorded at the 94 BAM sites, sorted by major habitat type is presented in **Table 3-11** and is presented visually in **Figure 3-9**. The condition rating applied uses a range adapted from the BAM scoresheet and is therefore cross-checked and standardised against representative benchmark sites (Section 2.2.2).

The vegetation condition scores are representative of point locations along the alignment, rather than from linear assessments traversing through vegetation along the alignment. The data presented is considered reflective of the vegetation condition along the alignment.

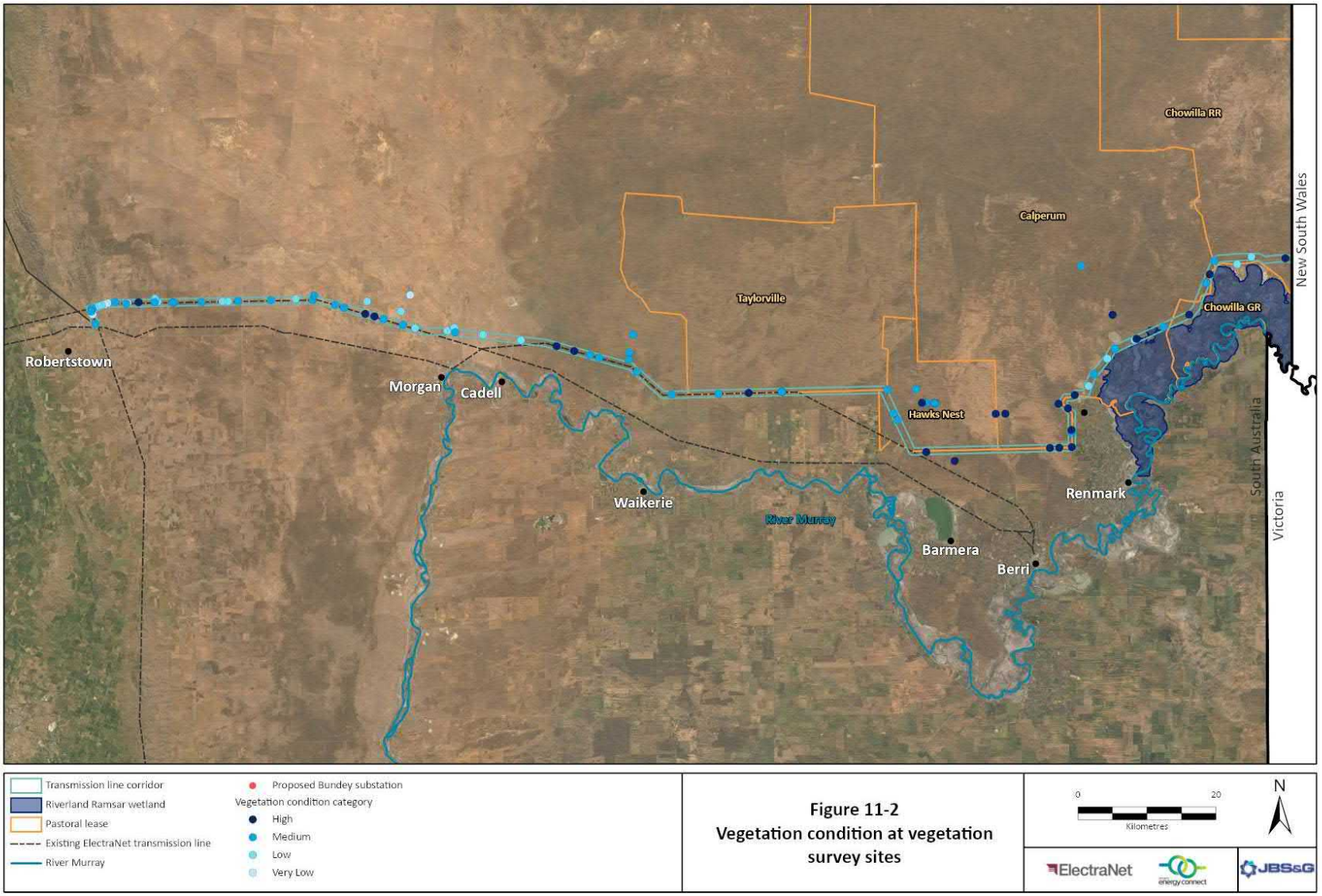


Figure 3-9: Summary of vegetation condition at 78 BAM sites along the proposed alignment route

Table 3-11: Summary of BAM Vegetation Condition Score and Vegetation Condition Category

BAM site	Vegetation Condition Score	Condition Category	BAM site in TLC*	BCM comm	Broad Habitat Group
1b	7.5	Very Low	Yes	9.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
2b	5.9	Very Low	Yes	9.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
4a	19.35	Very Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
101c	16.63	Very Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
102b	18.29	Very Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
1c	33.28	Low	No	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
2c	21.37	Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
3a	30.27	Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
3c	25.71	Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
101a	33.31	Low	Yes	3.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
101d	23.63	Low	Yes	1.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
4c	41.43	Medium	Yes	10.11	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
6a	16.03	Very Low	Yes	2.2	Chenopod open shrubland -western half of alignment
12a	10.32	Very Low	No	11.6	Chenopod open shrubland -western half of alignment
7b	33.54	Low	Yes	2.2	Chenopod open shrubland -western half of alignment
10b	23.22	Low	No	2.2	Chenopod open shrubland -western half of alignment
11b	25.8	Low	Yes	11.6	Chenopod open shrubland -western half of alignment
12b	25.8	Low	No	2.2	Chenopod open shrubland -western half of alignment
13a	25.8	Low	Yes	2.2	Chenopod open shrubland -western half of alignment
13b	28.38	Low	Yes	2.2	Chenopod open shrubland -western half of alignment
14b	33.12	Low	Yes	2.2	Chenopod open shrubland -western half of alignment
6c	45.32	Medium	Yes	2.2	Chenopod open shrubland -western half of alignment
102c	41.93	Medium	yes	2.2	Chenopod open shrubland -western half of alignment
107	39.35	Medium	Yes	2.2	Chenopod open shrubland -western half of alignment
7c	65.4	High	Yes	11.6	Chenopod open shrubland -western half of alignment
14c	30.57	Low	Yes	2.2	Chenopod shrubland - eastern half of alignment
25b	23.54	Low	Yes	2.2	Chenopod shrubland - eastern half of alignment
26b	24.48	Low	Yes	2.2	Chenopod shrubland - eastern half of alignment
13c	49.02	Medium	Yes	4.3	Chenopod shrubland - eastern half of alignment

BAM site	Vegetation Condition Score	Condition Category	BAM site in TLC*	BCM comm	Broad Habitat Group
20a	35.86	Medium	Yes	2.1	Chenopod shrubland - eastern half of alignment
112	62.38	High	Yes	10.11	Chenopod shrubland - eastern half of alignment
9a	33.79	Low	Yes	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
9b	30.32	Low	No	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
114	34.14	Low	Yes	1.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
5c	50.68	Medium	Yes	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
6b	42.73	Medium	Yes	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
8b	38.03	Medium	No	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
10a	42.73	Medium	Yes	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
11a	40	Medium	Yes	2.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
105	52.85	Medium	Yes	1.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
111	49.49	Medium	Yes	10.8	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
29b	56.15	High	Yes	1.1	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
104	74.66	High	Yes	11.6	Low Open Woodland (*Casuarina pauper*, *Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey
1b	7.5	Very Low	Yes	9.1	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks
1a	40.5	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
2a	40.16	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
3b	44.72	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey

BAM site	Vegetation Condition Score	Condition Category	BAM site in TLC*	BCM comm	Broad Habitat Group
5a	40.74	Medium	Yes	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
5b	36.78	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
7a	36.12	Medium	Yes	1.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
8a	47.2	Medium	Yes	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
12c	50.7	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
14a	53	Medium	No	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
15a	53.5	Medium	No	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
15b	53.44	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
19a	50	Medium	No	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
19b	49.19	Medium	Yes	4.2	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
19c	40.74	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
26c	48.75	Medium	No	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
108	52.65	Medium	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
117	42.22	Medium	Yes	1.2	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
4b	59.13	High	Yes	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
8c	65.25	High	Yes	2.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
10c	59.63	High	Yes	1.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
18a	61	High	No	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
18c	60	High	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
23b	56.64	High	No	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
23c	60.45	High	No	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
24b	56.64	High	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
27b	62.56	High	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey

BAM site	Vegetation Condition Score	Condition Category	BAM site in TLC*	BCM comm	Broad Habitat Group
116	66.3	High	Yes	3.1	Old growth mallee over open sclerophyll and/or chenopod shrub understorey
21c	56.15	High	Yes	3.1	Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey
9c	47.7	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
16a	38.5	Medium	No	4.2	Mallee over *Triodia* dominated understorey
16b	45.34	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
17a	48.5	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
17b	48	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
17c	49.24	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
18b	46.21	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
20b	47.78	Medium	No	4.2	Mallee over *Triodia* dominated understorey
24c	43.23	Medium	No	4.2	Mallee over *Triodia* dominated understorey
25c	51	Medium	No	4.2	Mallee over *Triodia* dominated understorey
27c	41.24	Medium	No	4.2	Mallee over *Triodia* dominated understorey
28c	42.73	Medium	No	4.2	Mallee over *Triodia* dominated understorey
109a	52.65	Medium	Yes	4.2	Mallee over *Triodia* dominated understorey
16c	56.64	High	Yes	4.2	Mallee over *Triodia* dominated understorey
20c	55.15	High	Yes	4.2	Mallee over *Triodia* dominated understorey
21b	57.64	High	No	4.1	Mallee over *Triodia* dominated understorey
22b	58.63	High	No	4.1	Mallee over *Triodia* dominated understorey
22c	56.55	High	Yes	4.2	Mallee over *Triodia* dominated understorey
29c	63.1	High	Yes	4.2	Mallee over *Triodia* dominated understorey
115	64.59	High	No	4.2	Mallee over *Triodia* dominated understorey
28b	33.12	Low	No	4.3	Hopbush (*Dodonaea viscosa* ssp. *angustissima*) shrubland – eastern half of alignment
15c	40.08	Medium	Yes	3.1	Hopbush (*Dodonaea viscosa* ssp. *angustissima*) shrubland – eastern half of alignment
11c	63.21	High	Yes	4.3	Hopbush (*Dodonaea viscosa* ssp. *angustissima*) shrubland – eastern half of alignment

*TLC = 500m buffer wither side of proposed alignment

3.4 Threatened Species and Ecological Communities

No Threatened Ecological Communities (TECs) were identified along the alignment on any of the three surveys.

One Nationally threatened flora species was identified along the ElectraNet alignment, *Dodonaea subglandulifera* (Peep Hill Hopbush). An estimated 50 – 100 individuals of *Dodonaea subglandulifera* occurred over approximately 0.5 ha at site 101a. Individuals ranged from approximately 0.2 to 1 m high. Grazing pressure on the *Dodonaea* was low and the plants appeared slightly droughted, otherwise in good health. No flowers or fruits were present. A further population of three bushes has also been recorded approximately 500 m east of site 101a. The three bushes were in similar habitat – rocky slope with Mallee, near an existing transmission line

pole. These plants all occur with proximity or are likely part of the known 'Robertstown Subpopulation documented in the species recovery plan (Moritz and Bickerton 2010).

One State rated as Rare threatened flora species was recorded, namely *Geijera parviflora* (Wilga. This species was recorded at BAM sites 14a and 15a, which are within 1 km of each other. These sites are about 20 km north of Waikerie and 1 km north of (outside) the current alignment.

One state rated as Rare threatened fauna species *Corcorax melanorhamphos* (White-winged Chough) was observed at sites 5a, 3b and 4b during the June 2019 survey.

Conservation significant flora and fauna are assessed in more depth in the EIS for the project.

3.5 Weeds

As per Section 2.2.3, Declared weeds are plants that are regulated in South Australia under the *Landscape South Australia Act* 2019 with regards their movement, sale and control. Weeds of National Significance (WoNS) are Australia's most invasive plants and are subject to national regulations and control strategies.

There were two Declared weed species identified along the alignment, one of which are also a Weed of National Significance, summarised below (**Table 3-12**).

Table 3-12: Summary of exotic species recorded for EnergyConnect Project (94 BAM sites in total, 72 of which are within the January 2021 alignment).

Common Name	Species	Threat rating*	Number of Records	BAM Sites
African Boxthorn	*Lycium ferocissimum*# ^	4	3	101a, 1b, 2a
Barley	*Hordeum vulgare*	1	4	3a, 4a
Barley-grass	*Hordeum sp.*	1	1	101a, 1b, 2a
Brome Grass	*Bromus sp.*	2	1	1c
Cut-leaf Heron's-bill	*Erodium cicutarium*	2	1	1b
Heron's-bill	*Erodium spp.*	2	4	20b, 25b, 26b, 28b
Horehound	*Marrubium vulgare*#	3	2	2a, 4a
Iceplant	*Mesembryanthemum crystallinum*	2	1	5c
Maltese thistle	*Centaurea melitensis*	2	1	117
Match-head Plant	*Psilocaulon granulicaule*	2	2	111, 27b
Medic	*Medicago sp.*	2	13	11c, 12b, 13c, 14b, 1c, 25b, 26b, 28b, 2c, 3b, 3c, 6c, 7c
Onion Weed	*Asphodelus fistulosus*	2	6	101c, 15b, 1b, 4a, 6a, 8c
Potato Weed	*Heliotropium europaeum*	1	2	117, 7c
Saffron Thistle	*Carthamus lanatus*	2	4	101a, 1b, 1c, 3c
Sea Barley-grass	*Hordeum marinum*	1	1	101c
Sea-lavender	*Limonium sp.*	2	4	112, 114, 25b, 26b

Small Burr-medic	*Medicago minima*	2	1	114
Smooth Cat's Ear	*Hypochaeris glabra*		1	1b
Stemless Thistle	*Onopordum acaulon*	3	3	104, 101a, 1c
Thread Iris	*Moraea setifolia*	2	3	11b, 15b, 1b
Tiny Bristle-grass	*Rostraria pumila*		5	104, 111, 112, 114, 101a
Tree Tobacco	*Nicotiana glauca*	2	2	2c, 3c
Ward's Weed	*Carrichtera annua*	1	17	104, 105, 111, 112, 114, 101a, 11b, 14b, 14c, 15b, 25b, 26b, 27b, 4b, 6c, 8b, 8c
Wild Mustard	*Sisymbrium sp.*	1	4	104, 111, 114, 117
Wild Oat	*Avena fatua*	2	2	101a, 3a
Wild Sage	*Salvia verbenaca var.*	2	9	111, 114, 117, 14c, 15c, 17c, 20a, 21c, 22c

* Environmental Threat Rating as per BCM manual (DEW 2020); # Declared = *Marrubium vulgare* and *Lycium ferocissimum;* ^ WoNs = *Lycium ferocissimum.* Species lists per site are within each BAM scoresheet.

4. Conclusions

A desktop ecological review and a series of four field surveys have been conducted along the length of the EnergyConnect alignment between the Robertstown substation and the SA-NSW state border between November 2018 – January 2021. In total, 94 sites were assessed, comprising 7 Bushland Condition Monitoring communities (13 sub-communities). The results of the four surveys have been consolidated in this report and have identified the following:

- There were no Threatened Ecological Communities (TECs) identified along the alignment on any of the three surveys.
- One Nationally threatened flora species (*Dodonaea subglandulifera*, Peep Hill Hopbush) was found along the current alignment. An estimated population of 50 – 100 individuals were recorded within an area of about 0. 5 ha, associated with rocky slopes and gullies near the western end of the alignment. There is a known Robertstown subpopulation listed in the species national recovery plan.
- One State threatened flora species was recorded (*Geijera parviflora,* Wilga) – recorded at two adjoining sites of mallee in the western third of the project area, and approximately 1 km north of the current alignment.
- One Rare state threatened fauna species (*Corcorax melanorhamphos*, White-winged Chough) was sighted at three sites along the alignment; Site 5a (Nov 2018), Site 3b and 4b (June 2019).

Vegetation Condition: Along the length of the alignment, vegetation condition scores ranged from 6 (Very Low) to 74 (High) (out of a possible score of 80). Vegetation at the western end of the alignment was generally in low condition due to land use (with cleared agricultural paddocks and heavily grazed shrublands subject to prolonged drought), as was vegetation at the far eastern end (due to prolonged drought). Condition of vegetation within large patches of ungrazed old growth Mallee found in the central portion of the alignment was generally found to be in higher condition, as portions of these areas were within protected areas such as land managed for conservation / heritage agreement areas.

Fire History: The central portion of the alignment contains a number of sites that were burnt in either the Bookmark bushfire (2006) or the Calperum bushfire (2014). The sites were noted to be recovering well from the fire events, with regeneration being reflected in the medium to high vegetation condition and relative unit biodiversity scores.

Weeds: There were two Declared weeds along the alignment: *Marrubium vulgare* (Horehound) and *Lycium ferocissimum* (African Boxthorn) which is also a Weed of National Significance (WoNS).

This report has provided a comprehensive summary of vegetation present along the length of the alignment, its condition and fire history, and will support associated reporting including a native vegetation clearance application and an Ecological Impact Assessment for threatened fauna habitat.

5. References

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Appendix A. Additional Information

Flora Lists

Table 1. Native species recorded at BAM sites for EnergyConnect Project (94 BAM sites in total, 72 of these are within the January 2021 alignment). Species lists per site are within each BAM scoresheet.

Common Name	*Species Name*	Number of Records
Annual Groundsel	*Senecio glossanthus*	1
Australian Boxthorn	*Lycium australe*	10
Baldoo	*Atriplex lindleyi ssp.*	2
Ball Bindyi	*Dissocarpus paradoxus*	12
Beaked Red Mallee	*Eucalyptus socialis ssp.*	6
Bindyi	*Sclerolaena sp.*	1
Bitter Saltbush	*Atriplex stipitata*	30
Black Bluebush	*Maireana pyramidata*	32
Black Oak	*Casuarina pauper*	15
Black-anther Flax Lily	*Dianella revoluta var.*	3
Black-anther Flax-lily	*Dianella revoluta var. revoluta*	1
Bladder Saltbush	*Atriplex vesicaria*	12
Bluebush	*Maireana sedifolia*	35
Bluebush Daisy	*Cratystylis conocephala*	1
Blue-leaf Mallee	*Eucalyptus cyanophylla*	1
Bonefruit	*Osteocarpum acropterum var.*	1
Bottle-washers/Nineawn	*Enneapogon sp.*	2
Box Mistletoe	*Amyema miquelii*	3
Broad-leaf Desert Senna	*Senna artemisioides ssp. X coriacea*	15
Broom Emubush	*Eremophila scoparia*	12
Broombush Templetonia	*Templetonia egena*	12
Brown-head Samphire	*Tecticornia indica ssp.*	1
Buckbush	*Salsola australis*	8
Bulbine-lily	*Bulbine bulbosa*	3
Bullock Bush	*Alectryon oleifolius ssp. canescens*	23
Burr-daisy	*Calotis sp.*	1
Bush Bean	*Rhyncharrhena linearis*	1
Casuarina Mistletoe	*Amyema linophylla ssp. orientalis*	2
Climbing Saltbush	*Einadia nutans ssp.*	4
Climbing Twinleaf	*Roepera eremaea*	2
Comb Grevillea	*Grevillea huegelii*	17
Common Eutaxia	*Eutaxia microphylla*	1
Cotton-bush	*Maireana aphylla*	4
Cottony Goosefoot	*Chenopodium curvispicatum*	9
Cypress Daisy-bush	*Olearia teretifolia*	1
Dark Turpentine Bush	*Beyeria opaca*	18
Desert Bog-rush	*Schoenus subaphyllus*	2
Desert Goosefoot	*Chenopodium desertorum ssp.*	2

Desert Hop-bush	*Dodonaea stenozyga*	1
Desert Poplar	*Codonocarpus cotinifolius*	8
Desert Senna	*Senna artemisioides ssp. artemisioides x ssp. coriacea*	1
Desert Senna	*Senna artemisioides ssp.*	7
Dodder-laurel	*Cassytha sp.*	2
Dryland Tea-tree	*Melaleuca lanceolata*	2
Dune Grevillea	*Grevillea pterosperma*	1
Dune Tea-tree	*Leptospermum coriaceum*	2
Dwarf Nealie	*Acacia wilhelmiana*	9
Dwarf Twinleaf	*Roepera ovata*	5
Emubush/Turkey-bush	*Eremophila sp.*	1
Erect Mallee Bluebush	*Maireana pentatropis*	39
Eucalyptus sp.		3
False Sandalwood	*Myoporum platycarpum ssp.*	32
Feather Daisy-bush	*Olearia passerinoides ssp.*	2
Feather Spear-grass	*Austrostipa elegantissima*	1
Fine-leaf Desert Senna	*Senna artemisioides ssp. filifolia*	18
Fleshy Saltbush	*Rhagodia crassifolia*	1
Fuzzy New Holland Daisy	*Vittadinia cuneata var.*	1
Gilja	*Eucalyptus brachycalyx*	5
Grass Family	*Gramineae sp.*	1
Grassy Bindweed	*Convolvulus remotus*	2
Green Bindyi	*Sclerolaena decurrens*	1
Grey Bindyi	*Sclerolaena diacantha*	19
Grey Germander	*Teucrium racemosum*	1
Hairy Angianthus	*Angianthus tomentosus*	1
Hairy Burr-daisy	*Calotis hispidula*	1
Hairy-fruit Bluebush	*Maireana trichoptera*	6
Hall's Wattle	*Acacia halliana*	1
Harlequin Mistletoe	*Lysiana exocarpi ssp. exocarpi*	10
Inland Pigface	*Carpobrotus modestus*	1
Intricate Saltbush	*Rhagodia ulicina*	23
Kerosene Grass	*Aristida contorta*	1
Leafless Cherry	*Exocarpos aphyllus*	12
Little Plantain	*Plantago sp. B*	1
Mallee Box	*Eucalyptus porosa*	5
Mallee Fringe-lily	*Thysanotus baueri*	1
Mealy Saltbush	*Rhagodia parabolica*	3
Mueller's Daisy-bush	*Olearia muelleri*	10
Narrow-leaf Bindweed	*Convolvulus angustissimus*	3
Narrow-leaf Hop-bush	*Dodonaea viscosa ssp. angustissima*	20
Narrow-leaf Red Mallee	*Eucalyptus leptophylla*	11
Native Apricot	*Pittosporum angustifolium*	3
Native Camomile	*Gnephosis sp.*	1

Native Carrot	*Daucus glochidiatus*	1
Native Daisy	*Brachyscome sp.*	1
Nealie	*Acacia rigens*	4
New Holland Daisy	*Vittadinia sp.*	2
New Zealand Spinach	*Tetragonia tetragonoides*	1
Nitre-bush	*Nitraria billardierei*	4
Oblique-spined Bindyi	*Sclerolaena obliquicuspis*	20
One-flower Apple-berry	*Billardiera uniflora*	1
Pale-fruit Bluebush	*Maireana appressa*	1
Panic/Millet	*Panicum sp.*	1
Peep Hill Hopbush	*Dodonaea subglandulifera*	1
Pimelea Daisy-bush	*Olearia pimeleoides*	9
Pleated Copper-wire Daisy	*Podolepis rugata var.*	1
Pointed Twinleaf	*Roepera apiculata*	16
Pointed Twinleaf	*Zygophyllum apiculatum*	3
Potato Weed	*Heliotropium europaeum*	1
Purple Emubush	*Eremophila weldii*	1
Pussytails	*Ptilotus spathulatus*	1
Quandong	*Santalum acuminatum*	1
Radiate Bluebush	*Maireana radiata*	8
Red Mallee	*Eucalyptus oleosa ssp.*	36
Ridge-fruited Mallee	*Eucalyptus incrassata*	8
River Box	*Eucalyptus largiflorens*	1
Rosy Bluebush	*Maireana erioclada*	3
Rough Blue-flower	*Halgania cyanea*	1
Ruby Saltbush	*Enchylaena tomentosa var. tomentosa*	29
Ruby Saltbush	*Enchylaena tomentosa var.*	13
Rusty Spear-grass	*Austrostipa eremophila*	2
Salt Sand-spurrey	*Spergularia marina*	1
Saltbush	*Atriplex sp.*	2
Satiny Bluebush	*Maireana georgei*	14
Saw-sedge	*Gahnia sp.*	1
Scarlet Mintbush	*Prostanthera aspalathoides*	2
Scented Mat-rush	*Lomandra effusa*	5
Scrub Cypress Pine	*Callitris verrucosa*	5
Senna	*Senna artemisioides ssp. petiolaris*	21
Sheep Bush	*Geijera linearifolia*	3
Short-leaf Bluebush	*Maireana brevifolia*	21
Short-wing Bindyi	*Sclerolaena brachyptera*	1
Shrubby Riceflower	*Pimelea microcephala ssp.*	4
Shrubby Twinleaf	*Roepera aurantiaca ssp. aurantiaca*	18
Shrubby Twinleaf	*Zygophyllum aurantiacum ssp.*	2
Shrubby Twinleaf	*Zygophyllum aurantiacum/eremaeum*	3
Sida	*Sida sp.*	3

Silky Cryptandra	*Cryptandra propinqua*	1
Silver Senna	*Senna artemisioides ssp. X artemisioides*	1
Slender Dodder-laurel	*Cassytha glabella f. dispar*	1
Small Hop-bush	*Dodonaea bursariifolia*	4
Small-flower Bindyi	*Sclerolaena parviflora*	3
Small-flower Goodenia	*Goodenia pusilliflora*	2
Small-flower Tobacco	*Nicotiana goodspeedii*	1
Small-flower Wallaby-grass	*Rytidosperma setaceum*	2
Southern Cypress Pine	*Callitris gracilis*	2
Spear-fruit Bindyi	*Sclerolaena patenticuspis*	20
Spear-grass	*Austrostipa sp.*	30
Spine Bush	*Acacia nyssophylla*	25
Spinifex	*Triodia sp.*	23
Spiny Fanflower	*Scaevola spinescens*	4
Spiny Saltbush	*Rhagodia spinescens*	17
Spiny Wattle	*Acacia spinescens*	2
Spreading Saltbush	*Atriplex limbata*	1
Spurge	*Euphorbia drummondii group*	1
Spurge	*Euphorbia sp.*	1
Star-flower	*Grammosolen dixonii*	5
Sticky Sword-sedge	*Lepidosperma viscidum*	2
Stiff Westringia	*Westringia rigida*	6
Sword-sedge/Rapier-sedge	*Lepidosperma sp.*	1
Tar Bush	*Eremophila glabra ssp.*	10
Thick-leaf Emubush	*Eremophila crassifolia*	8
Thorny Lawrencia	*Lawrencia squamata*	5
Thread-petal	*Stenopetalum sp.*	2
Three-spine Bindyi	*Sclerolaena tricuspis*	2
Three-wing Bluebush	*Maireana triptera*	1
Tobacco	*Nicotiana sp.*	1
Top-fruit Bluebush	*Maireana turbinata*	6
Turkey-Bush	*Eremophila deserti*	2
Turpentine Bush	*Eremophila sturtii*	4
Twiggy Guinea-flower	*Hibbertia virgata*	1
Twinleaf	*Roepera sp.*	1
Two-horn Saltbush	*Dissocarpus biflorus var.*	1
Umbrella Bush	*Acacia ligulata*	8
Umbrella Wattle	*Acacia oswaldii*	7
Variable Daisy	*Brachyscome ciliaris var.*	2
Veined Wait-a-while	*Acacia colletioides*	3
Wallaby-grass	*Rytidosperma sp.*	5
Wallowa	*Acacia calamifolia*	3
Wattle	*Acacia sp.*	1
Western Bindyi	*Sclerolaena parallelicuspis*	2

White Everlasting	*Rhodanthe floribunda*	1
White Mallee	*Eucalyptus dumosa*	20
Wild Turnip	*Brassica sp.*	1
Wilga	*Geijera parviflora*	2
Wire-leaf Mistletoe	*Amyema preissii*	1
Wiry Podolepis	*Podolepis capillaris*	8
Woolly Mat-rush	*Lomandra leucocephala ssp. robusta*	12
Woolly New Holland Daisy	*Vittadinia gracilis*	1
Woolly-fruit Bluebush	*Eriochiton sclerolaenoides*	12
Yellow-tails	*Ptilotus nobilis*	1
Yorrell	*Eucalyptus gracilis*	18

Location of Photopoints EnergyConnect BAM sites

Table 2. Photo easting and northings, BAM sites for EnergyConnect Project (94 BAM sites in total, 72 of these are within the January 2021 alignment). Photos are within BAM scoresheets and site descriptions Section 3.1

BAM Site	Easting	Northing
1a	326912	6241289
2a	326346	6243131
3a	327444	6243894
4a	328332	6244173
5a	331393	6244270
6a	331405	6244311
7a	338077	6244405
8a	342323	6244493
9a	346146	6244541
10a	362948	6243674
11a	368680	6242036
12a	372504	6245494
13a	373231	6240712
14a	404140	6236150
15a	404256	6237216
16a	404821	6239765
17a	417173	6231199
18a	474243	6242614
19a	469729	6249710
20a	488983	6250431
1c	335546	6244992
2c	335638	6244883

3c	335914	6244541
4c	335480	6244469
5c	358422	6244788
6c	361627	6244063
7c	366026	6242758
8c	393756	6238108
9c	398599	6236782
10c	396259	6237409
11c	488350	6248485
12c	487807	6247222
13c	481632	6240897
14c	473515	6236303
15c	471539	6234044
16c	467806	6229090
17c	468375	6225832
18c	468304	6225993
19c	468361	6225520
20c	465196	6223380
21c	466543	6223395
22c	468377	6223447
23c	446654	6229898
24c	446916	6229978
25c	447230	6229902
26c	448474	6229841
27c	448617	6229771
28c	448383	6229876
29c	421552	6231323
1b	326523	6242708
2b	326460	6243549
3b	329771	6244488
4b	333182	6244427
5b	338305	6244423
6b	352355	6244757
7b	355898	6244955
8b	358615	6245421
9b	366296	6244560
10b	371154	6243102
11b	377868	6240339
12b	378885	6240770

13b	383097	6239751
14b	388568	6238936
15b	399893	6236417
16b	410363	6231087
17b	426320	6231528
18b	426353	6231480
19b	441608	6231793
20b	445729	6231861
22b	458734	6228331
21b	457366	6228304
23b	466426	6229766
24b	468806	6231037
25b	470792	6232321
26b	477457	6239001
27b	485341	6242661
29b	499305	6250798
28b	492299	6249947
101a	327812	6244016
101c	328710	6244316
102b	331559	6244345
101d	345324	6244565
102c	347590	6244617
104	367285	6242379
105	3711445	6241155
107	379005	6240092
108	405343	6234430
109a	442440	6228408
117	443199	6227379
116	447230	6222783
115	451391	6221568
111	474564	6237682
112	477773	6239172
114	494322	6251009

EIS Volume 2 Appendix I-3

Significant Impact Assessments

JBS&G

project energy connect

Contents

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Appendix I-3: Significant Impact Assessments

1. Introduction

This document presents an assessment of the significance of residual impacts of Project EnergyConnect on Matters of National Environmental Significance protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This document is an update of the tables contained in the Significant Impact Assessment that was undertaken as part of pre-feasibility assessments and submitted with the Project's EPBC referral as Attachment 7 (Jacobs 2019a).

Only species that were considered present, likely or possible to occur are considered in this assessment. Refer to Chapter 11 of the EIS for methodology regarding data inputs, justification for likelihood of occurrence and references.

2. Significant Impact Criteria

The Matters of National Environmental Significance that are relevant to the Project are:

- Wetlands of International Importance
- Listed threatened species and ecological communities
  - Critically Endangered and Endangered species or communities
  - Vulnerable species
- Migratory species.

The significant impact criteria for these Matters of National Significance are outlined by DoTE (2013) and are summarised in Table 1. The full text of the criteria are contained in DoTE (2013).

For species listed as Vulnerable, the term 'important population' is used to define a number of the significant impact criteria. For the purpose of this significant impact assessment, we consider 'important populations' of a species to be 'key' or 'core' populations which are defined as strongholds within relevant SPRAT profiles (DotEE), or by recent relevant population studies or management plans for the target species. A small, isolated population, remote from a core population (or meta-population) as a result of historic habitat fragmentation would also represent an important population. Examples of populations considered to not represent important populations would be small portions of much larger and/or predominantly continuous populations, or discrete populations as part of a larger patchy population distribution as a result of natural habitat variability and islanding of microhabitat features.

Table 1: EPBC Significant Impact Criteria

Criteria	Wetlands of international importance	Critically Endangered and Endangered Ecological Communities	Critically Endangered and Endangered Species	Vulnerable Species	Migratory Species
A	Areas of the wetland being destroyed or substantially modified	Reduce the extent of an ecological community	Lead to a long-term decrease in the size of a population	Lead to a long-term decrease in the size of an important population of a species	Substantially modify (including by fragmenting, altering fire regimes, nutrient cycles or hydrological cycles), destroy or isolate an area of important habitat for a migratory species
B	A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland	Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Reduce the area of occupancy of the species	Reduce the area of occupancy of an important population	Result in invasive species that are harmful to a migratory species becoming established in an area of important habitat for migratory species
C	The habitat or lifecycle of native species dependent upon the wetland being seriously affected	Adversely affect habitat critical to the survival of an ecological community	Fragment an existing population into two or more populations	Fragment an existing important population into two or more populations	Seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of a population of a migratory species
D	A substantial and measurable change in the water quality of the wetland	Modify or destroy abiotic factors (such as water, nutrients, or soil) including reduction of groundwater levels.	Adversely affect habitat critical to the survival of a species	Adversely affect habitat critical to the survival of a species	
E	An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.	Cause a substantial change in the species composition of an occurrence of an ecological community	Disrupt the breeding cycle of a population	Disrupt the breeding cycle of a population	
F		Cause a substantial reduction in the quality or integrity of an ecological community, including:	Modify, destroy, remove, isolate or decrease the availability or quality of habitat	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent	

Criteria	Wetlands of international importance	Critically Endangered and Endangered Ecological Communities	Critically Endangered and Endangered Species	Vulnerable Species	Migratory Species
		• assisting harmful invasive species to become established, or • causing regular mobilisation of harmful chemicals or pollutants into the community	to the extent that the species is likely to decline?	that the species is likely to decline?	
G		Interfere with the recovery of an ecological community	Result in harmful invasive species becoming established in endangered species' habitat?	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	
H			Introduce disease that may cause the species to decline?	Introduce disease that may cause the species to decline?	
I			Interfere with the recovery of the species	Interfere with the recovery of the species	

Modified version of information provided in the Commonwealth Significant Impact Guidelines 1.1 Matters of National Environmental Significance DotE (2013)

3. Assessment of Significance of Residual Impacts on Matters of National Environmental Significance

Table 2 below presents an assessment of whether the proposed development would result in significant impacts to relevant Matters of National Environmental Significance, namely EPBC Wetlands of International Importance, Threatened Ecological Communities, and listed flora and fauna which were considered 'likely' to occur, or as 'possible' occurrences within the study area during the desktop review undertaken here. The assessment was based on the significant impact criteria outlined in Table 1 above (sourced from DoTE (2013).

Table 2: Significant Impact Assessment for Matters of National Environmental Significance that are considered 'likely' or as 'possible' occurrences in study area

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
Wetlands of International Significance						
Riverland			The transmission line corridor passes predominantly north of the Riverland site boundary and the River Murray floodplain, on higher ground on the northern side of the Renmark-Wentworth Road. It does not cross any areas that are regularly inundated, and crosses 3 areas of upper floodplain (approximately 2 km in length) that were flooded in the 1956 flood and could be flooded in extreme flood events.	Migratory and water bird collisions with transmission lines	Installation of reflectors on transmission lines near wetlands in Ramsar site (e.g. areas within 500 m of the indicative 1 in 10 year inundation extent).	**Significant impacts considered not likely** • A: Not likely. The transmission line will traverse the northern margin of the wetland site (north of Main Wentworth Road), predominantly north of the Ramsar site boundary. It does not cross any areas that are regularly inundated. No part of the wetland will be destroyed or substantially modified. • B and D: Not Likely. The project will not intercept or divert surface water, or cause the alteration of surface water flows. Hence it will not alter the hydrological regime of the wetland. No changes in water quality due to the project are likely. • C: Not Likely. The northern boundary of the wetland (defined by the historical 1956 flood level) is predominantly south of the proposed alignment (which runs on the northern side of the Main Wentworth Road). It is acknowledged there is an increase in likelihood potential for migratory or water bird collisions with the transmission line due to proximity, and potentially also elevated by the rising land away from the wetland (i.e. as birds gain altitude, the land also rises, meaning birds may still be relatively close to the ground as they pass the line). Whilst it is noted that the highest mortality rates as a result of bird strike with transmission lines occur where transmission lines pass directly through wetlands, lower rates still occur when transmission lines pass near wetlands (Faanes 1987 cited in Carpenter 2002). The

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						current project does not cross any areas that are regularly inundated, and crosses three areas of upper floodplain (totalling approximately 2 km in length) that were flooded in the 1956 flood and could be inundated again in extreme flood events. Several towers will be constructed in these areas of upper floodplain. Carpenter (2002) suggests that mortality rates for similar species to those that occur in these SA wetlands (derived from Australian and International studies) indicate that mortality rates (as a function of overall population size) are generally low compared with other causes. In addition, most studies have shown a reduction in collisions and/or an increase in behavioural avoidance at marked lines when compared to unmarked lines, but this can vary with location, type of line marking device, and bird species (APLIC 2012). Many studies of transmission lines with high collision rates indicate that collision risk can be lowered by 50% to 80% when these lines are marked, however some studies report much lower levels of reduction, particularly for species which move after dusk. The area adjacent to the transmission line would be periodically and infrequently flooded, rather than always containing water. Therefore, there is potential for higher incidence of bird collision during periods of inundation, but periods of time (years) when birds are not present or present only in very low numbers, or at restricted locations. Although the transmissions lines may cause the death of some birds, the losses are not expected to be significant compared with total population numbers locally and globally (Carpenter 2002, Appendix I5 of EIS), and hence the project is not considered to significantly affect the habitat or lifecycle of native birds dependent on the wetland. In addition, a high level risk assessment of unweighted likelihood and consequence factors for species most commonly recorded in the wetland considered overall risk for the majority of birds that use the wetland was low for most threatened species and

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						migratory species and moderate for two state-rated species, no threatened species were considered at high risk (Refer Wetland Bird Review, Appendix I5). The transmission line is not considered likely to significantly reduce a population of migratory birds given the large extent of riverine floodplain areas (i.e. 34,000 ha of Riverland Wetland Complex) that occurs immediately south of the proposed alignment, as well as additional riverine, floodplain and wetland habitat along the length of the Murray both upstream and downstream. • E: Not likely. The introduction of invasive species into the wetland is not likely as the proposed alignment is along an existing highly used road. Hence, the project will not be creating additional risk of invasive species introduction, because there is currently high volume traffic in this location.
Threatened Flora						
Peep Hill Hop-bush *(Dodonaea subglandulifera*)	EN	E	Present Two groups of plants present within existing transmission line easement on rocky slopes, one group of three plants already avoided by regular track maintenance upgrades. Second group is 50-100 plants of mixed age. Both groups can be avoided	No direct impact expected. Small-scale clearance of individual plants, associated with tower platforms, or construction of access tracks, would be avoided by micro-siting. Introduction of invasive weed species or disease	Alignment placement to avoid known groups of plants / recent occurrences within study area. Micro-siting footprints of proposed towers and associated infrastructure that will require vegetation clearance (access tracks, laydown areas) to avoid impacts to other individuals. Flag off and avoid disturbance to any populations present via fine tuning alignment or footing locations. Implement CEMP / OEMP (e.g. weed hygiene practices during construction and l weed surveillance and control	**Significant impacts considered not likely** Known from 45 sites, 45,700 individuals, comprising 11 subpopulations, including a known subpopulation that occurs NW to NE of Robertstown (Moritz and Bickerton 2010). Recent records occur within 0.1 to -2km of the proposed alignment, at its western end within the transmission line corridor. Groups of plants located as part of substation upgrade (on hill avoided by access track), and additional groups located as part of recent surveys, all near known records in similar habitats, and are likely an extension of the known subpopulation. • A, B, C: Not likely. Long-term decline and/or fragmentation of a population is not likely. The mitigation measures are aimed at avoiding clearance (e.g. micro-positioning of infrastructure and access tracks).

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			with micro-siting and or spanning. Suitable habitat is only present at the western end of the corridor and is not critical to the species survival		programs during operation) to manage indirect impacts.	• D and F: (adversely affect critical habitat). Not Likely. The proposed clearance required for the transmission project is a very small fraction of the available critical habitat. • E: Not Likely. Reproduction of Peep Hill Hop-bush would not be disrupted by a transmission line. The location of any new access tracks would be sited to avoid any populations. Mitigation measures proposed enable any populations present to be identified and avoided, so the action will not disrupt the breeding cycle of the species. • G and H:Not likely. Invasive species and/or disease becoming established in critical habitat is not likely. Proposed vehicle hygiene measures would reduce the spread of invasive species into the project footprint areas. • I: Not likely. The key objectives of the recovery plan (Moritz and Bickerton 2010) are to reduce the extinction risk of the species and downlist it under the EPBC Act and NPW Act from Endangered to Vulnerable. Increasing knowledge of extant occurrence assists with this objective. The project will avoid individuals and micro-siting will add to the existing knowledge for the species extent at the Robertstown substation.
Silver Daisy Bush (*Olearia pannosa* ssp. *pannosa*)	VU	V	Possible Suitable habitat present in the western end of TLC. No records in TLC, not detected during surveys. The TLC is at the eastern margins of the species distribution, hence significant or populations	No direct impact expected. Impacts to individual plants, if they occur, can be avoided with micro-siting. Unlikely key population occurs in TLC. If present, low potential for indirect impact via weed introduction or spread within EIS transmission line corridor.	Micro-site to avoid impacts to individuals (if present) prior to construction to refine alignment, proposed new access track and/or tower construction footprints. If identified as present flag off and avoid disturbance to any populations present via fine tuning alignment or footing locations. Documentation of presence would add to regional knowledge, distribution and	**Significant impacts considered not likely** Existing records within the study area are west of the proposed alignment. The study area is at the eastern margins of its likely distribution, hence significant or important populations are unlikely along the proposed transmission line. • A, B, C, D, E, F, Not likely. Long-term decline in important population size, reduced area occupancy or fragmenting existing important population) and adversely affect critical habitat) or disruptions to the reproductive cycle of and important population, are all not likely, given the species has not been located within the transmission line corridor to date and mitigation measures will ensure the project avoids impacts to individuals. No known populations occur within the transmission line corridor,

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			are unlikely along the TLC.		significance of any potential impacts. Implement CEMP / OEMP (e.g. weed hygiene practices during construction weed control surveillance and control programs during operation) to manage indirect impacts.	which is located on the margins of the species predicted distribution where there are no known important populations. Given the species occupies a wide range of habitats and occurs over a wide area in South Australia, the small area of proposed clearance will not significantly impact upon the extent of potential habitat for this species • G and H: Not likely. Invasive species and/or disease becoming established in critical habitat Is unlikely given critical habitat is not within transmission line corridor and the mitigation measures (e.g. weed hygiene practices) that will be implemented. • I: The proposed actions will not interfere with the recovery of the species. A recovery program for this species is current (Trees for Life 2019). This program has collected seed and leaf sample from Silver Daisy populations in South Australia, but none the recovery actions have concerned the proposed transmission alignment study area
Yellow Swainson-pea (*Swainsona pyrophila*)	VU	R	Possible No known populations identified within corridor, but suitable habitat occurs. Germination is triggered by soil disturbance or fire.	No direct impact expected. Seeds may be present and impacted by soil disturbance, however the area of disturbance represents a very small proportion of suitable habitat in the region. Impacts to individual plants, if they occur, can be avoided with micro-siting. Unlikely key population occurs in TLC. If present, low potential for indirect impact via weed introduction or	Micro-site to avoid impacts to individuals (if present) prior to construction to refine new access track and/or tower construction footprints. If identified as present, flag off and avoid disturbance to any populations present via fine tuning alignment or footing locations. Documentation of presence would add to regional knowledge, distribution and significance of any potential impacts Implement CEMP / OEMP (e.g. weed hygiene practices during construction and	**Significant impacts considered not likely** • A: Not Likely. Yellow Swainson-pea is a short-lived species with long-term survival of populations reliant upon soil stored seed. The mitigation measures are aimed at avoiding clearance (e.g. micro-positioning of the footings). However, if there is small scale unintentional clearance, then above-ground clearance is unlikely to have a long-term impact on localised populations. This is because the area of proposed clearance is a very limited fraction of the total area of potential occurrence within the study area. Further, this species survives largely as soil-stored seed. • B and C: Unlikely. No 'important populations' known from within the project area. Disturbance to any population detected would be avoidable with mitigation measures proposed, and therefore reduction in area of occupancy and/or

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
				spread within EIS transmission line corridor.	implement post construction and annual weed control surveillance and control programs) to manage indirect impacts.	fragmentation of an existing important population is considered unlikely. • D: Not Likely. Preferred habitat for this species is potentially most of the study area. The proposed clearance required for the transmission project is a very small fraction of the available critical habitat. • E: Not Likely. No population is known from the project area, so highly likely that no important population exists in the area. Reproduction of Yellow Swainson Pea would not be disrupted by a transmission line or access track if present and avoided during construction. Mitigation measures proposed enable any populations present to be identified and avoided, so the action will not disrupt the breeding cycle of the species. • F: Not Likely. No population currently known from project area. Mitigation measures proposed allow for detection of any population which may be present, and for avoidance of disturbance to those populations (if present). Transmission line proposed will not largely modify or decrease availability of habitat once constructed. The action is therefore not expected to modify or decrease the availability or quality of habitat to the extent that any population of Swainsona pyrophila (if present) is likely to decline, let alone the species as a whole. • G, H: Not Likely. Weed hygiene measures proposed are likely to prevent introduction of weed species and invasive species. • I: The proposed action will not interfere with the recovery plan for this species, which largely focuses on documenting distribution and increases knowledge of this species ecology and threats (Tonkinson and Robertson 2010).

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
Threatened Fauna - Mammals						
South-eastern Long-eared Bat / Corben's Long-eared Bat *(Nyctophilus corbeni*)	VU	V	Possible, but unlikely occurrence in mallee / woodland habitats. Would likely move to suitable habitat north of TLC or to NSW if impacted by disturbance. No bat camps / roosts known to occur in the transmission line corridor. Core important population occurs in NSW (Piliga Scrub). Critical habitat is not limited to the transmission line corridor.	Low potential for individuals to be impacted by collision with transmission line, if flying near line or roosting in mallee habitat that is cleared. Localised disturbance during construction, affecting a very small proportion of available non critical habitat.	Align proposed transmission line to existing cleared roads wherever practicable. Align maintenance tracks and clearance requirements with required fire management access tracks wherever practicable to avoid duplicated clearance. Ensure vehicle hygiene measures are adhered to, and observe quarantine restrictions, which will prevent the introduction of invasive species and disease.	**Significant impacts not considered likely** The core population of the species is located in NSW (Piliga Scrub, TSSC 2015). In South Australia, records are all confined to mallee shrubland. Commonly recorded in extensive stands of vegetation, old-growth vegetation, and areas with a dense understorey. There is one recent record within the ESA, 20 km from the alignment (1998 Calperum Station) and no recent records in the transmission line corridor. All records are within a very large tract of intact mallee well north of the project area. Potential habitat includes mallee over Triodia and Old growth within the transmission line corridor and mallee of the Riverland Biosphere reserve (600,000 ha) that is avoided by the project. The Project will result in clearance of approximately 195 ha of potentially suitable habitat along approximately 98 km of alignment. This is 0.033 % of the more than 600,000 ha of mallee habitat in the Riverland Biosphere Reserve and other properties surrounding the project. • A, B, C, D, E, F: Not likely. Long-term decline in population, reduction in area of occupancy, fragmentation of populations, disruption of breeding cycle, and adversely affecting critical habitat are not considered likely, as the use of existing tracks wherever practicable, rather than clearance of new tracks, and the proposed alignment with fire breaks, will substantially reduce the requirement for habitat clearance through suitable mallee habitat. The alignment will not bi-sect large tracts of mallee, but rather traverse primarily along the edges or fringe of large tracts of mallee, and a very large proportion of mallee within the Riverland Biosphere reserve will not be impacted by the project. Given that the core population is known to occur in Pilliga it is unlikely that an important population occurs within the study area. Whilst it is possible the species

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						occurs in or uses habitat in the study area, clearance of any potential habitat is likely to only have short-term impacts on transient populations and is unlikely to reduce the occupancy of an important population. As such significant impacts are not considered likely to this species. In addition, collisions with transmission line are not expected, given the transmission lines would be 50 m high and this species prefers to fly closer to vegetation to hunt for prey. Bat species are also known to utilise cleared tracks as fly-ways within areas of dense vegetation. • G, H: Not likely. Introduction of invasive species and disease is not considered likely if appropriate hygiene measures are implemented. • I: Not likely. A National Recovery Plan is required. There is no SA recovery plan, but there are recovery actions under the NSW Saving our Species Program, no key management sites are known for the area in SA • (OEH 2019h, SPRAT). The proposed action will affect only a very limited area (very small proportion, 0.033% of the Biosphere Reserve) of potential non-core habitat and is therefore unlikely to affect any recovery programs which are in place.
Threatened Fauna - Birds						
Australasian Bittern *(Botaurus poiciloptilus*)	EN	V	Possible occurrence in swampy well vegetated riverine / Ramsar wetland habitats immediately adjacent eastern end of TLC. Limited suitable habitats occur immediately	Low potential for individuals to be impacted by collision with transmission line, if flying from southern wetland habitats to northern wetland habitats.	Buffer between corridor and wetland habitats. Bird reflectors on transmission line near wetlands in Ramsar site. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts not considered likely** There are 8 records (2010) within the ESA (all at the same location), records are in the River corridor near Morgan and Berri. No records within the transmission line corridor. Possible within riverine environments south of the corridor, potential flyover. Shy elusive species. No habitat of this species occurs within the transmission line corridor, hence no habitat would be cleared. • A: Not Likely. The population in the study area is small. Carpenter (2002) notes that small numbers of this cryptic species occur in reedbeds along the River Murray. “Little

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			north of TLC for these birds to move to if present, more likely to move to adjacent wetlands.			is known of their dispersal, although they are likely to move at night and not necessarily along the floodplain. The species may therefore be at risk of collision with the proposed transmission lines. Given the small numbers in the floodplain wetlands, the risk of collision is likely to be low" (Carpenter 2002). • B, C, D, F: Not Likely. The area of occupancy is not likely to be reduced, nor is an important population likely to be fragmented, or critical habitat affected, because the proposed alignment does not traverse species preferred habitat (river corridor). • E: Not Likely. Breeding is likely to occur on the River Murray, habitat which will not be affected. • G, H: Not Likely. Invasive species or disease are unlikely to be introduced into the Australasian Bittern's core habitat (reed beds) because the project footprint avoids this habitat. • I: Not Likely. Recovery actions for this species will focus on enhancement of core habitat, which will not be affected by the project.
Australian Painted Snipe *(Rostratula australis*)	EN	V	Possible	Collisions with transmission lines	Install markers on transmission lines near wetland habitats.	**Significant impacts not considered likely** • A: Not Likely. No known population occurs in the ecological study area. Within the study area, the only recent records are three records, all from Berri. The alignment is generally several kms from the River, and does not intercept existing wetlands or habitat of this species. The species may be at risk of collision with the proposed transmission lines, if present and if traversing between the Ramsar site and areas north of the transmission line. Given the small numbers in the floodplain wetlands, the risk of collision with transmission lines is likely to be low (Refer Appendix I5 for further discussion). • B, C, D, F: Not Likely. The area of occupancy is not likely to be reduced, nor is a population likely to be fragmented, or critical habitat affected, because the

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						proposed alignment does not traverse species preferred habitat (wetlands). • E: Not Likely. Breeding is likely to occur on the River Murray, habitat which will not be affected. • G, H: Not Likely. Invasive species or disease are unlikely to be introduced into the Australian Painted Snipe core habitat (reed beds) because the project footprint avoids this habitat. • I: Not Likely. Recovery actions for this species will focus on enhancement of core habitat, which will not be affected by the project.
Black-eared Miner *(Manorina melanotis*)	EN	E	Present Present / likely in long unburnt mallee habitats. Listed Critical Habitat area occurs north of the Project area and southern boundary intersects the transmission line corridor. Core populations occurs in northern half of Listed Critical Habitat. Key threat to species is degradation / fragmentation / fire impacts to habitat and further hybridization with	Clearance of very small proportion of available habitat (e.g. 0.03% of listed Critical Habitat). Localised disturbance during construction, affecting a very small proportion of available habitat. Low potential for individuals to be impacted by vehicle collision. Low potential for increase in predators as line follows existing disturbance corridors. Minor to moderate potential for increase in rate of hybridization as hybrids and Yellow-throated Miners are already present.	Avoid BEM Critical Habitat Area. Minimise vegetation clearance that could facilitate additional fragmentation / rate of hybridisation / increased fire potential. Implement CEMP/OEMP to manage indirect impacts (including fire management measures refer EIS 11.4.6).	**Significant impacts not considered likely** • A, B, C., D, E: Not likely. A large tract of intact mallee to the north of the alignment is listed as Critical Habitat for the Black-eared Miner in South Australia (mapped as > 380,000 ha) . This critical habitat occurs within the larger Biosphere Reserve of >600,000 ha north of Cooltong Conservation Park northern boundary track and Taylorville Station / Calperum southern boundaries. Core populations or breeding groups of the species are considered more like to occur deeper with the tracts of intact old growth mallee rather than close to Wentworth Road or edges of the mallee habitat. The area of threatened species' habitat that will be cleared represents a very low proportion of available habitat in the region. The Project will result in clearance of approximately 201 ha of potentially suitable non-core habitat (mallee) along approximately 100 km of alignment[3]. In particular, the proportion of the area of listed Critical Habitat for Black-eared Miner that will be impacted by traversing the southern boundary of this area (i.e. Taylorville, and the section of Calperum north of Wentworth Road) is extremely low (approximately 0.04% of the Critical Habitat, along the southern-most fringe). It traverses the southern edge of this Critical Habitat area, follows existing disturbance and is not in the core mallee habitat where the vast majority of Black-

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			Yellow-throated Miner (hybrids and YTM already present with the transmission line corridor, north and south of).			eared Miners have been recorded (i.e. the northern half of the Critical Habitat Area). In addition, the upper estimate of clearance of non-core mallee habitat would be 0.034 % of the more than 600,000 ha of mallee habitat in the Biosphere Reserve and other properties surrounding the Project. Based on this it is not considered that it clearance would lead to a long-term decrease in the size of a population, reduce the occupancy of the species or significantly fragment the population into two or more populations or adversely affect Critical Habitat for the species. . • F, G, H: Not likely. The main threats to Black-eared Miner are broad-scale habitat loss and/or degradation; or destruction via fire through large tracts of old growth mallee. Clearance within old-growth mallee will be avoided where possible. Further hybridization with Yellow-throated Miner is also a key threat however hybrids and YTM are already present within and north and south of the transmission line corridor If any required clearance for new tracks is done in association with landowners and their requirement for fire-breaks for land management, this could benefit the Black-eared Miner by reducing impacts associated with loss of old-growth habitat through fire. Fire management is identified in the recovery plan for the species, which additional tracks by land owners could facilitate. Introduction of invasive species and disease that would lead to species decline are not considered likely as a result of the project, particularly with implementation of mitigation measures. • I: Not likely. The recovery plan for the species identifies a number of key threats to the species habitat including fire and grazing impact (Baker-Gabb 2001). The proposed measures will not significantly increase the risk of uncontrolled fire. Creation of tracks for fire management (fire prevention) may be favourable for long-term

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						recovery and survival of Black-eared Miners, by reducing the extent of habitat alteration due to fire. Broad recovery goals for the species includes: provision of greater habitat security, controlling hybridization, monitoring trends in numbers and colony quality and supplementing birds isolated colonies in Vic and NSW with birds from SA. The isolated colony in NSW is located in Tarawi Nature Reserve, located north of the study area where the SA / NSW borders meet. The proposed action will avoid clearance where possible and any clearance would be offset, which could include protection of better quality tracts of vegetation. It is not considered that the proposed action will interfere with the recovery of the species as a whole.
Curlew Sandpiper *(Calidris ferruginea*)	CE / MW	Not rated	Possible Occurrence in riverine, wetland, artificial water habitats of or adjacent the transmission line corridor. Potential flyover species. Predominantly migratory birds that are not present all year round, breed outside of Australia. Habitats adjacent the transmission line corridor are not core habitats.	Collisions with transmission lines	Install markers on transmission lines near wetland habitats.	**Significant impacts not considered likely** This species occupies wetlands, which will not be traversed by the proposed alignment. • A: Not Likely. This migratory species visits the survey area after breeding in the northern hemisphere and migrating to the southern hemisphere each year (Carpenter 2002). They migrate at night and are likely to arrive in the survey wetlands from the north during the spring months. This species would therefore be at risk of collision with the proposed transmission lines. However, numbers in the survey area are low hence the risk of collision is also low. In addition, mitigation such as placement of markers along the sections of transmission line close (e.g. within 500 m) of wetlands will reduce the potential mortality rates. • B, C, D, F: Not Likely. The area of occupancy is not likely to be reduced, nor is a population likely to be fragmented, or critical habitat affected, because the proposed alignment does not traverse species preferred habitat (wetlands). Numbers in the survey area are low compared with wetland areas elsewhere in South Australia, indicating that the Riverland Wetlands do not

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						constitute a significant habitat for these species (Carpenter 2002). • E: Not Likely. Breeding is likely to occur on the River Murray, habitat which will not be affected. • G, H: Not Likely. Invasive species or disease are unlikely to be introduced into the Curlew Sandpiper's core habitat (reed beds) because the project footprint avoids this habitat. • I: Not Likely. Recovery actions for this species will focus on enhancement of core habitat, which will not be affected by the project.
Malleefowl *(Leipoa ocellata)*	VU	V	Present No nesting mounds identified to date within TLC. Would move away from area if present, vast areas of suitable habitat present north of the eastern end of TLC and in conservation areas that are avoided. Critical habitat is not limited to the transmission line corridor. Juveniles are vulnerable to fox predation. Ground dwelling bird that is vulnerable to vehicle collision.	Clearance of very small proportion of available mallee habitat. Localised disturbance during construction, affecting a very small proportion of available habitat. Low potential for individuals to be impacted by vehicle collision, given relatively low densities and management controls. Low potential for impacts to nesting mounds within dense mallee given lack of mounds detected to date and micro-siting. Low potential for increase in predators as line follows existing disturbance corridors.	Avoid known nesting mounds. Micro-site to avoid impacts to mounds / breeding pairs (if present). Minimise vegetation clearance that could facilitate additional habitat fragmentation / predation. Implement CEMP/OEMP to manage indirect impacts (e.g. Speed limits, awareness, predator control).	**Significant impacts not considered likely** Malleefowl core habitat is semi-arid to arid zone shrublands and low woodlands dominated by mallee. Chenopod mallee is one of the least preferred Malleefowl habitats. Malleefowl populations are highest in WA and SA, but also occur in NSW and Victoria. Given the large distribution of Malleefowl across Australia, no particular populations have been described as of greater importance for the long-term survival of the species in the Malleefowl Recovery Plan, but there are declines across the range and ongoing objectives to conserve the species (Benshemesh 2007). • A, B, C, D, F: Not considered likely. Records suggest the Malleefowl population in the project area is broadly distributed in this locality. Suitable Malleefowl habitat in the Biosphere Reserve (> 600,000 ha in SA) occurs in this region, and is predominantly north of the proposed alignment. The proposed action may impact a very small percentage of this existing habitat. The Project will result in clearance of approximately 201 ha of potentially suitable habitat along approximately 100 km of alignment[3]. This clearance of non-core mallee habitat is 0.034 % of the approx. 600,000 ha of suitable mallee habitat that will be available primarily north of the

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			> 600,000 ha of more suitable habitat (mallee extent and mosaic of fire history in the Riverland Biosphere Reserve) is avoided.			Project in the e.g. Biosphere reserve and other properties. • Impacts from direct clearance, vehicle and personnel presence, or increased fox presence is not likely to affect the total population size, nor area of occupancy. If new tracks are constructed, this is unlikely to lead to population fragmentation, due to Malleefowl's willingness to traverse and utilize vehicle tracks. Mitigation measures of mound avoidance will ensure minimal impact on the local population. • E: Not likely. The mitigation measures aim to ensure avoidance of active mounds, and hence will minimise interruption of the breeding cycle. Construction program will be short term in individual areas, and once constructed, ongoing disruption will be very minimal (and intermittent at worst) • G: Not likely. Mitigation measures are proposed to control key threats to the species; foxes. • H: Not likely. The proposed actions are unlikely to introduce disease that will lead to the species decline, particularly given the wide distribution of the species across Australia. • I: Not likely. It is acknowledged that there is a National Recovery Plan (Benshemesh 2007) in place for this species, which is constantly updated by the Malleefowl Recovery Team. The recovery plan includes a number of objectives including avoiding clearance of habitat. The proposed action will avoid clearance where possible, particularly around active mounds with suitable buffers and any clearance would be offset, and per the NVC clearance policy. It is not considered that the proposed action will substantially interfere with the recovery of the species.
Painted Honeyeater (*Grantiella picta*)	V	R	Possible Given the limited records within	Clearance of very small proportion of available habitat.	Avoid clearing preferred habitats.	**Significant impacts considered not likely** Nomadic mobile species that occurs at low densities throughout its range. Strongholds for the species and

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			the ESA and its status as a vagrant in South Australia, but presence of habitat its occurrence within the transmission line corridor is considered possible, but unlikely.	Localised disturbance during construction, affecting a very small proportion of available non-critical habitat. Low potential for individuals to be impacted by vehicle collision. Low potential for increase in predators as line follows existing disturbance corridors.	Micro-siting to minimise vegetation clearance that could facilitate additional habitat fragmentation / predation. Implement CEMP/OEMP to manage indirect impacts.	breeding areas occur on the inland slopes of the Great Dividing Range in NSW, Vic and Southern Queensland. There are few records in South Australia, outside of the known range. Occurs in dry open forests and woodlands, strongly associated with mistletoe There are 3 Birdlife records within the ESA (from 2000, 2011, 8-24 km from the alignment). There are 6 Birdlife records 29-32 km north of the transmission line corridor near Gluepot Homestead in mallee vegetation. A: Not likely. Clearance of vegetation associated with the project will not lead to a long-term decrease in the size of an important population of the species. The core population occurs on the inland slopes of the Great Dividing Ranges between Victoria, NSW and Southern Queensland (OEH 2019j, DotE 2015), over 1000km from the study area. Vegetation clearance would be minimised, particularly for habitat suitable to this species. Any impacts to non-core populations or nomadic individuals would be short-term. B: Not likely. Given that the core population is known to occur in the Great Dividing Range of NSW it is unlikely that an important population occurs within the study area. Whilst it is possible the species occurs in or uses habitat in the study area, clearance of any potential habitat is likely to only have short-term impacts on transient populations and is unlikely to reduce the occupancy of an important population. C: Not likely. As above, given that an important population is not known from the study area, it is unlikely that any disturbance for the project or on going operation will fragment an existing important population. D: Not likely. Habitat within the study area is only mapped as 'may occur' and is outside the species core range, while this habitat may provides refuge and retreat for transient / nomadic individuals and populations it is not critical to the survival of the species. E: Not likely. As above important populations are not known to occur in the study area, therefore any vegetation

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						clearance associated with the project is unlikely to disrupt the breeding cycle of the important populations. Core breeding populations are known to occur in the Great Dividing Range of NSW (OEH 2019j). F: Not likely. As above, clearance of potential habitat will be avoided, minimised. It is acknowledged that cumulative clearance of potential and known habitat is likely to be major factor in the previous and future decline of the species (TSSC2015). However it is unlikely that clearance for this project alone will result in the decline of the species, particularly given the stronghold for the species occurs over 1000 km from the study area. G: Not likely. Standard mitigation measures, such as vehicle cleaning and weed hygiene practices will ensure invasive species will not be introduced that will lead to the species decline. H: Not likely. As above, mitigation measures will ensure diseases will not be introduced that will lead to the species decline. I: Not likely. There is no adopted national recovery plan for the species, but one is required. Both Victoria and NSW have recovery initiatives. Key recovery actions relate to clearing suitable habitat, which will be avoided by the project (DotE 2015). Therefore, it is considered that the project would not result in substantial impacts to recovery actions.
Red-lored Whistler *(Pachycephala rufogularis*)	VU	R	Present Known to occur in the Riverland Biosphere Reserve, prefers long-unburnt mallee habitats. Critical habitat is not limited to the transmission line corridor, but	Clearance of very small proportion of available habitat. Localised disturbance during construction, affecting a very small proportion of available non-critical habitat. Low potential for individuals to be impacted by vehicle collision.	Avoid clearing preferred habitats. Micro-siting to minimise vegetation clearance that could facilitate additional habitat fragmentation / predation. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts not considered likely** Occurs in mallee woodland with shrub layer of Broombush and Native Pine (Callitris verrucosa), with occasional patches of Spinifex and emergent mallee. Most abundant in areas with post fire history of 21-40 years. Key threats relate to clearance of habitat and fragmentation of habitat. • A, B, C, E: Not likely. The large tract of mallee that includes the Biosphere Reserve, and through which the alignment traverses, is one of the core habitat areas for Red-lored Whistlers in South Australia. If this species is present along or near the proposed alignment, the limited areas of potential habitat to be removed,

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			occurs 30 km north of the transmission line corridor. Species prefers Spinifex / Mallee shrubland or mallee heath shrubland where canopy is sparse and shrubs at high densities. Observed near Pooginook Conservation Park (the transmission line corridor traverses northern border which abuts Taylorville Station), where occurrence is limited.	Low potential for increase in predators as line follows existing disturbance corridors.		compared with the extensive areas (e.g. > 600,000 ha of Biosphere Reserve) of similar suitable habitat present, means an important population is unlikely to be significantly impacted, or significantly reduce the area of occupancy. i.e. The Project will result in clearance of approximately 200 ha of non-core mallee habitat along approximately 100 km of alignment[3]. This is 0.03% of the more than 600,000 ha of mallee habitat in Riverland Biosphere Reserve and other properties traversed by the proposed alignment). The species' very low population densities also makes the possibility of a significant impact less likely, including less likely to fragment populations. The limited clearance compared to the area of remaining habitat means that fragmentation of populations is unlikely to occur, and hence disruption of breeding cycle of an important population is unlikely to occur. • D, F: The limited clearance compared to the area of remaining habitat means that habitat critical to survival is unlikely to be affected. The proposed clearance is of limited extent compared with the amount of existing suitable habitat. • G,H: Invasive species and diseases are unlikely to result from the proposed action, if appropriate hygiene practices are implemented. • I: It is acknowledged that there is a national recovery plan (DEWLP 2016) for the species. The main threat to habitat is fire and grazing impact. The proposed measures will not increase the risk of fire, therefore will not impact current recovery programs.
Regent Parrot *(Polytelis anthopeplus monarchoides*)	VU	V	Present / possible foraging in mallee habitats 20 km from nesting areas, less frequently north of the transmission line	Clearance of very small proportion of available mallee foraging habitat. Localised disturbance during construction, affecting a very small proportion of available foraging habitat.	Speed limits, awareness. Fauna awareness protocols. Minimise vegetation clearance of foraging habitat and 'treed corridors' between nesting and foraging areas.	**Significant impacts not considered likely** A single population known for the species spans across inland south-eastern Australia, which ranges across the lower Murray-Darling basin region of South Australia, New South Wales and Victoria (Baker-Gabb and Hurley (2011). The project Ecological Study Areas contains the South Australian sub-population, which is well surveyed and well known (Baker-Gabb and Hurley 2011). Core breeding habitat

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			corridor. Nesting habitat is well south of the transmission line corridor (along the River Murray). Juveniles and males may be prone to strike with powerlines when flying to northern mallee areas to forage. Noting that the species usually fly less than five meters above the tree canopy / use treed corridors to move between breeding and foraging localities.	Low potential for individuals to be impacted by vehicle collision, when flying from southern nesting habitats to northern foraging habitats. Low potential for individuals to be impacted by collision with transmission line, when flying from southern nesting habitats to northern foraging habitats, particularly juveniles / males.	Transmission line design with clearance of more than 5 m from tree canopy below. Implement CEMP/OEMP to manage indirect impacts.	includes large hollow bearing trees, along the River Murray, to the south of the alignment. Foraging habitat (within large blocks of intact mallee) are within 5-20 km (usually 5-10 km) of these areas, but it is acknowledged that they will forage more extensively in the non-breeding season. Favoured mallee includes Beaked Red Mallee and Ridge-fruited Mallee. • A, B, C, D, E, F, G, H. Not likely. The alignment traverses foraging habitat, rather than breeding habitat. Because possible clearance of foraging habitat is very limited compared to the amount of potential foraging habitat available, the impacts on population size, habitat availability, and area of occupancy are considered not significant. The Project will result in clearance of approximately 251 ha of potentially suitable habitat along approximately 125 km of alignment[3]. This is 0.042% of the more than 600,000 ha of potentially suitable mallee / woodland habitat in the Biosphere Reserve and other properties traversed by the proposed alignment. It is considered that breeding is not likely to be affected. Similarly, once constructed, the development will not result in ongoing disturbance to this species. It is acknowledged that during and following breeding season primarily males and juvenile creche groups will forage in surrounding mallee, flying close to the canopy; conductors would have at least 5 m of clearance from the tree canopy for safety / operational purposes under typical operating conditions. • I: There is a recovery plan for the species (Baker-Gabb and Hurley (2011). major threats include clearing and degradation of nesting and foraging habitat, disturbance around nesting sites, competition for nesting hollows, deliberate killing of birds, road kill and accidental poisoning. The proposed action is not likely to interfere with any breeding habitat, there will be clearance of some non-core foraging habitat primarily > 20 km from nesting areas, this upper estimate of clearance of non-core foraging habitat is 0.042% of the available habitat in the surrounding Riverland Biosphere Reserve.

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
Threatened Fauna - Reptiles and Amphibians						
Flinders Ranges Worm Lizard (*Aprasia pseudopulchella*)	VU	Not rated	Possible in grassland, woodland, rocky loose soil and litter habitats toward western end of TLC. Habitat in TLC is not critical to the species.	Habitat disturbance Low potential for individuals to be impacted by ground disturbance if present in transmission line corridor. Low potential for increase in predators as line follows existing disturbance corridors. Low potential for temporary barriers to movement within transmission line corridor.	If suitable habitat (grasslands and grassy woodlands) present within proposed infrastructure footprint (roads, towers, transmission line), micro-site to avoid impacts. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts not considered likely** The Energy Connect Transmission line corridor occurs on the edge / outside the known range of where the species may occur. Marginal suitable habitat (if any) occurs at the very western extent. Any potential habitat in this location is not critical to the survival of the species. • A, B, C: Not Likely. The preferred habitat of this species – grassland, grassy woodland with rocky outcrops is considered likely only west of the alignment (within the study area). Such habitat is not present along the alignment itself (within the area bound by its predicted distribution). As such, any population which may be present is unlikely to be a significant or important population. Further the impact of the proposed works on Flinders Ranges Worm Lizard will be restricted to possible minor and localized clearance of habitat. This is unlikely to reduce or fragment populations, reduce area of occupancy, or fragment existing populations. • D: Not Likely. Habitat (if any) along the proposed alignment is likely to be marginal for the Flinders Ranges Worm Lizard (mallee and degraded chenopod shrubland rather than grassy habitats). Hence any impact on potential habitat in the study area would not be affecting habitat critical to this species survival. • E: Not likely. Any populations occurring in the area of the proposed alignment are not likely to be important for this species. Notwithstanding this, breeding cycles are unlikely to be disrupted because the area of habitat disruption would be very minor compared with the surrounding area of similar habitat. • G, H: Not Likely. Weed hygiene measures proposed are likely to prevent introduction of weed species and invasive species. • I: Not likely. The proposed action will not interfere with the recovery of this species; main population and core

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						habitat is the southern Flinders Ranges. A specific recovery plan in not required for this species (SPRAT 2020).
Pygmy Bluetongue (*Tiliqua adelaidensis*)	EN	E	Possible if suitable unploughed grassland habitats are present toward western end of transmission line corridor, however targeted searches for habitat have not detected suitable habitat or species to date. Transmission line corridor is east of all known records. No known habitat in transmission line corridor that is critical to the species or cannot be avoided by micro-siting or spanning if present.	Habitat disturbance Low potential for individuals to be impacted by ground disturbance if present in transmission line corridor. Low potential for increase in predators as line follows existing disturbance corridors. Low potential for temporary barriers to movement within transmission line corridor.	Within the area of predicted occurrence (namely western end of alignment), undertake micro-siting prior to construction. Possible species presence can be detected by spider holes of an appropriate size being present in suitable habitat (unploughed grasslands) within proposed construction footprints. If detected, flag off and avoid disturbance to any populations present via fine tuning alignment or footing locations. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts not considered likely** Preferred habitat is unploughed grassland, commonly *Lomandra* grassland (with spider holes). Has been recorded from the mid-north of South Australia with most records between Burra and Jamestown. Suitable habitat not detected to date, but may be some suitable marginal habitat at the western end, such habitat would not be critical to the species survival. The Area of Occupancy for the species (500km^2) does not overlap with the transmission line corridor. • A, B, C, D, E, F: Not Likely. The potential presence of Pygmy Bluetongues is easily assessed. If spider holes (of appropriate dimensions) are present on unploughed treeless areas, then Pygmy Bluetongues are potentially present. If so, the alignment and siting of towers can be re-routed to avoid potential populations and habitat modification / destruction. Due to probable lack of suitable habitat, and the small area in which suitable habitat is likely to occur, the presence of this species is considered only a very low possibility along the very western end of the alignment. Declines in population, and loss or degradation of habitat are not likely if the mitigation measures are implemented -namely avoidance of any potential habitat areas if detected (at the far western end of the alignment). • G, H: Mitigation measures will prevent the establishment of invasive species and pests that could impact the species • I: Key disturbance activities include ploughing and ripping paddocks and inappropriate grazing regimes (Duffy, Pound and How (2012). Avoidance of potential habitat (if detected during micro-siting), and/or minor clearance associated with the project in potential marginal habitat will not impact the recovery plan for this species

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
Southern Bell Frog (*Litoria raniformis*)	VU	V	Possible Occurrence in riverine / wetland habitats immediately adjacent eastern end of TLC, but will move into adjacent areas during appropriate season / rainfall. Critical habitat is not limited to the transmission line corridor.	Low potential for individuals to be impacted by vehicle collision if present in transmission line corridor during seasonal conditions (e.g. winter, flooding events). Low potential for increase in predators as line follows existing disturbance corridors	Speed limits, awareness, predator control. Implement CEMP/OEMP to manage indirect impacts (e.g. vehicle hygiene measures and quarantine restrictions, to prevent the introduction of invasive species and disease).	**Significant impacts not considered likely** There are 402 recent records (1995-2017) within the ESA, no records in the transmission line corridor and no suitable habitat. Records occur along the River Murray corridor with occasional records from nearby evaporation ponds. However, the species may move through the landscape during suitable weather conditions. • A, B, C, D, E, F: Not likely. Long-term decline in population, reduction in area of occupancy, fragmentation of populations, disrupt breeding cycle, adversely affecting critical habitat are not considered likely provided that no new roads are created where the proposed line traverses in proximity to existing inundation extents. The nearest records to the proposed alignment occur south of the Wentworth-Renmark Road, between Chowilla homestead and the SA-NSW border. The alignment follows an existing high traffic volume road in this location, hence no new roads will be required in the area of most likely occurrence of Southern Bell Frogs. The breeding cycle is not expected to be impacted provided no barriers (namely roads) are established that will prevent the frog's dispersal after breeding. • G,H: Not likely. Invasive species or disease are not likely to be introduced, provided appropriate vehicle hygiene measures are adhered to. • I: Not likely. Recovery actions occur as part of the National Recovery Plan (Clemann and Gillespie 2012) and the Sub-regional species strategy. DSE 2011. Given the mitigation measures proposed, and the proposed action will not affect Southern Bell Frog habitat, substantial impacts to the recovery program are not expected.
Migratory Wetland Birds (Functional Group)						
Actitis hypoleucos (Common	MW		Possible or likely (refer Table 11-11 of EIS).	Low potential for individuals to be impacted by collision	Buffer between corridor and wetland habitats / inundation extents of nearby ephemeral	**Significant impacts considered not likely** • A: Not likely. The proposed alignment does not traverse wetland areas. The majority of migratory waders breed

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
Sandpiper), *Calidris acuminata* (Sharp-tailed Sandpiper), *Calidris melanotos* (Pectoral Sandpiper), *Calidris ruficollis* (Red-necked Stint), *Gallinago hardwickii* (Latham's Snipe), *Tringa nebularia* (Common Greenshank), *Pluvialis fulva* (Pacific Golden Plover), *Tringa glareola* (Wood Sandpiper), *Tringa stagnatilis* (Marsh Sandpiper)			Occurrence in riverine, wetland, artificial water habitats of or adjacent the transmission line corridor. Potential flyover species. Predominantly migratory birds that are not present all year round, breed outside of Australia. Habitats adjacent the transmission line corridor are not core habitats.	with transmission line, if flying from southern wetland habitats to northern wetland habitats.	freshwater swamps and salt lakes. Bird reflectors on transmission line near wetlands in Ramsar site. Implement CEMP/OEMP to manage indirect impacts.	overseas, or in significant areas of wetland or intertidal habitat which will not be influenced by this project. As such, the action will not substantially modify, destroy or isolate an area of important habitat for a migratory wader species. • B: Not likely. Mitigation measures proposed will control the spread of weed species during construction of the project and post construction. Existing service corridors and tracks run through the project area, meaning that new invasive species are unlikely. The project will not impact on important habitat features to migratory wader species, such as inland ephemeral lakes or wetland areas. • C: Not likely. The project is not located in an area where an ecologically significant proportion of a population of migratory species exists. Potential foraging habitat will be avoided. The project will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of migratory species. Carpenter (2002) notes that these species migrate at night and are likely to arrive in the survey area wetlands from the north during the spring months. These species would therefore be at risk of collision with the proposed transmission lines, which will be mitigated by providing reflectors on the line for areas that are in close proximity to wetland habitats (e.g. within 500 m of the indicative 1 in 10 year inundation extent). It is noted that the wetlands in the study area, the Riverland Complex (30,600 ha) and Banrock Station (1,375 ha) are considered nationally important and support a number of wetland dependent bird species (61 species recorded at Banrock Station, and 59 species at the Riverland Complex, reported at up to 23,000 individual waterbirds (migratory shorebirds and other water birds)). In general, however, records of migratory birds, particularly shorebirds are low for the inland Riverland Wetland Complex site compared to other coastal wetland areas elsewhere in South Australia. e.g.

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						at the Adelaide International Bird Sanctuary, which is recognised as being a globally significant site as part of the East-Asian-Australasian Flyway Network, 27,000 shorebirds alone visit between September and March (including 50 migratory species); the Coorong and Lake Alexandrina and Albert Rasmar Wetland Complex (total area of 140,500 ha and also recognised as internationally significant as a shorebird site) supports 307 wetland bird species (92% of the approx. 250,000 waterbirds counted at Living Murray Sites in SA (DEWNR 2013). The Coorong National Park reports maximum counts of 77,494 shorebirds for only 4 of the 307 species that occur there (Birdlife Australia 2019). The above suggests that, while these habitats are used by migratory species the Riverland Wetlands do not constitute critical habitat for these migratory wetland species when they are in the country. In addition, a high level risk assessment of likelihood and consequences suggested that overall risk to migratory species as a whole was low (Refer Appendix I5). Given the low risk to individual species as a whole, mitigation measures that will be proposed (e.g. bird reflectors near wetland areas) and the distance of the transmission line from 1 in 10 year inundation extents (refer EIS 11.4.4 and Appendix I5), significant impacts are considered unlikely.
Apus pacificus (Fork-tail Swift)	MM	Not rated	Possible Overfly species, uses aerial habitats to 1000m. Habitat is not limited to the transmission line corridor or broader region.	Low potential for individuals to be impacted by collision with transmission line, if flocks fly near line.	Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts considered not likely** • A: Not likely. Given the species breeds in eastern Asia, the proposed transmission line is not anticipated to impact the breeding of this species. The species is almost exclusively aerial, feeding on the wing above a variety of habitats (from inland open plains to wooded areas) across large portions of Australia during summer months (DOTE 2015b). Generally flies well above the height of the proposed transmission lines, up to 1000m. The proposed action will therefore not substantially modify, destroy or isolate an area of important habitat for this migratory species.

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
						• B: No. Weed control programs during and post construction would minimise the likelihood of new invasive species being introduced to the project area. In addition, invasive species that are harmful to this species are unknown, given the aerial nature of the species. The broad distribution of this species across multiple continents also makes weed invasions as a result of the project highly unlikely to result in significant impacts to this species. • C: Not likely. Given the species is a non-breeding migrant to Australia, the action, will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of this migratory species.
Caspian Tern (*Hydroprogne caspia*) / Crested Tern (*Thalasseus bergii*)	MM	Not Rated	Likely / possible foraging above in riverine / wetland habitats adjacent TLC, potential flyover species on route to and from wetland habitats. Evidence of tern deaths attributable to powerline bird strike, but mainly coastal species (Crested Tern) less likely to occur. Wetland review considered the overall risk to these species as low (based on likelihood and	Moderate potential for low numbers of individuals to be impacted by collision with transmission line, if flying from southern wetland habitats to northern wetland habitats.	Buffer between corridor and wetland habitats. Bird reflectors on transmission line near wetlands in Ramsar site. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts considered not likely** • A: Not likely. Given these species have global representation and breed in the northern hemisphere, the proposed transmission line is not anticipated to impact the breeding of these species. Core habitats are coastal areas, but will utilize inland wetland habitats. The proposed action will therefore not substantially modify, destroy or isolate an area of important habitat for this migratory species. • B: No. Weed control programs during and post construction would minimise the likelihood of new invasive species being introduced to the project area. In addition, invasive species that are harmful to this species are unknown, given the aerial nature of the species. The broad distribution of this species across multiple continents also makes weed invasions as a result of the project highly unlikely to result in significant impacts to this species. • C: Not likely. Given these species are non-breeding migrant to Australia, the action, will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of these migratory species.

Species name	EPBC Act[1]	NPW Act[2]	Likelihood of occurrence	Expected Impact*	Mitigation Measure	Significant Impact Assessment (following mitigations) against significant impact criteria (refer Table 1)
			consequence factors).			
Osprey (*Pandion haliaetus)*	MW	E	Possible foraging in riverine / wetland habitats adjacent TLC, or nesting in towers once established. Critical habitat is not limited to the transmission line corridor. Core populations and breeding areas occur along the coastline of Australia, greater numbers to the north of Australia.	Low potential for individuals to be impacted by collision with transmission line, if flying from southern wetland habitats to northern wetland habitats. Low potential for individuals to be impacted by collision with transmission line if nesting on towers.	Buffer between corridor and wetland habitats. Bird reflectors on transmission line near wetlands in Ramsar site. Regular tower monitoring for nest development / removal. Implement CEMP/OEMP to manage indirect impacts.	**Significant impacts considered not likely** Mostly occur in coastal habitats, but will travel inland along major rivers. Require extensive areas of open fresh or saline water for foraging. Occasionally construct nests on artificial structures such as towers, but primarily near water habitats. A: Not likely. The proposed alignment avoids impacts to water habitats which may represent occasional foraging for this species. The majority of Osprey pairs breed in coastal areas which will not be influenced by this project. As such, the action will not substantially modify, destroy or isolate an area of important habitat for this migratory species. B: Not likely. Mitigation measures proposed will control the spread of weed species during construction of the project and post construction. Existing service corridors and tracks run through the project area, meaning that new invasive species are unlikely. The project will not impact on important habitat features to this migratory species, such as large rivers, lagoons and lakes. . C: Not likely. The project is not located in an area where a known ecologically significant proportion of a population of this migratory species exists. No clearance of potential foraging habitat will occur. Suitable foraging habitat occurs in the Ramsar area and riverine habitats south of the transmission line corridor. Reflectors (to avoid collision) will be deployed on the power line in proximity to inundation extents. Towers will be monitored for nest development and removal / relocation, if required. The project will not seriously disrupt the life cycle of an ecologically significant proportion of the populations of this migratory species.

[1] *Environment Protection and Biodiversity Conservation Act 1999* Status: Critically Endangered (CE); Endangered (EN), Vulnerable (VU); Migratory Marine (MM); Migratory Terrestrial (MT); Migratory Wetland (MW);
[2] South Australian *National Parks and Wildlife Act 1972* Status: Endangered (E), Rare (R), Vulnerable (V).
[3] Estimates of vegetation clearance are based on upper estimates for land disturbance of 2 ha per km. The length of potentially suitable habitat along the transmission line corridor is based on mapping of broad habitat types along the corridor (see Section 11.3.4 of the EIS).

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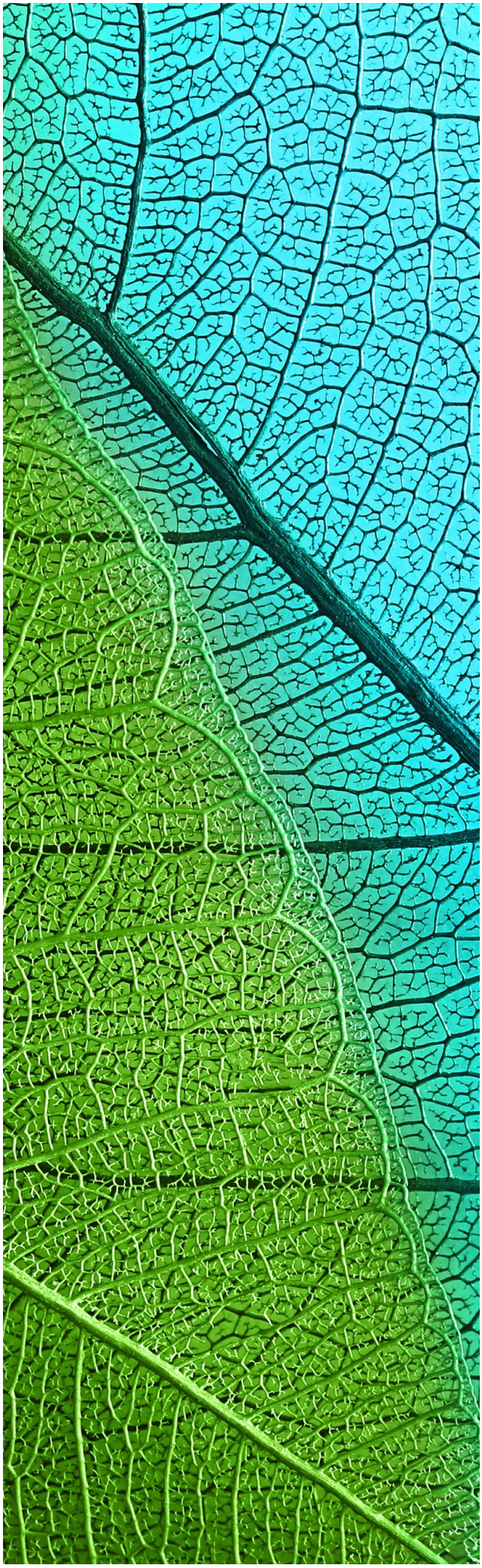
EIS Volume 2 Appendix I-4

Threatened Mallee Birds Assessment

JBS&G

project energy connect



Project Energy Connect: Threatened Mallee Birds

Prepared for JBS&G and Project EnergyConnect

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1. Executive summary

JBS&G Australia Pty Ltd on behalf of ElectraNet Pty Ltd engaged Nature Advisory Pty Ltd to undertake targeted surveys for threatened mallee bird species listed under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) over a 205 kilometre proposed power transmission line alignment between Robertstown, South Australia (SA) and the New South Wales (NSW) border at Chowilla Regional Reserve. The transmission line will comprise the South Australian component of Project EnergyConnect, a new high-capacity electricity interconnector linking the SA and NSW electricity grids between Robertstown and Wagga Wagga, NSW.

This investigation was commissioned to provide information on the status in the study area of four threatened bird species listed under the EPBC Act and one species that is likely to be added to the EPBC Act threatened species list in the near future: the mallee race of the Striated Grasswren.

Common Name	Scientific Name	Status
Black-eared Miner	*Manorina melanotis*	Endangered: EPBC Act
Malleefowl	*Leipoa ocellata*	Vulnerable: EPBC Act
Striated Grasswren	*Amytornis striatus*	Considered endangered[1]
Red-lored Whistler	*Pachycephala rufogularis*	Vulnerable: EPBC Act
Regent Parrot	*Polytelis anthopeplus*	Vulnerable: EPBC Act

Field surveys were undertaken in late October 2019 during the bird breeding season using transect-based visual and aural survey methods involving observers experienced in the identification of mallee threatened bird species. A total of 56 sites were surveyed and 112 kilometres of transect (2 km per site) were surveyed in two separate layouts: alternate grid and linear. Observers walked transects and watched for the key threatened species, as well as listening for their calls. At the end of each walk, call-playback was used to elicit a response from Black-eared Miner, Red-lored Whistler and Striated Grasswren.

The 56 survey sites were located along the alignment that was proposed in October 2019. This has since been modified on Hawks Nest Station following ongoing consultation with the Department of Environment and Water (DEW) to avoid areas of higher quality mallee bird habitat. Although undertaken during the breeding season, the surveys coincided with a severe, long-term drought that suppressed breeding activity due to a lack of food resources. Therefore, call-playback was not considered to be particularly effective this spring and more effort was devoted to listening for contact and alarm calls during transect surveys.

A review of existing information revealed that most records of the species concerned occurred as follows:

[1] For this report, the latest taxonomic revision and nomeclature (Black, et al. 2020) has been adopted.

- Black-eared Miner – in areas of old-growth mallee unburnt for at least 15 years and often for longer (e.g. 40 years or more), the vast majority of previous records were located further north of the alignment and some located in the central and eastern parts of the alignment.
- Malleefowl – in most areas of mallee vegetation of varying age.
- Striated Grasswren – few recent records, suggesting a significant decline; once widespread in the central part of the alignment.
- Red-lored Whistler – in mature, shrubby mallee in Pooginook Conservation Park, Taylorville Station and Calperum Station.
- Regent Parrot – most records are from the River Red Gum breeding and roosting areas along the Murray River and its floodplain but it forages out into mallee woodland and shrubland to a distance of 20 kilometres where continuous vegetated links provide access.

Of the target species, only two were observed during the field surveys: Black-eared Miner (seven sites) and Red-lored Whistler (one site). In addition, the footprints of Malleefowl were recorded at one site. Table 2 presents the results of the targeted survey and Figures 7–11 show the locations of the observations, together with existing records. The Regent Parrot and Striated Grasswren were not recorded during targeted surveys.

Impacts of the proposed transmission line relate to both construction and operations periods and have been assessed systematically in accordance with the project's overall impact assessment framework. Most impacts were considered acceptable with and could be predicted with a medium to high level of certainty.

An outbreak of fire has the potential for catastrophic consequences as the mallee threatened birds concerned depend on old-growth mallee vegetation and are very vulnerable to fire. The development and strict implementation of a fire prevention and control plan for the project is considered essential if this key residual risk of the project is to be controlled effectively.

2. Introduction

JBS&G Australia Pty Ltd on behalf of ElectraNet Pty Ltd engaged Nature Advisory Pty Ltd to undertake targeted surveys for threatened mallee bird species listed under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) and the South Australian *National Parks and Wildlife Act 1972* (NPW Act) over a 205 kilometer proposed power transmission line alignment between Robertstown, South Australia (SA) and the New South Wales (NSW) border at Chowilla Regional Reserve. The transmission line will comprise the proposed Project EnergyConnect, a new high-capacity electricity interconnector linking the SA and NSW electricity grids between Robertstown and Wagga Wagga, NSW.

This investigation was commissioned to provide information on the status in the study area of four threatened bird species listed under the EPBC Act and one species that is likely to be added to the EPBC Act threatened species list in the near future: the mallee race of the Striated Grasswren.

- Black-eared Miner *Manorina melanotis* (Endangered: EPBC Act)
- Malleefowl *Leipoa ocellata* (Vulnerable: EPBC Act)
- Striated Grasswren *Amytornis striatus striatus* (considered endangered)
- Red-lored Whistler *Pachycephala rufogularis* (Vulnerable: EPBC Act)
- Regent Parrot *Polytelis anthopeplus* (Vulnerable: EPBC Act).

Initially, two additional species were considered for survey: the Mallee Emu-wren *Stipiturus mallee* and Western Whipbird *Psophodes nigrogularis leucogaster*. However, review of all available data strongly indicated that neither of these species occurred in the vicinity of the study area so these were not actively surveyed during the current investigation.

Specifically, the scope of the investigation included a terrestrial avifauna survey campaign for the Project (in South Australia only) across the broad route alignment proposed in October 2019, with particular focus on the alignment through Taylorville, Hawks Nest and Calperum Stations, targeting threatened mallee birds.

This report presents the findings of the assessment, identifies issues and provides recommendations and mitigation options. It is divided into the sections described below.

Section 3 presents the biology of each targeted species.

Section 4 presents the sources of information and methods of the surveys.

Section 5 presents the results of the assessment.

Section 6 presents the impact assessments.

This investigation was undertaken by a team from Nature Advisory, comprising, Peter Lansley (Senior Ecologist), Curtis Doughty (Senior Zoologist) and Brett Lane (Principal Consultant).

This investigation has benefited from consultation and input from Dean Ingwersen and Andrew Hunter of Birdlife Australia and Chris Hedger of the Department of Environment and Water (DEW) in the South Australian Government. We are very grateful for their advice.

3. Species biology

3.1. Black-eared Miner

3.1.1. Description

A medium sized, grey honeyeater with a black facial mask, grey rump and tail the same colour as the back; a yellow bill and small patch of skin behind the eye; a dark grey sub-moustachial stripe contrasting with a grey chin; fine mottling on the breast; and a white belly. Juveniles are browner (BirdLife International 2019). Identification can be difficult given that many colonies in the Murray Mallee contain intermediate-plumaged birds due to hybridisation with invading Yellow-throated Miners. Identification criteria have been presented by Joseph (1986), Starks (1987), McLaughlin (1993) and Ingwersen (2008), many of whom warn that use of popular field guides for identification of this taxon could result in misidentifications. The criteria presented by Ingwersen (2008) were used to identify any miners observed as these are optimal for field use and does not require examination of birds in the hand.

3.1.2. Habitat

The preferred habitat of the Black-eared Miner comprises dense multi-stemmed eucalypt formations known as 'mallee', growing to *c*. 10 metres, either with spinifex *Triodia* and or a chenopod shrub (saltbush or bluebush) ground layer. It prefers extensive, contiguous areas of 'old-growth' mallee, unburnt for a minimum of 45 years (McLaughlin 1993, Clarke *et al*. 2005) and not degraded by recent heavy grazing pressure (Clarke *et al*. 2005). However, this species is not restricted to 'old-growth' mallee (Silveira 1995).

3.1.3. Distribution

The Black-eared Miner occurs in the Murray Mallee around the junctions of the SA, NSW and Victorian (Vic.) borders (Figure 1). It is now mainly restricted to Riverland Biosphere Reserve, SA, and a much smaller and phenotypically lower quality population in Murray Sunset National Park, Vic. and a few birds in Annuello Flora and Fauna Reserve, Vic. NSW populations (formerly in Scotia and Tarawi Nature Reserves) are currently considered extinct (Clarke *et al*. 2005, BirdLife International 2019).

3.1.4. Threats

The species is subject to two main threats: loss and modification of suitable habitat (McLaughlin 1992) and interbreeding and displacement by the 'dominant' Yellow-throated Miner *Manorina flavigula*. With the reduction in availability of suitable habitat, this habitat modification has favoured the Yellow-throated Miner which has expanded its range and moved into degraded mallee habitats where the two species were once separated by occupying distinct habitats (McLaughlin 1992). This alteration in habitats has resulted in the two species interbreeding and in large-scale introgressive hybridisation between the Black-eared Miner and Yellow-throated Miner. As a result, Black-eared Miner genes are being lost (McLaughlin 1993).

3.1.5. Legislative protection

The Black-eared Miner is listed as Endangered under South Australia*'s National Parks and Wildlife Act 1972* (NPW Act) (as a subspecies of Yellow-throated Miner, i.e. *Manorina flavigula melanotis*) and under the EPBC Act. It is listed as Critically Endangered in Victoria (DSE 2013) and New South Wales *Biodiversity Conservation Act 2016* (BC Act).

It is noteworthy that there is ongoing debate as to whether the Black-eared Miner is a full species (Christidis and Boles 2008, Menkhorst *et al*. 2017, HBW & BirdLife International 2018, Clements *et al*. 2019, Gill and Donsker 2019) or a subspecies of the widespread Yellow-throated Miner (e.g. Silveira 1995, Schodde and Mason 1999). Nonetheless the taxon is listed as Endangered under South Australian legislation (Appendix 7 of NPW Act schedules).

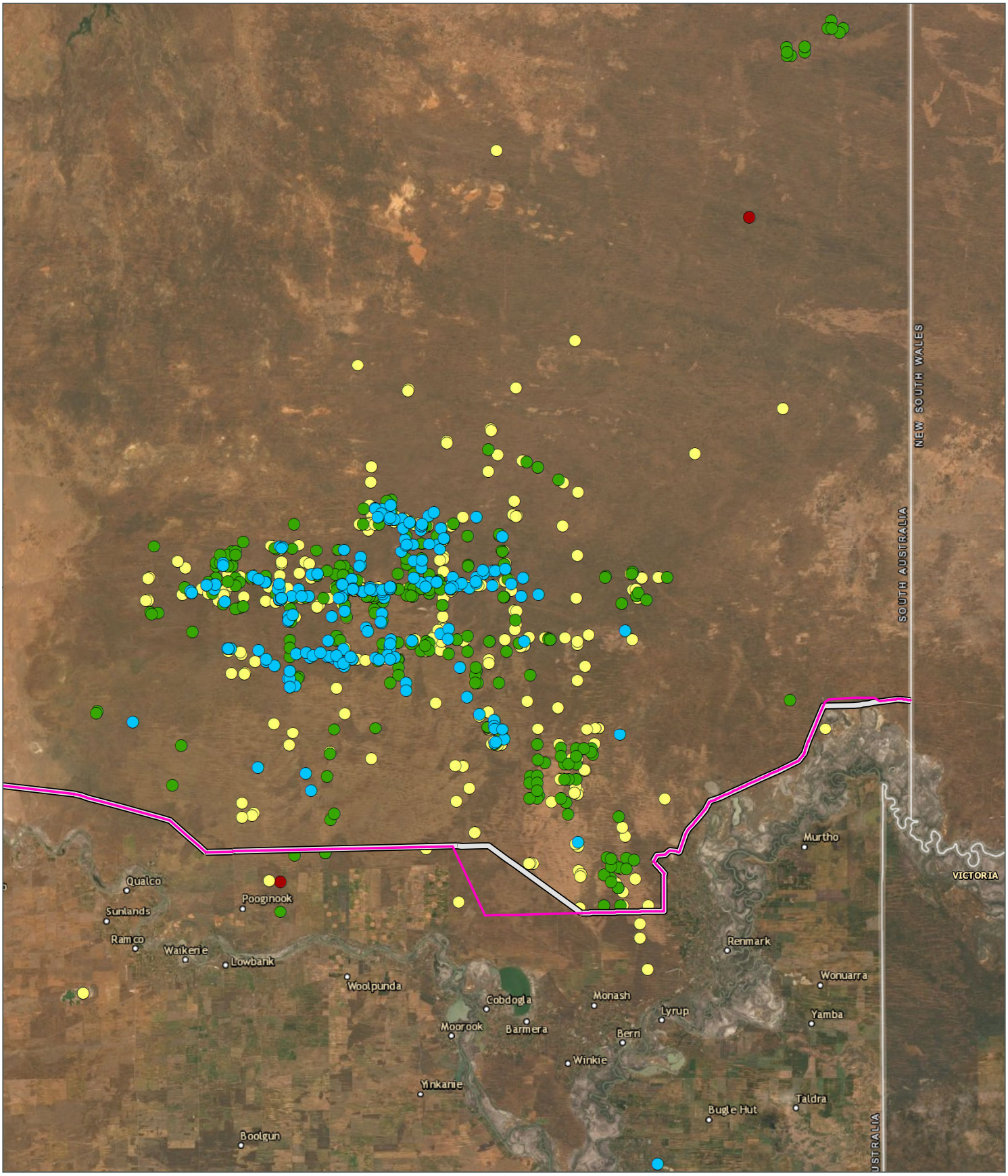

Figure 1: Black-eared Miner records

Project: Project EnergyConnect **Client**: JBS and G Australia **Date**: 04/12/2020

Current proposed alignment

Proposed alignment October 2019

Year recorded

- 2011-2020
- 2001-2010
- 1991-2000
- 1977-1990

N

Metres

0 10,000

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3.2. Malleefowl

3.2.1. Description

The Malleefowl is a large, ground-dwelling, mound-nesting bird (megapode), nearly as large as a turkey. It is grey with brown and white barring and mottling and a black line on the throat.

3.2.2. Habitat

It occurs in multi-stemmed eucalypt formations known as 'mallee'. It occupies a variety of mallee types, from dense heath-mallee to spinifex-dominated mallee.

3.2.3. Distribution

It occurs in southern Australia from near Shark Bay in Western Australia (WA), across SA excluding the Nullarbor Plain and Lake Eyre Basin, through to north-west Victoria and central New South Wales.

3.2.4. Threats

Habitat loss through clearing, fragmentation and fires represent then greatest threats to this species. It is also adversely affected by degradation of habitat from grazing by feral and domestic herbivores (e.g. cattle, sheep, goats) and in some areas from native species (i.e. kangaroos). Predation of young and adults by introduced predators, such as foxes and cats, is also of concern (Garnett *et al.* 2011).

3.2.5. Legislative protection

The Malleefowl is listed as Vulnerable under South Australia*'s* NPW Act and federally under the EPBC Act. It is listed as Endangered in Victoria (DSE, 2013) and in NSW under the BC Act.

3.3. Striated Grasswren

3.3.1. Description

The Striated Grasswren is a small, rufous-brown passerine with fine white streaks on a darker greyish head, and on the back and wings; it has a black moustachial streak; and mostly white underparts with a buff tinge on the flanks. It usually carries its long tail cocked and is often seen running between clumps of spinifex or dense shrubs in a mouse-like fashion. It can be detected by its high-pitched contact calls, and liquid trilling notes, usually uttered in the spring breeding season.

3.3.2. Habitat

The Striated Grasswren inhabits multi-stemmed mallee eucalypt woodlands, growing on sandplain dune systems in the semi-arid zone, almost always with a spinifex ground layer. It occasionally occurs in heathland dominated by *Banksia* and *Hakea*, and mallee shrubland with dense *Beyeria opaca* from which spinifex is absent (Garnett *et al*. 2011).

3.3.3. Distribution

The Striated Grasswren occurs in the Murray Mallee near the junction of SA, NSW and Vic. borders, extending patchily into central NSW. Other species of the former Striated Grasswren (Black et al. 2020) occur from Eyre Peninsula across western SA into south-western Northern Territory (NT) and the western sandy deserts and Goldfields regions of WA (now known as the Rufous Grasswren), a separate sub-species of which occurs in rocky habitats of the Pilbara in WA. An isolated population occurs in south-western Queensland (Opalton Grasswren).

In this study we have treated the Striated Grasswren as a full species separate from all other forms of related Grasswrens in accordance with the revisions of Black et al. (2020).

3.3.4. Threats

The prime threat to the Striated Grasswren is habitat loss through fires and clearance of mallee vegetation for agriculture. Degradation of habitat from grazing may be an issue in some areas. Introduced predators (i.e. foxes and cats) could have some impact but the level of impact is uncertain (Garnett *et al*. 2011).

3.3.5. Legislative protection

The Striated Grasswren is listed as Rare under the SA NPW Act. It is listed as Near Threatened in Vic. (DSE, 2013) and Vulnerable in NSW (BC Act). It is not listed federally under the EPBC Act at this stage but is likely to be added in the near future.

3.4. Red-lored Whistler

3.4.1. Description

The Red-lored Whistler is a greyish-brown whistler with bright rufous lores and throat, and a buffy-rufous belly (male); the female is duller with buff colours where the male is rufous.

3.4.2. Habitat

The Red-lored Whistler occurs in dense, older-growth, heath-mallee, particularly where Broombush *Melaleuca uncinata* and/or other shrubs occur at high densities in the lower strata, Spinifex *Triodia*-mallee (particularly in SA), mallee with dense shrubby understorey and Callitris-mallee associations (Woinarski 1987, Menkhorst *et al*. 2017). South of the Murray River, it is found to prefer areas that support earlier successional stages of vegetation (5 to 30 years) post-fire (Woinarski 1987).

3.4.3. Distribution

The Red-lored Whistler can be found in the Murray Mallee surrounding the border region of SA, NSW and Vic Isolated populations occur in the northern Eyre Peninsula, SA, and in the vicinity of Round Hill Nature Reserve, NSW. The largest remaining populations are in the Riverland Biosphere reserve, SA and Murray-Sunset National Park, Vic.

3.4.4. Threats

The prime threat to the Red-lored Whistler is habitat loss or alteration through fires, since the species prefers long-unburnt mallee. Degradation of habitat from grazing (stock, goats, rabbits) may impact

some areas as does Broombush *Melaleuca uncinata* cutting, where still permitted. Predation by introduced predators such as foxes is another threat (Garnett *et al*. 2011).

3.4.5. Legislative protection

The Red-lored Whistler is listed as Rare in SA NPW Act and Vulnerable federally under the EPBC Act. It is listed as Endangered in Victoria (DSE, 2013) and Critically Endangered in NSW under the BC Act.

3.5. Regent Parrot

3.5.1. Description

The Regent Parrot is a large, long-tailed parrot with yellow head, shoulders, rump and underparts, green back and dark wings and tail with red patches on the inner-wing (male); the female is duller and greener; both sexes have a red bill.

3.5.2. Habitat

The Regent Parrot breeds in riparian River Red-gum woodlands along inland watercourses. It moves in small flocks and family parties through wooded corridors up to 20 kilometres to feed in mallee (multi-stemmed eucalypt) associations (Baker-Gabb and Hurley 2011).

3.5.3. Distribution

The Regent Parrot of the eastern subspecies *monarchoides* occurs in the Murray Mallee region surrounding the junction of the SA, NSW and Vic. borders. The species also occurs in the south-west WA wheatbelt, (nominate form *anthopeplus*, not considered further here).

3.5.4. Threats

Primarily threats to the species are habitat loss, of both breeding and foraging habitat and of wooded corridors linking the two, through clearance, fragmentation and timber extraction (e.g. River Red-gum *Eucalyptus camaldulensis*, which are used for breeding). Its habitat can be degraded by grazing by stock and feral herbivores. It is also subject to increasing competition with other hollow-nesting birds that have benefitted from expansion of agriculture such as Common Starling *Sturnus vulgaris*, Little Corella *Cacatua sanguinea* and Sulphur-crested cockatoo *Cacatua galerita* and introduced European Honey-bees. Waterlogging and subsequent collapse of riparian trees used for breeding, ingestion of poisoned grain, vehicular road-kill, illegal trapping for aviculture and deliberate shooting by farmers for crop protection are other threats (Garnett *et al*. 2011).

3.5.5. Legislative protection

The eastern subspecies of the Regent Parrot is listed as Vulnerable in SA under NPW Act, in Victoria (DSE, 2013), and federally under the EPBC Act. It is listed as Endangered in NSW under the BC Act.

4. Existing information and methods

4.1. Existing information

4.1.1. Existing reporting and documentation

The existing documentation below, relating to the study area was reviewed.

- EPBC Act Protected Matters Significant Impact Assessment – Project EnergyConnect Transmission Line, South Australia, April 2019, Jacobs, Adelaide SA.
- Preliminary Ecological Constraints Assessment – Energy Connect, February 2019, Jacobs, Adelaide, SA.

In addition to the above-mentioned reporting, Chris Hedger from the DEW of the South Australian Government kindly provided his knowledge of the target species in the study area. The DEW also provided spatial data with some notes on the target species across part of the project area for use in developing the field study.

4.1.2. Listed matters

Existing mallee bird species records and information on the potential occurrence of listed matters was obtained from an area termed the 'search region', defined for this assessment as an area within 10 kilometres from the approximate centre line of the proposed October 2019 alignment.

A list of the bird species recorded in the search region was obtained from Birdata, a database administered by BirdLife Australia and the Biological databases of South Australia, a public database held by the South Australian DEW.

The online EPBC Act Protected Matters Search Tool (DEE 2019) was consulted to determine whether nationally listed species or communities potentially occurred in the search region based on habitat modelling.

An initial review of the distribution of the target species shows that neither Mallee Emu-wren nor Western Whipbird have been recorded near the Project area.

The Mallee Emu-wren is now restricted to the Victorian Mallee and a small, reintroduced population in Ngarkat Conservation Park, in SA, well south of the Murray River. Historically, it was more widespread (Atlas of Living Australia, 2019) but not north of the Murray or in the Project area.

The nearest occurrence of the Western Whipbird is in Billiatt and Ngarkat Conservation Parks south of the Murray River, a number of other sites west of there and a site to the north-west of the western end of the Project area (Birdlife Australia 2019). None have been recorded in the Project area.

Based on this, the Mallee Emu-wren and Western Whipbird have not been considered further. That said, a watching brief was maintained during surveys for these species and other key mallee species and any occurrences would have been recorded and documented.

During discussions with BirdLife Australia, it was recommended that the survey also target the Striated Grasswren as BirdLife's soon-to-be published updated review of bird status indicated it has qualified as 'Endangered'.

Therefore, the five targeted species for this survey are listed below.

- Black-eared Miner
- Malleefowl
- Striated Grasswren
- Red-lored Whistler
- Regent Parrot.

4.2. Field methodology

Before the field methodology was finalised, a draft was prepared and circulated to key stakeholders, in particular Birdlife Australia (Dean Ingwersen and Andrew Hunter) and the South Australian DEW (Chris Hedger). This was reviewed at a meeting of these stakeholders during which the method was refined to reflect their recent observations of survey conditions in the area and their understanding of the species and previous survey protocols. This input is gratefully acknowledged.

The targeted surveys were undertaken from 22nd to 29th October 2019 in mallee habitats in the proposed October 2019 alignment. The current proposed alignment has subsequently been altered to avoid important habitat for the Black-eared Miner at Hawks Nest Station. Care was taken to conduct surveys in areas with apparently high-quality mallee (not recently burnt, i.e. not in the past 15 years), based on aerial photograph interpretation and expected habitat suitability provided by DEW for the five threatened species. A lower proportion of surveys were conducted in areas lacking mallee or in the more degraded (grazed) areas west of Taylorville Station; these were deemed less suitable for the targeted threatened mallee birds.

Two types of surveys were used to ensure maximum coverage of habitats in the vicinity of the proposed October 2019 alignment. These were (a) four, 500-metre square grid transects and (b) 2,000-metre, straight-line transects. The locations of the starting points of the surveys are presented in Figures 2–6. A total of 56 survey sites (112 kilometres of transect) were surveyed within the easternmost section of the proposed October 2019 alignment as this is where mallee habitat was present.

At each survey site, the vegetation type, structure and habitat quality were noted. Habitat components, considered important in influencing the distribution of the threatened mallee birds, were assessed for each survey site.

For Regent Parrot and Malleefowl, surveying was done on an ad hoc basis, hoping to observe or hear these species during the course of the transect surveys. It was considered that call playback was not effective for either of these two species. The Regent Parrot has an obvious harsh contact call and is fairly obvious in flight. The Malleefowl is probably best surveyed by air, searching for its nesting mounds. Searching for Malleefowl nesting mounds by drone was envisaged for the current

survey but Lidar detection is now believed to be a more effective technique. Footprints of the Malleefowl were searched for during the current survey.

4.2.1. Square grid transects

The square grid transects method is described below.

This method allows for sampling of, on-average, two swales and two dune crests (which average about 250 m apart) per transect, therefore maximising the habitat variability in each 2,000-metre survey and hence the chances of detecting the targeted species.

- Transects were 500 metres in length
- Transects were usually oriented north-south and/or perpendicular to the direction of parallel dunes to sample the range of mallee vegetation structure across this habitat gradient
- Transects were located to maximise coverage along the proposed powerline route; given the number of replicates, this ensured representative sampling of habitat
- Transects were surveyed from half an hour after dawn to midday, longer when temperatures remained below 30 degrees celsius
- Two observers quietly walked grid transects, each walking four, 500-metre transects forming a square grid, usually on opposite sides of the transect (non-overlapping); totalling 2,000 metres each
- The same two experienced mallee birders undertook all surveys
- All birds seen or heard within approximately 200 metres of each transect line were recorded
- At the end of each transect, call playback was used (for two minutes) to elicit a response from three target species: Black-eared Miner, Red-lored Whistler and Striated Grasswren; five minutes of listening was included
- Once found, as a priority, the number of Black-eared Miner found were determined and
- Where possible, as many miners in the group as possible were identified and their hybrid status determined and recorded as per details in McLaughlin (1993) and Ingwersen (2008).

4.2.2. Straight-line transects

The 2,000-metre line transects method is described below.

Line transects comprised four 500-metre transects laid out in a straight line (i.e. totalling a 2,000 metre transect). These were used in areas where there was a straight-line section of the proposed October 2019 alignment adjacent to a vehicular access track. Observers alternated with two 500-metre transects each, allowing for efficient use of time and vehicles with no backtracking. All birds seen or heard within approximately 200 metres of the transect line were recorded.

4.3. Limitations of field assessment

The timing of the threatened mallee bird survey, its duration and the weather conditions under which surveying was undertaken, was considered suitable for detecting the targeted species.

The proposed October 2019 alignment has been modified on Hawks Nest Station subsequent to the survey, following ongoing consultation by ElectraNet with DEW (Chris Hedger) to avoid areas of higher quality mallee bird habitat that were identified by DEW (Figure 4). Minor changes were also made at the eastern and western ends (Figure 6) of the proposed October 2019 alignment.

The results of the field assessment cover the alignment that was current at the time of the survey, as this represents useful data and commentary is provided where appropriate on the proposed alignment presented in the Environmental Impact Statement (EIS).

The weather conditions were fine throughout (although there was some overnight rain nearby on the morning of 26th October) and temperatures varied from overnight lows of 3° to 18° C and daily maxima varied between 22° and 39° C. All surveys were undertaken between dawn and midday and temperatures did not reach greater than 30° C when undertaking surveys. Generally light winds prevailed throughout. Conditions were mostly sunny or partly so, except two days when it was mostly cloudy.

During the time of the survey the area had been experience lower than average rainfall and drought conditions. Some bird species were not breeding as they usually would during usual spring conditions. This reduced their likely responsiveness to call-playback so during transect walking, a strong emphasis was placed on listening for contact and alarm calls of the target species.

Wherever appropriate, a precautionary approach has been adopted in the discussion of implications. That is, where insufficient evidence is available on the occurrence or likelihood of occurrence of a species, it is assumed that it could be in an area of habitat, if suitable, and the implications under legislation and policy are considered accordingly.

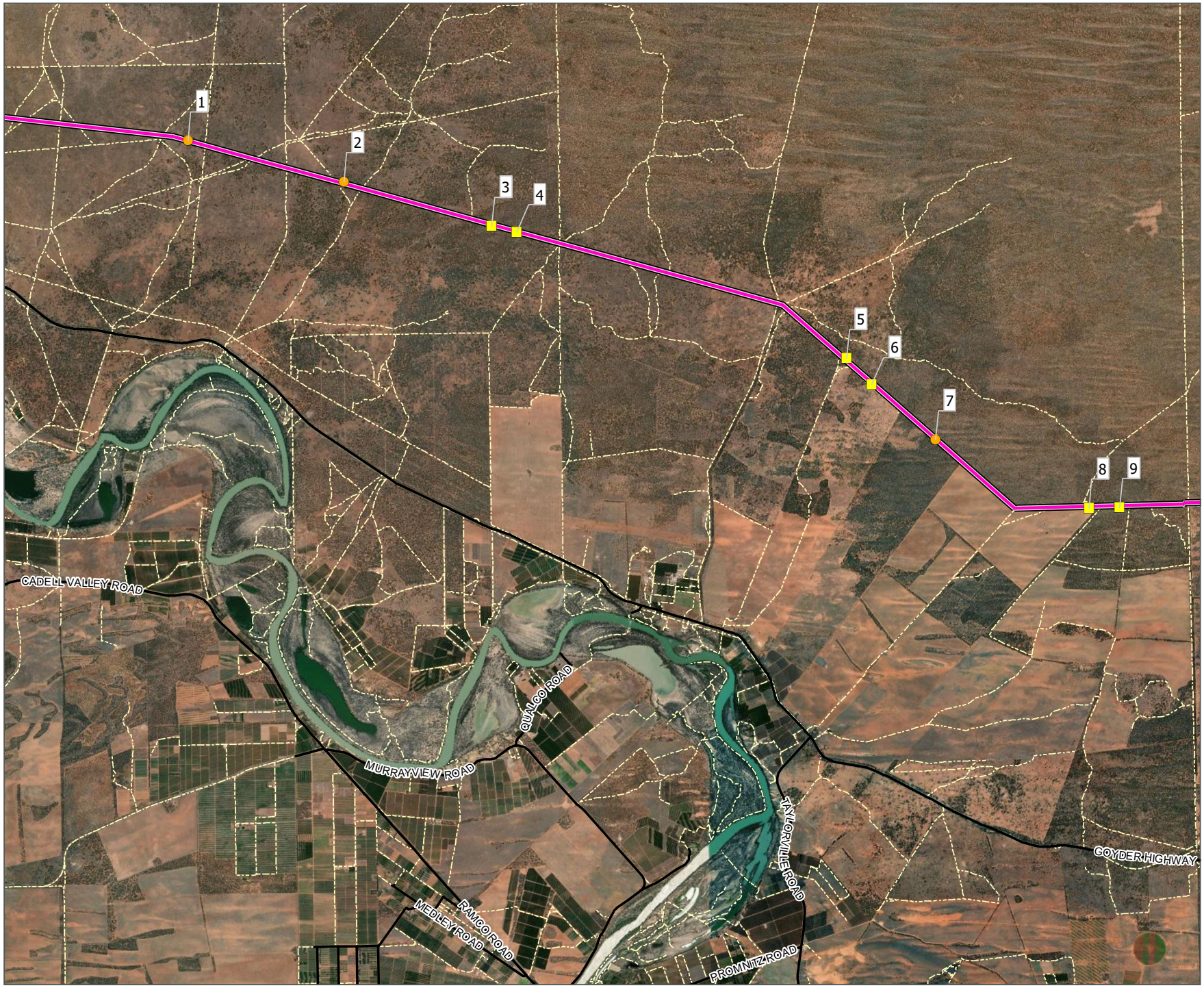
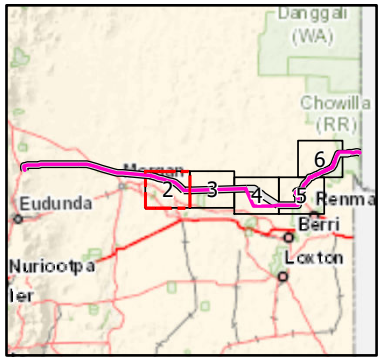


Figure 2: Survey locations and types

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

- Current proposed alignment
- Proposed alignment October 2019
- 2km transect line
- 500m x 500m survey grid



N

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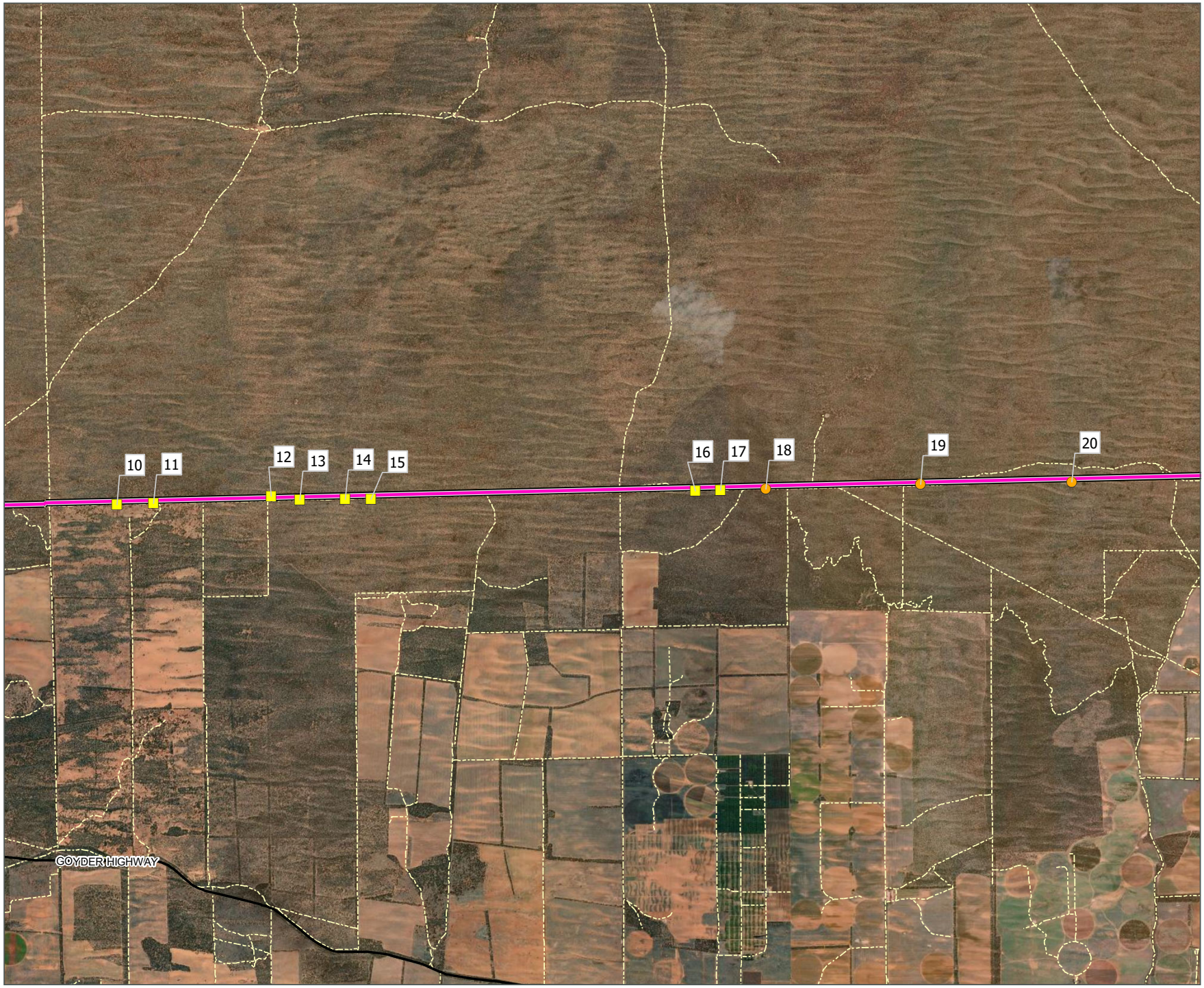
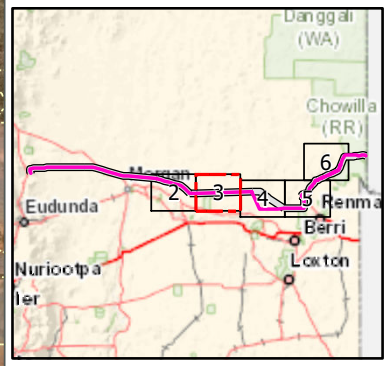


Figure 3: Survey locations and types

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

- Current proposed alignment
- Proposed alignment October 2019
- 2km transect line
- 500m x 500m survey grid



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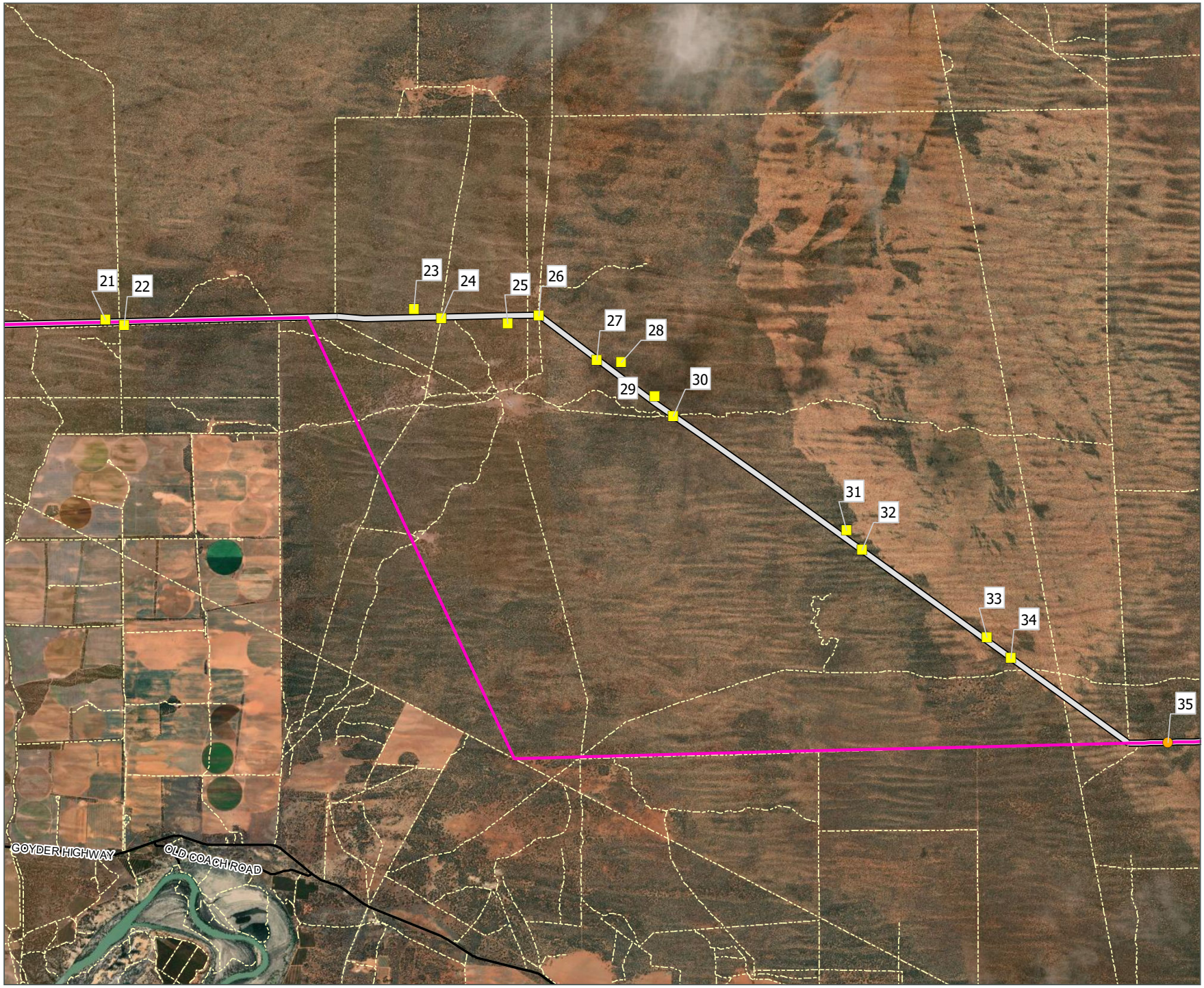

Figure 4: Survey locations and types

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

- Current proposed alignment
- Proposed alignment October 2019
- 2km transect line
- 500m x 500m survey grid

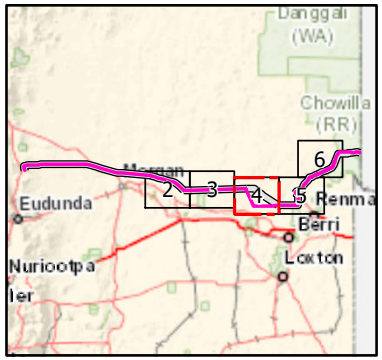

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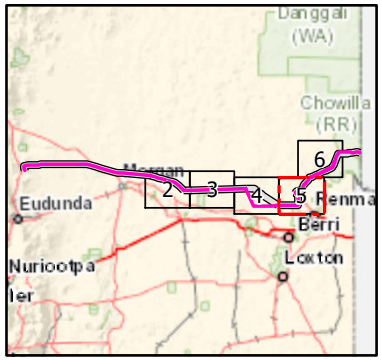
Figure 5: Survey locations and types

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

- Current proposed alignment
- Proposed alignment October 2019
- 2km transect line
- 500m x 500m survey grid



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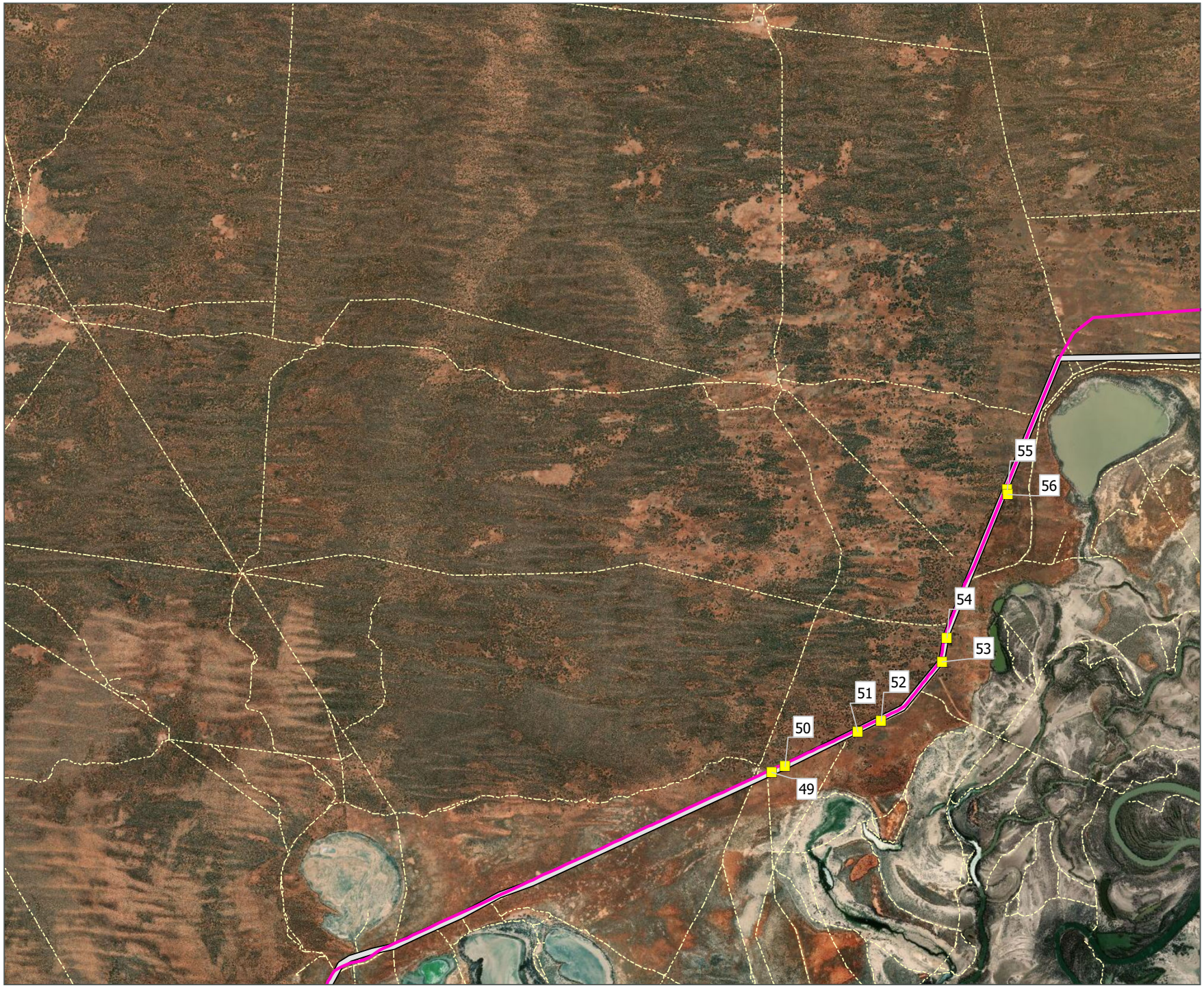
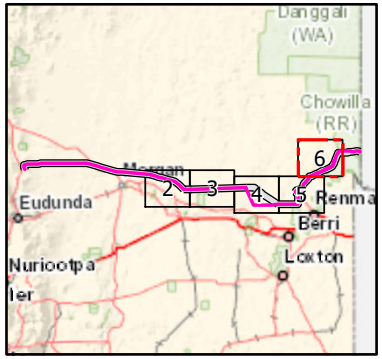


Figure 6: Survey locations and types

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

- Current proposed alignment
- Proposed alignment October 2019
- 2km transect line
- 500m x 500m survey grid



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5. Results

5.1. Site description

The study area for this investigation (Figure 2–6) was along the proposed October 2019 alignment approximately 205 kilometres over Commonwealth, state and private land running between Robertstown to Chowilla Regional Reserve on the SA/NSW border. The study area runs through several properties, including Taylorville and Calperum Stations, which are listed on the Commonwealth heritage list for their natural and cultural values.

The study area supported sandy soil on a predominantly dune landscape. The majority of the study area is used for grazing. Taylorville and Calperum Stations form part of the Riverland Biosphere Reserve, which contains one of the largest intact stands of old-growth mallee habitat and is managed for threatened species habitat and conservation, scientific research and public education.

Four broad habitat types occurred throughout the surveyed alignment, including the following:

(a) Mallee with *Triodia* (spinifex) understory

(b) Mallee with mixed chenopod understory

(c) Chenopod shrubland, treeless plains with saltbush and bluebush.

(d) Semi-arid woodland (Belah *Casuarina pauper*, Slender Cypress Pine *Callitris preissii* Sugarwood *Myoporum platycarpum,* Cattlebush *Altectryon oleofolium*, Silver Needlewood *Hakea leucoptera* or Wattle *Acacia* spp. overstorey with saltbush and bluebush [chenopod] understory).

The far western section of the alignment from Robertstown to Newenham property was dominated by chenopod shrubland, habitat not considered suitable for the targeted threatened mallee birds.

There were signs of various degrees of degradation by grazing and fire throughout the study area. Domestic sheep and cattle dominated grazing pressure in some areas while in others the Feral Goat, Western Grey Kangaroo and Red Kangaroo predominated. In the mallee, three different age classes related to time since last fire, were sampled. The most recent fire was in 2014; another fire dated from 2006; remaining vegetation was classified as greater than 15 years of age since fire.

Three distinct areas of mallee habitat were present along the alignment. These three different habitats included the following.

- The western section - form Newenham to Private properties
- The centre section – Taylorville, Hawks Nest and Calperum Stations
- The eastern section – eastern end of Calperum Station and Chowilla Regional Reserve.

From Newenham to Private's property in Markaranka the mallee habitat was open in parts and showed signs of grazing pressure from sheep, cattle, Feral Goats and kangaroos. The overstorey was generally old-growth mallee eucalypts. The ground was quite bare and fire would have difficulty burning in these areas with such a sparse understorey of Chenopod shrubs and *Triodia*.

The central part of the alignment encompassed Taylorville, Hawks Nest and Calperum Stations, which had a continuous cover of mallee habitat with varying age-classes due to recent fires. These areas had the highest quality mallee habitat for threatened bird species.

The eastern part of the alignment, including parts of Calperum Station and the Chowilla Regional Reserve, had small patches of mallee and chenopod shrubland. There were also small patches of semi-arid woodland dominated by Belah or Slender Cypress Pine. Grazing pressures were observed in these areas though where there were mallee eucalypts they were generally old-growth trees.

5.2. Existing information

Two wildlife databases have been acquired: Birdata from Birdlife Australia (2019), and biological databases from DEW (2019). The target species recorded in the search region (within 10 kilometres of the centre line of the proposed October 2019 alignment) have been mapped and presented in Figures 7-11. Each threatened species is discussed below.

5.2.1. Black-eared Miner

The largest population of the Black-eared Miner occurs in the Riverland Biosphere Reserve, comprising the Taylorville, Gluepot, Calperum, Danggali and Chowilla properties and several smaller reserves and properties nearby (Clarke *et al.*, 2005). The population in Riverland Biosphere Reserve has been estimated at 3760 individuals, however the effective population size of pure phenotypes was estimated at 390 (95% confidence limits 210-726) owing to complex social organisation and skewed sex ratios. This population represents over 95% of the total Black-eared Miner population (Clarke *et al.*, 2005). Since work for this estimate was carried out in 2000-2002, a lengthy drought and extensive fire had initially reduced the population but this is now recovering after several 'good' years up to 2016 (R. Boulton in BirdLife International, 2019).

There were 470 records from 1977 to present (DEW 2019) and 40 records from 1998 to present from Birdata (Birdlife Australia 2019) of Black-eared Miner. The most recent records from the databases were from 15th October 2018 (Birdlife Australia 2019) and 20th November 2017 (DEW 2019) at Calperum Station. Existing records of Black-eared Miner along the alignment were present in Taylorville, Hawks Nest and Calperum Stations. Chris Hedger (DEW) has also indicated that these areas are suitable for Black-eared Miner and he has recorded it previously at these stations. In addition, he has recorded it on the Private property to the west of Taylorville. These records indicate that there is a population of Black-eared Miner in the central section of the mallee habitat along the surveyed alignment.

The alignment has since been altered at Hawks Nest Station based on the survey results and consultation with Chris Hedger (DEW) to minimise impacts on areas of higher quality habitat on Hawks Nest Station. All previous Black-eared Miner records at Hawks Nest Station are now well north of the current proposed alignment with the exception of one record from the 1990's.

5.2.2. Malleefowl

The Malleefowl has been well studied in the search region. There are 1880 records from 1966 to the present from the SA biological database (DEW 2019) and 25 records from 1999 to the present

from Birdata (Birdlife Australia 2019). The most recent record was from 23rd June 2015 at Calperum Station (DEW 2019). The main concentrations of this species are from Pooginook Conservation Park, Taylorville Station, Calperum Station and Cooltong Conservation Park. These records indicate that there is a population of Malleefowl along the central section of the mallee habitat along the surveyed alignment.

5.2.3. Striated Grasswren

DEW (2019) has 632 records from 1972 to the present and Birdata (Birdlife Australia 2019) has 63 records from 1998 to the present of Striated Grasswren in the search region. The most recent records for this species were from 22nd February 2012 at Pooginook Conservation Park (Birdlife Australia 2019) and on the 2nd January 2012 at Cooltong Conservation Park (DEW 2019). Previous records come from Pooginook Conservation Park, Taylorville Station, Calperum Station and Cooltong Conservation Park. The lack of recent records of this species indicates that it has undergone a decline in the region.

5.2.4. Red-lored Whistler

In the search region, there are 175 records from 1970 to the present (DEW 2019) and 12 records from Birdata from 1998 to the present (Birdlife Australia 2019). The most recent records are from 24th April 2010 from Calperum Station and 23rd April 2010 from Taylorville Station (DEW 2019). The Red-lored Whistler has previous records from Pooginook Conservation Park, Taylorville Station and Calperum Station. Chris Hedger (DEW) indicated that there is suitable habitat for the species at Taylorville Station. The review of existing information indicates that this species is still present in the area although in low abundance.

5.2.5. Regent Parrot

There are 1177 records from 1917 to the present (DEW 2019) and 157 records from 1998 to the present in Birdata (Birdlife Australia 2019) of Regent Parrot from the search region. The most recent records are from 1st June 2019 from along the Murray River in Chowilla Regional Reserve and from 24th March 2019 from the Murray River at Morgan (Birdlife Australia 2019). Most of the records of this species are from the Murray River. There are few records away from the Murray River though the species has been recorded in Pooginook Conservation Park, Taylorville Station, Calperum Station, Cooltong Conservation Park, irrigation farms in Cooltong and Chowilla Regional Reserve. This species is more abundant along the river and floodplains habitats but will occasionally forage at distances from these habitats.

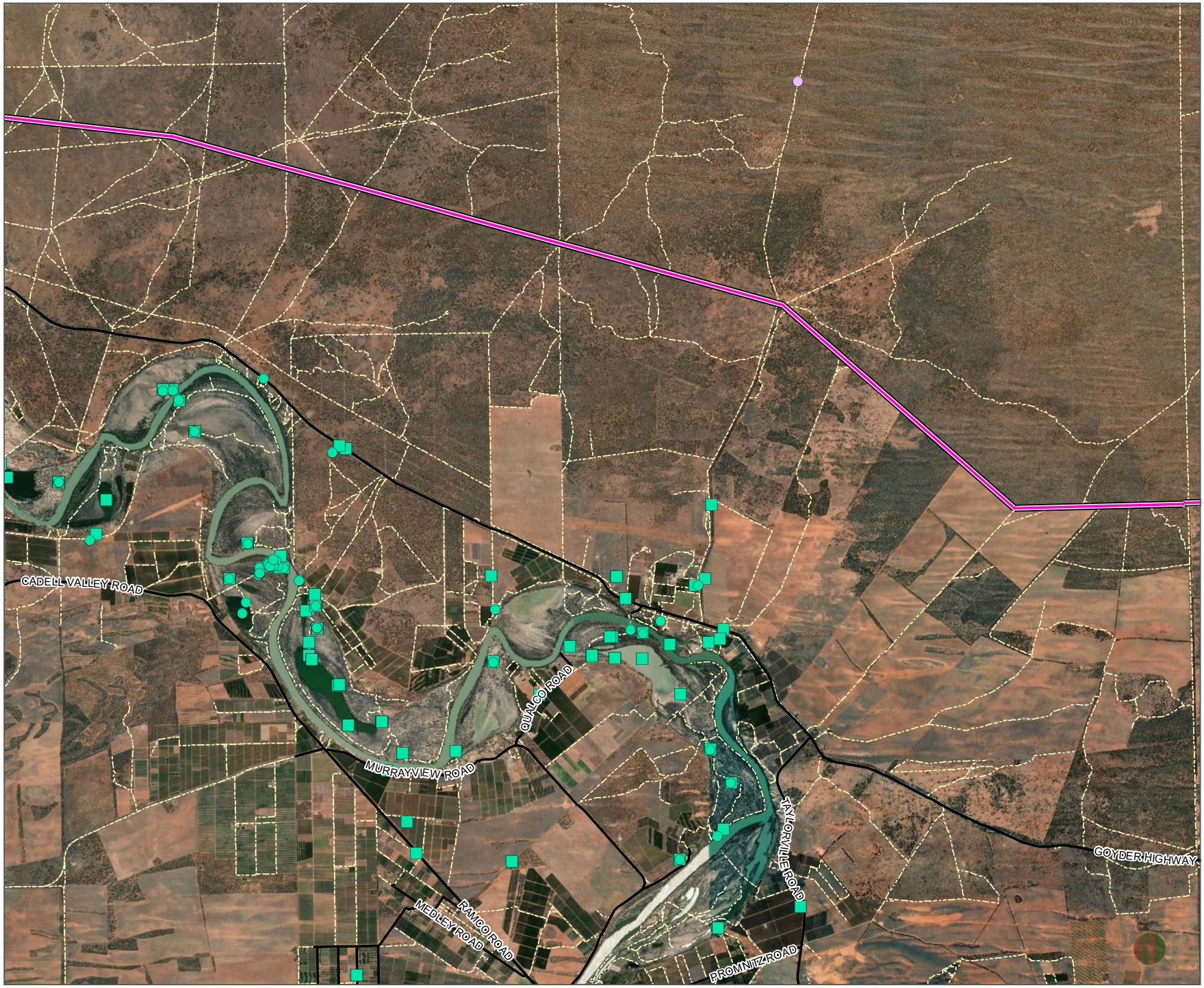


Figure 7: Threatened species observations

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

Current proposed alignment

Proposed alignment October 2019

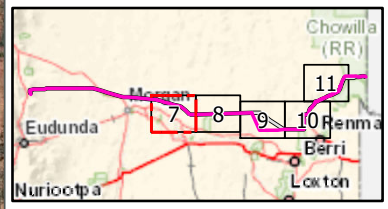
Birdata

Black-eared Miner (1)

Regent Parrot (53)

Biological database of South Australia

Regent Parrot (112)



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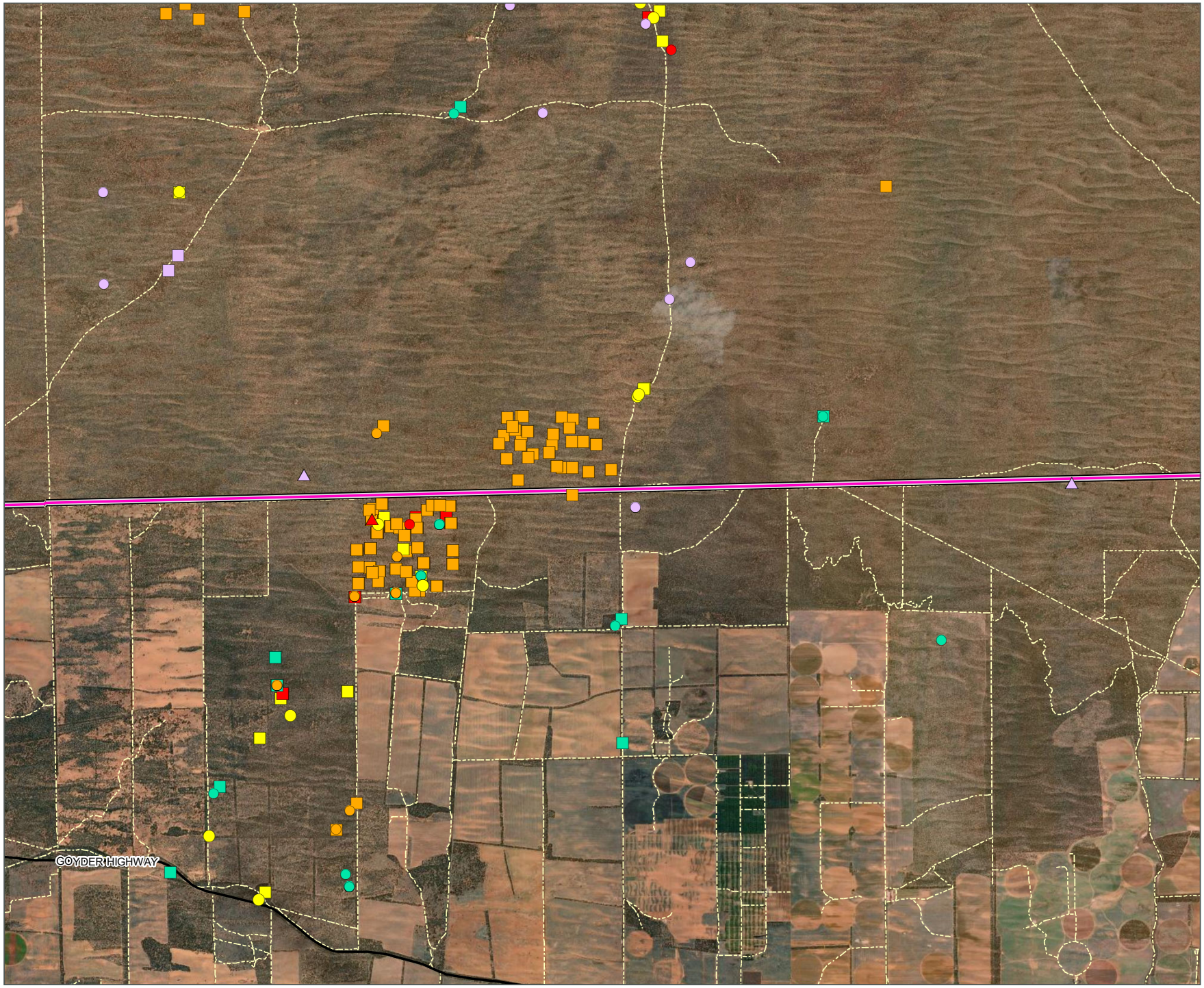


Figure 8: Threatened species observations

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

Current proposed alignment

Proposed alignment October 2019

Threatened species (Nature Advisory observations)

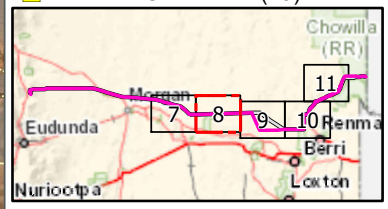
- Black-eared Miner (2)
- Red-lored Whistler (1)

Birdata

- Black-eared Miner (10)
- Malleefowl (18)
- Red-lored Whistler (2)
- Regent Parrot (18)
- Striated Grasswren (12)

Biological database of South Australia

- Black-eared Miner (4)
- Malleefowl (524)
- Red-lored Whistler (9)
- Regent Parrot (16)
- Striated Grasswren (25)



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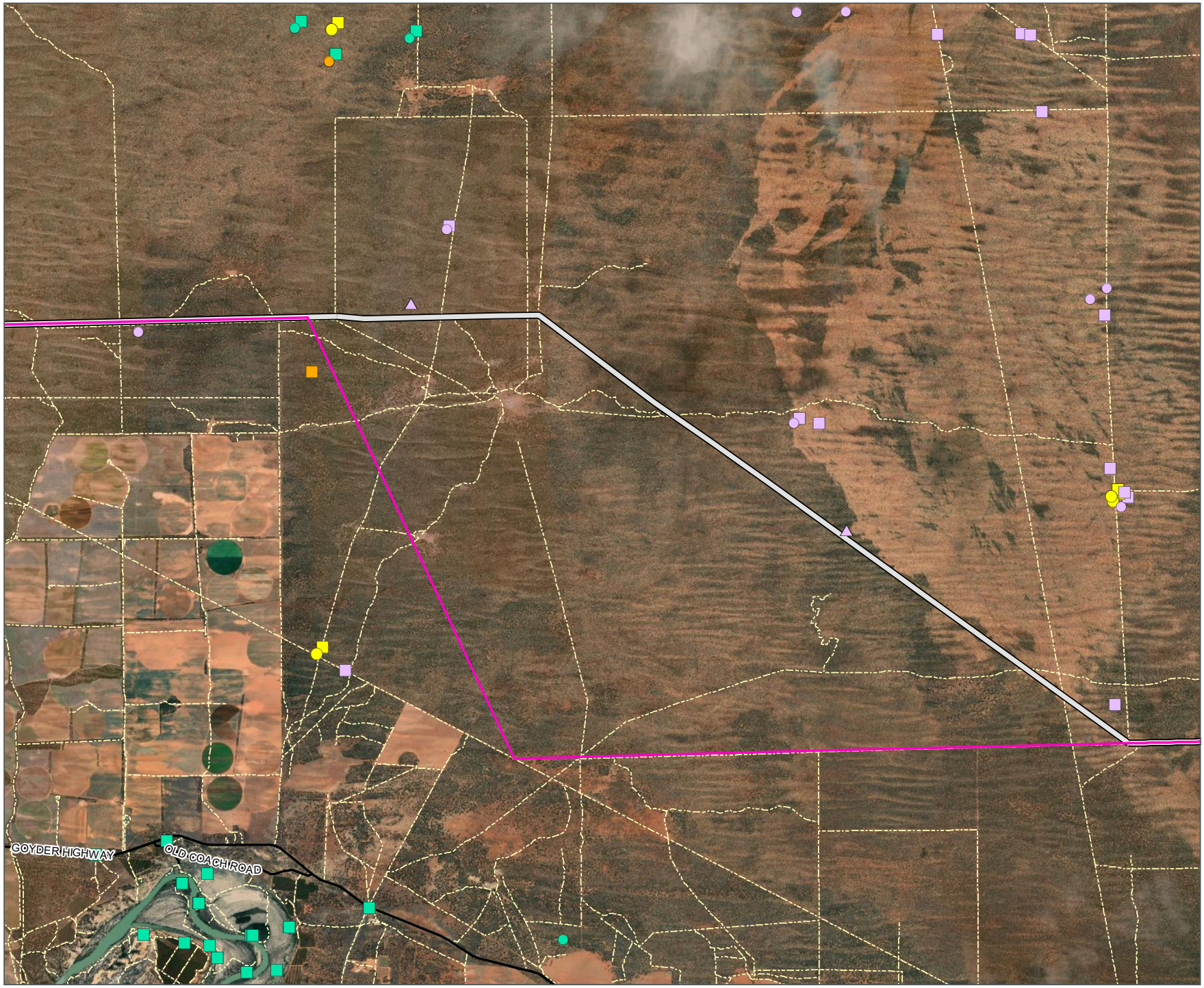


Figure 9: Threatened species observations

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

Current proposed alignment

Proposed alignment October 2019

Threatened species (Nature Advisory observations)

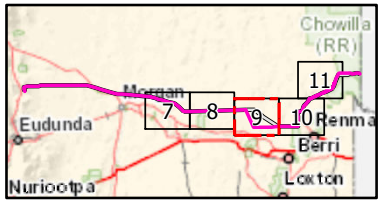
- Black-eared Miner (2)

Birdata

- Black-eared Miner (8)
- Malleefowl (2)
- Regent Parrot (3)
- Striated Grasswren (6)

Biological database of South Australia

- Black-eared Miner (13)
- Malleefowl (2)
- Red-lored Whistler (1)
- Regent Parrot (29)
- Striated Grasswren (4)



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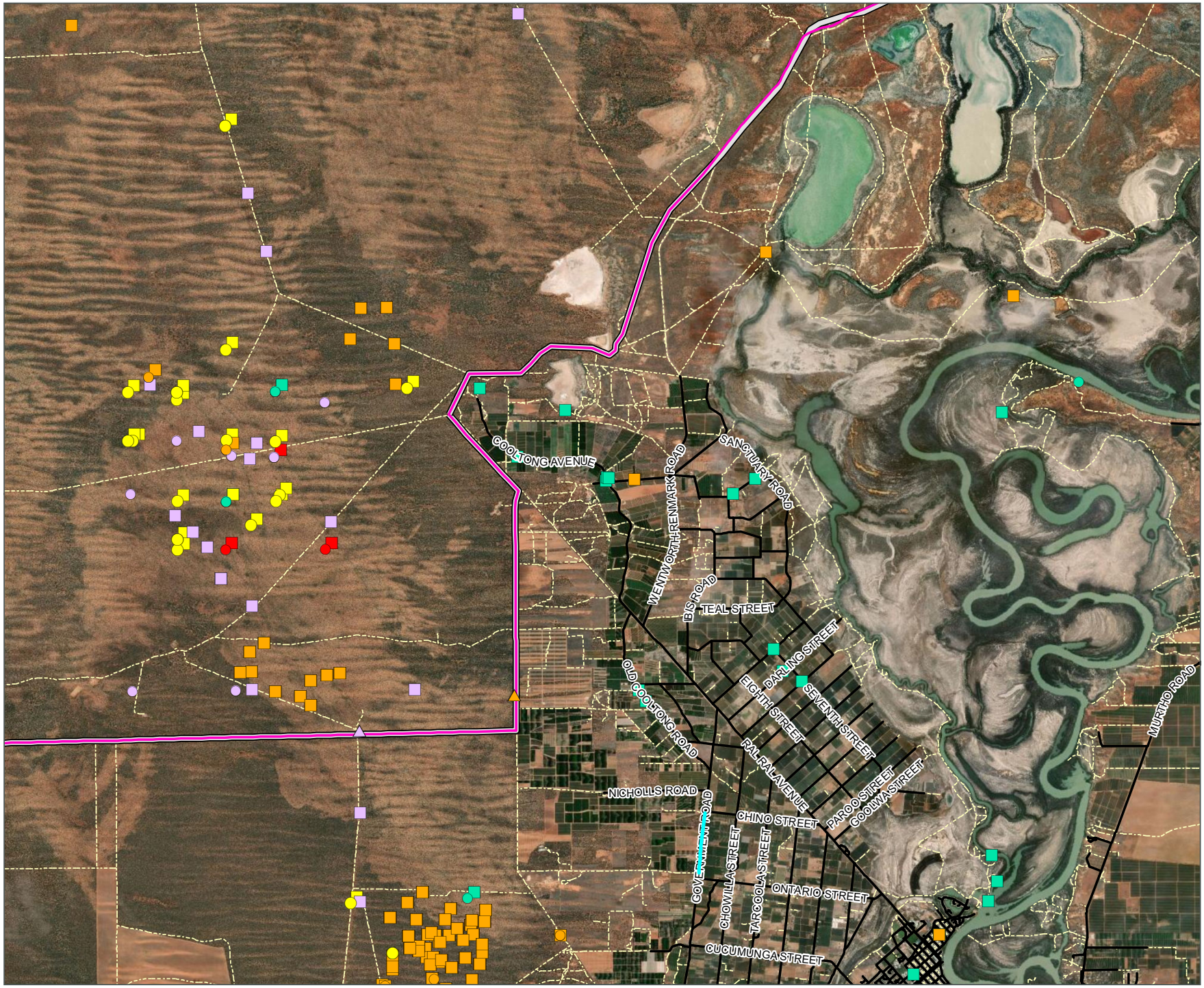


Figure 10: Threatened species observations

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

Current proposed alignment

Proposed alignment October 2019

Threatened species (Nature Advisory observations)

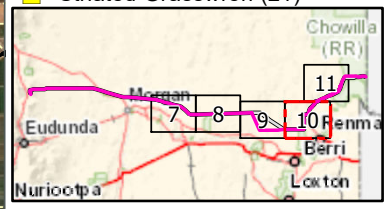
- Black-eared Miner (1)
- Malleefowl foot prints (1)

Birdata

- Black-eared Miner (8)
- Malleefowl (8)
- Red-lored Whistler (2)
- Regent Parrot (6)
- Striated Grasswren (22)

Biological database of South Australia

- Black-eared Miner (21)
- Malleefowl (623)
- Red-lored Whistler (3)
- Regent Parrot (26)
- Striated Grasswren (21)



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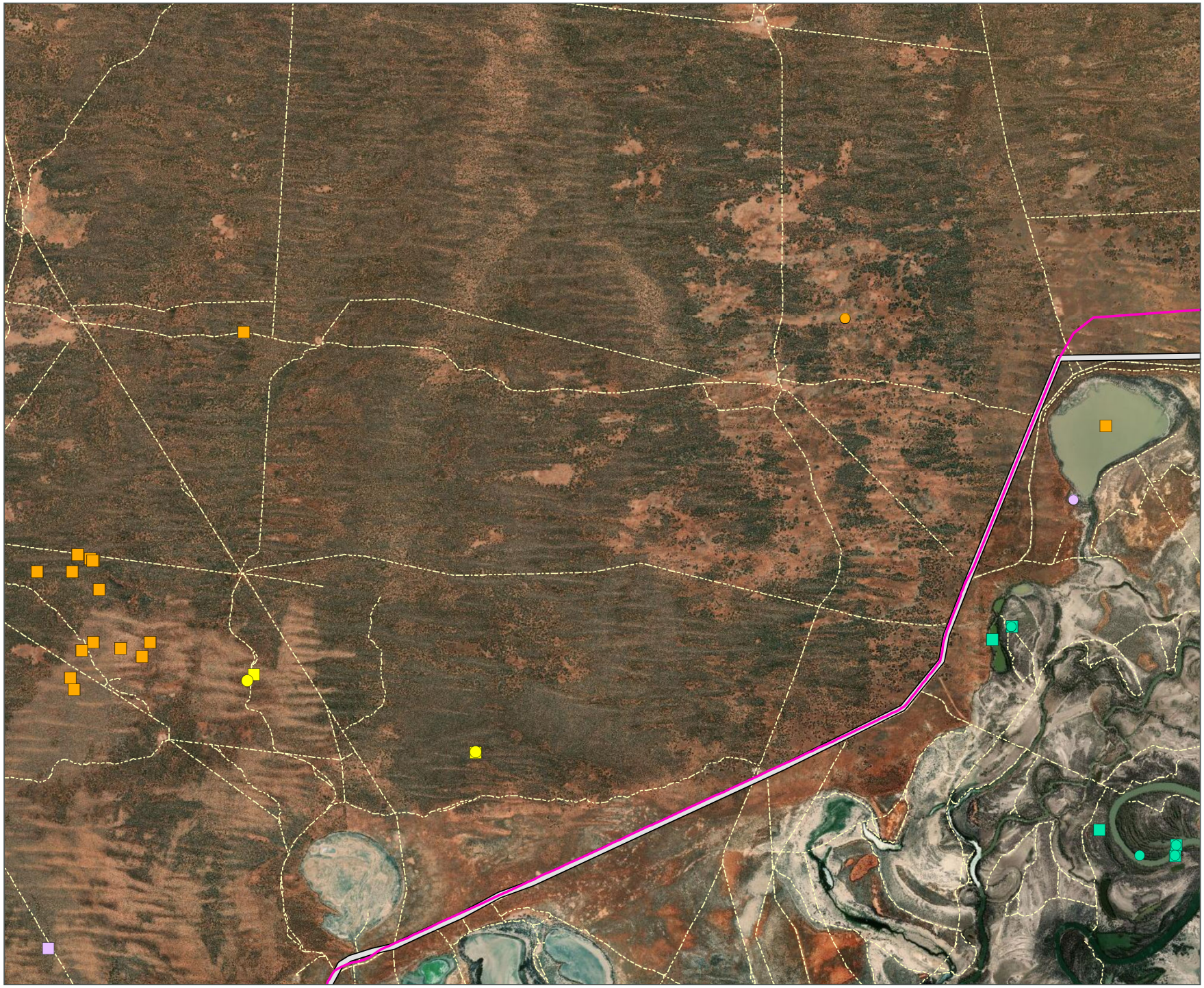


Figure 11: Threatened species observations

Project: Project EnergyConnect
Client: JBS and G Australia
Date: 04/12/2020

Current proposed alignment

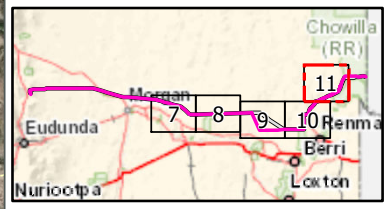
Proposed alignment October 2019

Birdata

- Black-eared Miner (1)
- Malleefowl (3)
- Regent Parrot (5)
- Striated Grasswren (2)

Biological database of South Australia

- Black-eared Miner (1)
- Malleefowl (46)
- Regent Parrot (10)
- Striated Grasswren (2)



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5.3. Habitat assessment

At each survey site the vegetation type, structure and habitat quality were noted. These habitat components, considered important in influencing the distribution of the threatened mallee birds, were assessed for each survey site and presented in Table 1 below.

Table 1: Habitat assessment for each survey site

Site number	GPS Site	Survey Date	Survey method	Habitat description	Property
1	30	28//10/2019	Transect	Scattered mallee eucalypts, a lot of bare ground, some chenopods and small shrubs.	Newenham
2	29	28/10/2019	Transect	Open mallee; understorey partly removed due to grazing; scattered chenopods and other shrubs. Tallish (up to 11m). Some stands of Casuarina (Belah) in half of transect. Looked unsuitable for target species.	Mitolo Holdings
3	28	28//10/2019	Grid	Open mallee, mixture of young and old growth trees, old growth occurring more in the south of the grid, the understorey is patchy, dominated by heath and chenopod with some Triodia in the west.	Mitolo Holdings
4	28	28/10/2019	Grid	Old growth mallee (up to 10m tall).	Mitolo Holdings
5	27	28//10/2019	Grid	Open mallee in southern section, mostly young approximately 2-3m tall eucalypts with some old growth trees also in south-west section of grid, the understorey was a mixture of shrubs, bluebush and Triodia, northern part of the grid more open shrubland with scattered trees.	Private Property
6	27	28/10/2019	Grid	Mostly regrowth mallee with Triodia (up to 5 m tall, <15 years since fire). Some old mallee grazed with chenopod understorey; some large trees with hollows.	Private Property
7	26	27/10/2019	Transect	Continuous mallee, regrowth with eucalypts approximately 2m tall with Triodia understorey.	Private Property
8	25	27/10/2019	Grid	Two different habitat types in this grid, to the west old growth mallee eucalypts with saltbush and bluebush understorey, to the east old and young growth eucalypts, with some Moonah and shrubs or Triodia understorey.	Private Property
9	25	27/10/2019	Grid	Mature mallee (up to 9m tall). Mixed shrub layer including groves of Moonah. Some Triodia.	Private Property

Site number	GPS Site	Survey Date	Survey method	Habitat description	Property
10	24	27/10/2019	Grid	Open mallee, young growth, trees on average 3-4m tall, some old growth in grid, understorey dominated by shrubs with some saltbush and bluebush.	Taylorville Station
11	24	27/10/2019	Grid	Regrowth mallee (up to 4m tall), estimated <15 years since fire. Leaf litter, but understorey plants limited; bare ground widespread, indicative of overgrazing? (goats present). Small area of dense Triodia.	Taylorville Station
12	23	27/10/2019	Grid	Continuous mallee, trees are young approximately 2m tall, Triodia dominates the understorey.	Taylorville Station
13	23	27/10/2019	Grid	Continuous mallee, trees are young approximately 2m tall, Triodia dominates the understorey.	Pooginook Conservation Park
14	22	27/10/2019	Grid	Continuous mallee, young regrowth trees just over 2m tall, Triodia dominated the understorey.	Taylorville Station
15	22	27/10/2019	Grid	Regrowth mallee (<15 years) with Triodia.	Pooginook Conservation Park
16	10	24/10/2019	Grid	Continuous mallee, eucalypts young no greater than 2m tall, some Moonah and Callitris, understorey dominated by Triodia, fire scar in surrounding area.	Taylorville Station
17	10	24/10/2019	Grid	Dense short mallee (up to 5m tall) mostly unburnt; small area burnt in one corner of grid. Moonah groves present; lots of Triodia.	Taylorville Station
18	11	24/10/2019	Transect	Continuous mallee, has be burnt in recent years, young trees, understorey dominated by Triodia.	Taylorville Station
19	12	24/10/2019	Transect	Regrowth mallee (<15 years since burnt), up to 4m tall; scattered shrubs. Regrowth Triodia widespread.	Taylorville Station
20	13	24/10/2019	Transect	Regrowth mallee up to 4-5m tall (foliage; excludes dead emergent branches). Triodia common.	Taylorville Station
21	14	24/10/2019	Grid	Mature mallee (up to 8m tall). Lots of shrubs; cryptogamic crust. More open and more leaf litter than sites 18-20. Large areas of Triodia of low sandy rises.	Taylorville Station
22	14	24/10/2019	Grid	Continuous mallee, some areas burnt in recent years, some areas had old growth trees, understorey dominated by Triodia.	Taylorville Station

Site number	GPS Site	Survey Date	Survey method	Habitat description	Property
23*	15	25/10/2019	Grid	Continuous mallee, mostly regrowth, some areas of mature trees, good cover of Triodia with some shrubby areas.	Hawks Nest Station
24*	15	25/10/2019	Grid	Open mallee (<15 years since burnt), up to 5m tall. Shrubs and Triodia widespread. Some mature mallee (up to 8m tall) - lots of leaf litter, shrubs.	Hawks Nest Station
25*	16	25/10/2019	Grid	Patchy mallee in northern section, with a mixture of old and young growth and understorey with Triodia and shrubs, some acacia shrubland within grid.	Hawks Nest Station
26*	16	25/10/2019	Grid	Open regrowth mallee (<15 years since burnt). Lots of Triodia, non-Eucalypt shrubs; some mature trees.	Hawks Nest Station
27*	17	25/10/2019	Grid	Open mallee with young regrowth eucalypts <2m tall, small shrubs and Triodia.	Hawks Nest Station
28*	17	25/10/2019	Grid	Open mallee mostly unburnt (up to ~10m tall); some largeish hollow-bearing trees; shrub layer widespread. Also more recently burnt (<15 years) with lots of Triodia.	Hawks Nest Station
29*	18	25/10/2019	Grid	Patchy mallee, majority young growth with some old growth eucalypts, understorey dominated by Triodia with some small shrubs in parts.	Hawks Nest Station
30*	18	25/10/2019	Grid	Patchy mallee, majority young growth with some old growth eucalypts, understorey dominated by Triodia with some small shrubs in parts.	Hawks Nest Station
31*	21a	26/10/2019	Grid	Mostly open mallee with young regrowth eucalypts, some open dunal chenopod systems, dominated by Triodia, with some shrubs.	Hawks Nest Station
32*	21a	26/10/2019	Grid	Regrowth mallee (<15 years); Triodia, numerous shrubs. Some burnt (<5 years)	Hawks Nest Station
33*	21	26/10/2019	Grid	Burnt mallee (<15 years); Triodia. Some burnt (<5 years)	Hawks Nest Station
34*	21	26/10/2019	Grid	Mostly mallee eucalypt regrowth with some old growth trees with a Triodia and shrubby understorey.	Hawks Nest Station
35	20	26/10/2019	Transect	Shrubland (up to 3m tall); mixed mallee, shrubby understorey. Some recently burnt mallee with chenopod ground layer; young Triodia.	Calperum Station
36	19	26/10/2019	Grid	Continuous mallee with old growth eucalypts, understorey dominated by Triodia with some shrubby areas.	Calperum Station

Site number	GPS Site	Survey Date	Survey method	Habitat description	Property
37	19	26/10/2019	Grid	Mature unburnt mallee (up to ~10m tall); lots of shrubs. Large area of Triodia.	Calperum Station
38	32	29/10/2019	Transect	Burnt mallee (<15 years); regrowth to 4m tall. Dead emergent branches to 8-10m tall. Triodia regenerating.	Calperum Station
39	31	29//10/2019	Transect	Continuous mallee abutting a citrus orchard and agricultural lands, mixture of shrubby and Triodia understorey.	Calperum Station
40	9	23/10/2019	Grid	Some mature mallee (up to 8m tall) with sclerophyllous shrub layer; also, regrowth mallee (up to 5m tall) with very little understorey but lots of leaf litter. Small patches of Triodia. Cryptogamic crust widespread. Large patches of Triodia on ridge (last 500m transect). Looked good habitat for Striated Grasswren.	Calperum Station
41	9	23/10/2019	Grid	Continuous mallee, canopy a little open, young trees, Triodia in dune crests, slope and swales mostly unvegetated with bare ground or leaf litter.	Calperum Station
42	8	23/10/2019	Transect	Dense mallee (up to 8m tall), opening out to cleared edge on southern boundary. Shrub layer and Triodia in parts but some open ground with cryptogamic crust.	Calperum Station
43	7	23/10/2019	Grid	Continuous mallee, understorey dominated by scattered small shrubs with some areas of Triodia.	Calperum Station
44	7	23/10/2019	Grid	Dense mallee (up to 8m tall), some Triodia, much leaf litter, scattered small shrubs (<1m), only a few small chenopods, some cryptogrammic crust.	Calperum Station
45	6	23/10/2019	Grid	Continuous cover of mallee, mostly shrubby understorey with some areas of Triodia.	Calperum Station
46	6	23/10/2019	Grid	Dense mallee (up to 6m tall) with Triodia ground cover in northern half, grading to low scrub (Acacia and Hakea) with scattered eucalypts in southern half, much disturbance of ground layer (overgrazing by kangaroos and goats).	Calperum Station
47	1	22/10/2019	Grid	Scattered mallee Eucalypts, Saltbush/bluebush ground cover, scattered Callitris/Myoporum, no Triodia.	Calperum Station
48	1	22/10/2019	Grid	Scattered mallee, saltbush and bluebush, acacia shrubs, some Callitris, mostly bare ground, no Triandia.	Calperum Station

Site number	GPS Site	Survey Date	Survey method	Habitat description	Property
49	2	22/10/2019	Grid	Open mallee on ridge to west/north-west. Sparse Bluebush ground cover, grove of Casuarina, large patches of bare ground, no Triodia, few Acacia shrubs.	Chowilla Regional Reserve
50	2	22/10/2019	Grid	Scattered mallee, saltbush and bluebush, bare ground.	Chowilla Regional Reserve
51	3	22/10/2019	Grid	Scattered mallee, some acacia shrubs, mostly saltbush understorey with some Triodia in north-west corner.	Chowilla Regional Reserve
52	3	22/10/2019	Grid	Open mallee, scattered acacia understorey, very degraded bluebush.	Chowilla Regional Reserve
53	4	22/10/2019	Grid	Open mallee, bluebush understorey, scattered small acacia, some old growth eucalypts, no Triodia.	Chowilla Regional Reserve
54	4	22/10/2019	Grid	Open mallee, bluebush understorey, scattered small Acacia, some old growth eucalypts, no Triodia.	Chowilla Regional Reserve
55	5	22/10/2019	Grid	Open mallee with leaf litter on swales, some old growth eucalypts with hollows, scattered Acacia and other shrubs and small trees on dunes, some bluebush as ground cover, no Triodia.	Chowilla Regional Reserve
56	5	22/10/2019	Grid	Open mallee with leaf litter on swales, some old growth eucalypts with hollows, scattered Acacia and other shrubs and small trees on dunes, some bluebush as ground cover, no Triodia.	Chowilla Regional Reserve

Notes: * - indicates the survey area is no longer along the current proposed alignment

In general, the properties that had the higher quality, continuous mallee habitat, notwithstanding the fires that have gone through the area in the past 15 years, were located in the central section and included the following.

- Pooginook Conservation Park
- Taylorville Station
- Hawks Nest Station
- Calperum Station and
- Cooltong Conservation Park.

Areas west and east of this section had more degraded, patchy areas of mallee.

5.4. Targeted surveys

Surveys were completed at 56 sites (Figures 2 to 6) during an eight-day period from 22nd to 29th October 2019. These comprised 46, 4 x 500-metre square transects and ten 2,000-metre line transects.

Of the target species, only two were observed: Black-eared Miner and Red-lored Whistler. In addition, the footprints of Malleefowl were recorded at one site. Table 2 presents the results of the targeted survey and Figures 7–11 show the locations of the observations. The Regent Parrot and Striated Grasswren were not recorded during targeted surveys.

Table 2: Targeted mallee birds recorded during the surveys

Site number	Survey Date	Survey method	Species	Count	Property
12	27/10/2019	Grid	Black-eared Miner	2	Taylorville Station
15	27/10/2019	Grid	Red-lored Whistler	1	Pooginook Conservation Reserve
20	24/10/2019	Transect	Black-eared Miner	4	Taylorville Station
23	25/10/2019	Grid	Black-eared Miner	2	Hawks Nest Station
31	26/10/2019	Grid	Black-eared Miner	2	Hawks Nest Station
38	29/10/2019	Transect	Black-eared Miner	7	Calperum Station
39	29//10/2019	Transect	Malleefowl	1	Calperum Station

Black-eared Miner

The Black-eared Miner was recorded at five survey sites. The species was recorded in the central section of the study area at Taylorville, Hawks Nest and Calperum Stations (Table 2, Figures 8–10), in the higher quality areas of mallee habitat. The location of two of these observations at Hawks Nest Station are now well to the north of the current proposed alignment as a consequence of the revisions to the alignment.

In most instances the species was detected by call playback although on one occasion they spontaneously flew in to investigate the arrival of the observer.

Black-eared Miners were observed in small groups from two to seven birds, displaying varying degrees of hybridisation. Sightings comprised birds conforming to pure phenotype Black-eared Miner and those with 'hybrid' characteristics using the schema of Ingwersen (2008).

Photo 1: Black-eared Miner, Calperum Station, 29th October 2019. The bird on the right is a 'pure' phenotype, while the bird on the left shows some hybrid characters (e.g. feathers on the lower jaw are paler than feathers on the crown, side of head and nape and more extensive pale tail tip). Photo by P.S. Lansley.

Red-lored Whistler

The Red-lored Whistler was recorded from one survey. It was recorded from the central section of the alignment at Pooginook Conservation Park (Table 2, Figure 8). One individual was initially heard calling before visual confirmation that it was a Red-lored Whistler and not the more common species, Gilbert's Whistler. There are previous records of Red-lored Whistler from this area during 2001, 2007 (Birdlife Australia 2019) and 1995, 2001 and 2002 (DEW 2019), which indicates that there is a still a population residing here.

Malleefowl

Malleefowl footprints were recorded from one survey location (Table 2, Figure 10, Photo 2), no other signs of Malleefowl were observed throughout the survey. It was recorded from the central section of the alignment at Calperum Station.

Photo 2: Footprints of Malleefowl, Calperum Station 29th October 2019.

6. Impact assessment

The impact assessment methodology outlined in Chapter 8 of the EIS has been used to identify and categorise potential impacts to threatened mallee birds.

The impact assessment involves the following steps:

- Assessment of the baseline condition of the existing environment. This identified the environmental values that could be impacted by the Project, and their condition.
- Review of aspects of the Project design to determine the ways in which the Project could potentially affect the environmental values. These are called the 'potential impact events'.
- Description of the impacts that are expected to occur as part of the construction and operation of the Project. These are the impacts that are planned for, and a necessary consequence of carrying out the Project. These are described in conjunction with control and mitigation measures.
- Use of risk assessment tools to evaluate the uncertainty in the assessment of expected impacts, where appropriate. Note: The impact assessment in this report goes as far as identifying the level of certainty in the impacts that it predicts. A Risk assessment is carried out by others in the main body of the EIS.

This report addresses the first three of these points. The final, integrated risk assessment (point 4) will be undertaken by others based on the results presented here.

6.1. Identification of environmental values

This report is focussed on undertaking an assessment of impacts to threatened mallee birds and their habitat that occur along the current proposed alignment of the Project. These birds have been identified previously in this report and include the following.

- Black-eared Miner
- Malleefowl
- Striated Grasswren
- Red-lored Whistler and
- Regent Parrot.

Their habitat is the mallee vegetation that occurs along the alignment. Significant habitat of the mallee birds occurs along the alignment at Taylorville, Hawks Nest and Calperum Stations.

6.2. Identification of potential impact events

Potential impact events that may directly or indirectly affect threatened mallee birds and/or their habitat are listed below and discussed in subsequent sub-sections.

- Habitat removal

    - For construction of towers
    - For access tracks (construction or widening) for stringing access corridor
    - For lay down areas
- Habitat fragmentation and reduction in quality of habitat (edge effects)
    - Spread of environmental weeds
    - Increase in predation due to opening up of habitat
    - Hybridisation (Black-eared Miner)
- Increased fire risk (during construction and operational phases)
- Injury or mortality of mallee birds during habitat removal
    - Bird strike
        - Strike with vehicle
        - Strike with infrastructure
    - Electrocution
- Disturbance during construction
    - Noise
    - Dust
    - Human activity, including construction and personnel vehicles
- Disturbance during operation
    - Maintenance personnel (noise/trimming vegetation)
    - Increased human activity due to improved road access

6.2.1. Habitat removal

Alternate alignment routes were investigated and a range of impacts were considered, including the removal of habitat for mallee birds. The current proposed alignment option was chosen to maximise the use of existing tracks, powerline easements and firebreaks and to minimise habitat removal and fragmentation. As Black-eared Miner require unfragmented mallee habitat for their survival, efforts have been made to locate the alignment on the edge of mallee habitat. Where this was not possible, the alignment has been altered and moved away from areas where Black-eared Miner have been recorded since the 1990's, areas considered by DEW and the current assessment as the most important habitat for the species (e.g. at Hawks Nest Station).

The easement is predicted to be 80 metres wide however habitat removal is not expected to affect the entire Project area as the habitats across the Project area are generally low in stature and will not interfere with the powerlines once these are raised. Access tracks will need to be formed in some areas where they do not currently exist. The width of access tracks in dune areas will be minimised. It has been estimated that in the order of 1.5 hectares per kilometre will need to be disturbed, which takes into account the standard tower base, access track, allowance for a stringing easement, brake and winch, temporary laydown yards and strain towers. Permanent removal will be approximately half of this as access and laydown areas only required for construction will be revegetated.

6.2.2. Habitat fragmentation and degradation

The construction of the transmission line and access tracks may cause habitat fragmentation for species that avoid open areas, such as Striated Grasswren and Red-lored Whistler. This is particularly the case where new access tracks are required to be constructed, such as through Hawks Nest Station (see Figure 9).

Regent Parrots, when moving from their Murray River breeding and roosting habitat to foraging areas in mallee woodland and shrubland use treed corridors and the project may lead to interruption of these movement zones. Key areas in this regard are

- Between Stuart and Makaranka
- Around Pooginook Conservation Park
- North of Lake Bonney
- East from Cooltong Conservation Park to the NSW border

There is potential for weed seed to be introduced to the Project area from vehicles and plant along the alignment that could alter the structure of the ground cover adjacent to tower sites and access tracks.

There is also potential for increased predation due to opening up of habitat, including ground cover, for access tracks in particular.

There is potential for Yellow-throated Miner to move into disturbed areas of mallee habitat along the alignment and interbreed with the local Black-eared Miner population. This is already occurring in some areas along the current proposed alignment though additional degradation and fragmentation of mallee habitat may exacerbate the issue.

6.2.3. Increased fire risk

Frequent fire is one of the most significant threats to mallee biodiversity and in particular to the threatened bird species considered in this report. Reducing the risk of fire start to an extremely low level is vital if the risk of the project to these birds is to be minimised to an acceptable degree.

6.2.4. Injury or mortality of mallee birds

There is potential for injury or mortality of mallee birds during construction and operation of the Project. Actions that may injure or kill mallee birds include initial site preparation when clearing habitat, movement of vehicles and plant, electrocution, and collision with towers and powerlines. Collision with towers and powerlines is more likely for larger birds, waterbirds and migrating birds. It is unlikely that most mallee birds would collide with infrastructure.

Provided there is adequate gap between the canopy and the powerlines, Regent Parrots moving between the Murray River breeding and roosting sites and mallee shrubland foraging areas, which usually fly less than five metres above the tree canopy, are unlikely to collide with the powerlines.

6.2.5. Disturbance during construction

The construction process will result in vehicle, plant and personnel accessing all parts of the alignment, in addition to access tracks and laydown areas. This will result in temporary noise and disturbance, including raised dust in these areas for the construction period. These impacts are considered to be localised and temporary. Mallee birds are likely to vacate the disturbed area when this occurs, returning once the construction has ceased.

6.2.6. Disturbance during operation

General maintenance and servicing will require vehicles and personnel to access the site occasionally, resulting in limited vehicle traffic, and occasional associated noise and dust. This is unlikely to be a regular occurrence and therefore impacts will be minimal. Opening of access tracks may increase recreation access to new areas currently not as frequently accessed, increasing levels of temporary vehicular and human activity, and associated noise, dust and visual disturbance.

6.3. Control measures

Design and standard management controls have been considered to minimise potential impacts identified above. Control measures that should be given consideration are described below.

6.3.1. Habitat removal

Efforts to reduce the amount of habitat removal are outlined below.

- Several alignment options were investigated taking into consideration a range of impacts including the loss of native vegetation/threatened species habitat and old-growth trees.
- Avoid habitat removal in areas that have not been burnt in the past 15 years, wherever possible, as these areas are preferred by the threatened mallee bird species considered here.
- Wherever possible existing roads, tracks, fire breaks and other existing disturbed areas will be used to minimise habitat removal, with widening to be limited to the minimum necessary for construction and operations. Where temporary habitat removal is involved, the areas not required for operations must be rehabilitated to prevent weed invasion and permanent changes in vegetation structure and function.
- Review proposed new track and tower locations in field prior to ground disturbance to ensure important habitat values are avoided wherever practicable

- Access and removal of habitat will not be undertaken outside of the approved areas
- No go areas will be clearly flagged/fenced prior to construction activities
- Access tracks to be rehabilitated where not required after construction
- In the areas of critical habitat for Black-eared Miner (Taylorville, Hawks Nest and Calperum Stations) if lay down areas are required, they will be located in more degraded habitat selected during the detailed design stage.

6.3.2. Habitat fragmentation and degradation

Wherever possible existing roads, tracks, fire breaks and other existing disturbed areas will be used to minimise habitat removal. Where mallee areas within 20 kilometres of the river are continuous, clearing should be reduced to the bare minimum required for the project to reduce fragmentation and potential for separation of Regent Parrot breeding/roosting areas and foraging habitat.

Best-practice construction vehicle and equipment hygiene procedures that should be given consideration are as follows.

- Adopt strict weed hygiene controls between properties and when first accessing the site
- Weeds will be controlled within the works area in accordance with the *Landscape South Australia Act 2019*
- All noxious weeds to be disposed of appropriately
- Conduct post construction weed survey and control program with particular focus on any weed infestations identified in pre-construction surveys
- Undertake pest animal control at the Project area where ground disturbance encourages pest animal (e.g. rabbit) activity.

Strict pest plant and animal controls will be implemented in the Construction Environmental Management Plan prior to works commencing to ensure the potential for the introduction of weed seeds and pest animal spread on the site is minimised. The weed hygiene protocol should include consultation with affected landholders and include a targeted weed survey of all areas likely to be affected by the construction footprint before, during and for a maintenance period after project completion.

6.3.3. Increased fire risk

Every effort will be made to reduce the fire start risk associated with the transmission line. ElectraNet, the owner of the South Australian section of the line, have adopted a risk management strategy that has the following aims (JBS&G 2019):

- *"Minimise the risk of fire ignitions by transmission network assets that could become a bushfire and threaten public safety and property meet the requirements of the associated Act, Regulations and Code*

- *Regularly review and develop management programs, processes, practices, methods and implement efficiencies for the benefit of customers and other stakeholders minimise the frequency and length of disruptions to the general public*
- *Be committed to the safety of the community, as a whole, and employees engaged in the provision of services preserve and enhance the environment*
- *Raise awareness of all aspects of bushfire mitigation through increased communication."*

ElectraNet undertakes a range of risk reduction measures in design, maintenance and operation of its transmission network and these measures include (JBS&G 2019).

- *"Transmission lines are designed to Australian and International Standards with particular attention to minimising the risk of fire start, including protection systems and increased conductor spacing to eliminate risk of 'conductor clashing'.*
- *Vegetation management (ElectraNet Vegetation Management Manual) asset inspection and maintenance via routine maintenance tasks*
- *Operation of the transmission system to lower the fire start risk*
- *Monitoring network performance and investigating fault events to determine root cause*
- *Preparation of a Fire Management Plan for construction and operation phases of the Project."*

Measure to reduce the likelihood of electrocution of birds (which, if they catch alight can start fires) are described in section 6.3.4 below.

Given the potential for a fire to have widespread habitat changes of catastrophic consequence for threatened mallee birds, project specific fire prevention measures should be developed for both the construction and operations phases of the project. The risk is considered particularly significant during construction and it will require a diligent approach, along with strong personnel training, awareness and practices.

Experience elsewhere on the ElectraNet network indicates that transmission lines similar to the design proposed have not resulted in the ignition of bushfires.. Given the low stature of the vegetation in the project area, the risk of contact with overhead lines is considered negligible. The powerline design will be undertaken to minimise the potential for ignition events and additionally, an emergency response plan will be developed to address bushfires in the Project locality.

6.3.4. Injury or mortality of mallee birds

A pre-clearance survey will be undertaken by an ecologist prior to the clearing of any mallee habitat. Nests of native birds that are detected will be flagged/marked and wildlife handler will be required to be present when removing nesting habitat.

Best-practice construction traffic management procedures are proposed including restriction of vehicle movements to pre-determined tracks and reduction of the speed limit in which vehicles and plant traverse the project area, to reduce the risk of vehicle collisions with wildlife. Personnel site induction will include awareness of environmental values and how to protect them.

No specific bird powerline collision reduction measures are warranted for the species concerned as they fly well below powerline height. The highest-flying of the five species considered is the Regent Parrot, discussed in Section 6.2.4, which is, nonetheless, not considered at risk.

Birds can be electrocuted when a bird perches on wires and either bridges wires or wires and grounded hardware on a pole structure. By ensuring that any bird (e.g. a Wedge-tailed Eagle, wing span up to 2.2 metres) cannot touch the relevant components using appropriate design the likelihood of electrocution can be reduced. Appropriate design can be achieved by one of two approaches listed below.

- Ensuring that the likely preferred perching space for a bird on the pole top is well clear of dangerous components
- Ensuring that the dangerous components are sufficiently separated by space to ensure that a bird cannot touch both.

6.3.5. Disturbance during construction

Air quality and noise modelling assessments have been undertaken and it is not anticipated there will be adverse impacts to fauna (Resonate 2019). Nature Advisory concurs with this conclusion.

All construction and operations traffic and equipment will only drive along pre-determined, well marked tracks. Construction activities are to be undertaken only in pre-determined times of the day. Water tankers will be required to water access tracks to keep dust levels down.

6.3.6. Disturbance during operation

Disturbance impacts on fauna during construction can be reduced, by minimising the amount of traffic traversing the Project area by scheduling maintenance of transmission lines located in mallee habitat during the same time period rather than at different times throughout the year. Vegetation clearing/trimming along the easement may need to be carried out to prevent vegetation encroaching into the vertical clearance zone underneath the transmission line conductors. This is unlikely across much of the Project area as vegetation canopy is mostly well below the height at which this is of concern.

Human access for recreation using upgraded tracks along the alignment can be prevented on entering private land through the installation of locked gates and appropriate signage once construction is completed.

6.4. Impact assessment

An environmental impact is any change, positive or negative, to environmental, social and economic values expected as part of planned activities associated with the construction and operation of the Project. Unlike environmental risks, environmental impacts are certain to occur if the Project proceeds.

The impact assessment has considered each identified impact event and predicted the expected impact, taking into account any expected reduction in the magnitude of impacts as a result of the planned control measures. The impact assessment considered the scale, intensity, duration and frequency of impacts and the sensitivity of the receptor. Impacts have been categorised with reference to the descriptors in Table 3 which are taken from Chapter 8 of the EIS. In determining the consequence of impacts, effects on both habitat and birds themselves are considered.

Table 3: Categorisation of impact consequence

Consequence Category	Listed mallee bird species
Negligible	Insignificant effect.
Minor	Local short-term decrease in abundance with no lasting effects on regional population.
Moderate	Local long-term decrease in abundance without reduction in regional population viability.
Major	Regional long-term decrease in abundance and/or local loss resulting in reduction in regional viability.
Catastrophic	Regional extinction of the species.

Sources of uncertainty create a risk that the impacts on environmental values may be greater than expected. Uncertainties in the impact assessment can derive from :

- Quality of site-specific data available
- The reliability of any modelling undertaken in the impact assessment
- Control measures not being as effective as expected

The level of certainty in relation to the predicted impacts has been rated based on the factors shown in Table 4.

This report identifies the level of certainty in the impacts that it predicts. Risk assessment tools are then used in the EIS by others to evaluate impact events with a 'Low' or 'Medium' level of certainty, and in all cases where there was no expected impact but a material impact could potentially occur.

Table 4: Rating level of certainty for threatened mallee bird impacts

Level of Certainty	Quality of data	Extent to which Modelling has been Validated	Effectiveness of Design Measures	Effectiveness of Management Measures
High	Comprehensive data. Further studies are unlikely to generate additional information that would change the conclusions reached in the impact assessment.	Excellent baseline data available.	Widely used and demonstrated to be effective at a range of infrastructure sites including sites with similar topographical /climatic conditions. Requires minimal checking and failure risk has been shown to be low.	Management measures are considered routine and used effectively throughout industry. Reduction in the level of impact from an unmitigated level does not rely primarily on the management measures.
Medium	Some site-specific information available to provide ground-truthing of regional desktop information. Further studies could change some of the conclusions reached in the impact assessment.	Some baseline data available. Model shows a reasonable approximation of real conditions but relies on a number of assumptions and sufficient data not available to demonstrate the model accurately portrays seasonal conditions.	Has been used at sites with similar conditions but requires regular checking or maintenance to ensure performance. Has only been used at limited sites. OR Effectiveness has not been established in the long term or at sites similar to the Project site.	Management measures have been effectively used at a limited number of sites and have not been demonstrated at similar sites or in the long term and/or reduction in the level of impact from an unmitigated level relies primarily on the management measures.
Low	Minimal site-specific data available. Reliance on regional desktop studies that may not accurately reflect site conditions. Low level of confidence	Minimal baseline data. Model is unable to be validated with current data.	Measures are novel and have not been demonstrated in the field.	Management measures are novel and/or heavily reliant on specialised technical expertise.

Level of Certainty	Quality of data	Extent to which Modelling has been Validated	Effectiveness of Design Measures	Effectiveness of Management Measures
	in the impact assessment.			

Table 5: Impact assessment

Impact Event	Consequence	Comments	Certainty
Black-eared Miner			
Removal of habitat	Minor to Moderate	Alignment modified to avoid impacts on habitat in areas where Black-eared Miner has been recorded most recently, including during the current, targeted survey. Black-eared Miners may remain where the new alignment occurs but advice from DEW indicates habitat here is less suitable.	High
Fragmentation and degradation of habitat	Moderate	About half of all clearing will be temporary and revegetation of temporary impact areas will reduce fragmentation. There is a possibility Yellow-eared Miner may enter new cleared areas and hybridise with Black-eared Miners but evidence indicates hybrid birds are already present in the impact area. The rate of hybridisation near the alignment may increase as a result of the project.	Medium to High
Environmental weed invasion	Minor	The Construction Phase EMP will reduce the likelihood that weeds will be introduced. Revegetation of temporarily disturbed areas will reduce weed invasion opportunities. Use of new access tracks by recreational vehicles may accelerate weed introduction to adjacent habitat. New access tracks should be effectively locked and public access restricted.	High

Impact Event	Consequence	Comments	Certainty
Increased risk of predation	Minor	The Construction Phase EMP will include protocols for waste control that prevent foxes from accessing waste food. New access tracks may increase fox and other predator activity in immediately adjacent habitat but the extent of this will be limited to the track and its immediate environs.	High
Injury or mortality of threatened Black-eared Miner.	Minor	Speed limits in key areas of potential habitat should apply Induction and oversight of construction personnel should ensure this is adhered to.	High
Disturbance during construction (noise, activity and dust)	Minor	Peak activity at any locality expected to last up to several weeks, with several periods of construction to install each component of the transmission line (towers and foundations, then stringing wires, then site rehabilitation and revegetation). Dust suppression measures to be used during this construction period.	High
Disturbance during operation	Minor	Increased vehicle activity along new access tracks may permanently increase recreational vehicle activity and associated noise, activity and dust. Unauthorised track access may occur during the operational phase of the project. New access tracks should be effectively locked and public access restricted.	Medium to high
Malleefowl			
Removal of habitat	Minor	Where Malleefowl has been intensively surveyed it is found to occupy most of the habitat surveyed (see Figure 8).	High

Impact Event	Consequence	Comments	Certainty
		Removal of habitat likely to represent a smaller proportion of suitable habitat for this species that the previous species.	
Fragmentation and degradation of habitat	Minor	Malleefowl persist near access tracks and are not at risk of hybridisation. Fragmentation of the scale proposed is not likely to be of significant consequence for this species.	High
Environmental weed invasion	Minor	The Construction Phase EMP will reduce the likelihood that weeds will be introduced. Revegetation of temporarily disturbed areas will reduce weed invasion opportunities. Use of new access tracks by recreational vehicles may accelerate weed introduction to adjacent habitat. New access tracks should be effectively locked and public access restricted.	High
Increased risk of predation	Minor to Moderate	The Construction Phase EMP will include protocols for waste control that prevent foxes from accessing waste food. New access tracks may increase fox and other predator activity in immediately adjacent habitat but the extent of this will be limited to the track and its immediate environs. Malleefowl chicks are particularly vulnerable to fox predation and this impact may have local population consequences.	High
Injury or mortality of Malleefowl.	Minor	As a ground-dwelling bird, Malleefowl is particularly vulnerable to collision with vehicles on access tracks. Speed limits in all areas of potential habitat should apply. Induction and oversight of construction personnel should ensure this is adhered to.	High

Impact Event	Consequence	Comments	Certainty
Disturbance during construction (noise, activity and dust)	Minor	Peak activity at any locality expected to last up to several weeks, with several periods of construction to install each component of the transmission line (towers and foundations, then stringing wires, then site rehabilitation and revegetation). Dust suppression measures to be used during this construction period.	High
Disturbance during operation	Minor	New access tracks may permanently increase recreational vehicle activity and associated noise, activity and dust. Unauthorised track access may occur during the operational phase of the project. New access tracks should be effectively locked and public access restricted.	High
Striated Grasswren			
Removal of habitat	Minor to Moderate	Location of current populations of this species are not known, and the extent of its decline is poorly understood. The species may persist in areas along the alignment despite anecdotal evidence of a widespread decline. It was not detected during any of the targeted surveys.	Medium
Fragmentation and degradation of habitat	Minor	Location of current populations of this species are not known, and the extent of its decline is poorly understood. This species remains in dense cover and wide gaps (20 metres or more) in habitat may prevent movements. Temporary clearance may temporarily halt movements in some areas although movements will return after revegetation.	Medium

Impact Event	Consequence	Comments	Certainty
Environmental weed invasion	Minor	The Construction Phase EMP will reduce the likelihood that weeds will be introduced. Revegetation of temporarily disturbed areas will reduce weed invasion opportunities. Use of new access tracks by recreational vehicles may accelerate weed introduction to adjacent habitat. New access tracks should be effectively locked and public access restricted.	High
Increased risk of predation	Minor	Species' preference for dense cover makes additional predation pressure of minor to moderate consequence The Construction Phase EMP will include protocols for waste control that prevent foxes from accessing waste food. New access tracks may increase fox and other predator activity in immediately adjacent habitat but the extent of this will be limited to the track and its immediate environs.	High
Injury or mortality of birds.	Minor	The Striated Grasswren occurs in low cover and flies low across narrow gaps, making it particularly vulnerable to collision with vehicles on access tracks. Speed limits in all areas of potential habitat should apply. Induction and oversight of construction personnel should ensure this is adhered to.	High
Disturbance during construction (noise, activity and dust)	Minor	Peak activity at any locality expected to last up to several weeks, with several periods of construction to install each component of the transmission line (towers and foundations, then stringing wires, then site rehabilitation and revegetation).	High

Impact Event	Consequence	Comments	Certainty
		Dust suppression measures to be used during this construction period.	
Disturbance during operation	Minor	New access tracks may permanently increase recreational vehicle activity and associated noise, activity and dust. Unauthorised track access may occur during the operational phase of the project. New access tracks should be effectively locked and public access restricted.	High
Red-lored Whistler			
Removal of habitat	Minor	Historical and current survey records show occurrence along alignment is limited (see Figure 3). In this area, alignment is located partly on existing, cleared track	High
Fragmentation and degradation of habitat	Minor	Where species occurs, alignment is located partly on existing, cleared track	High
Environmental weed invasion	Minor	The Construction Phase EMP will reduce the likelihood that weeds will be introduced. Revegetation of temporarily disturbed areas will reduce weed invasion opportunities. Use of new access tracks by recreational vehicles may accelerate weed introduction to adjacent habitat. New access tracks should be effectively locked and public access restricted.	High

Impact Event	Consequence	Comments	Certainty
Increased risk of predation	Minor	The Construction Phase EMP will include protocols for waste control that prevent foxes from accessing waste food. New access tracks may increase fox and other predator activity in immediately adjacent habitat but the extent of this will be limited to the track and its immediate environs.	High
Injury or mortality of birds.	Minor	The Red-lored Whistler inhabits the canopy and understorey shrubs of heathy mallee vegetation and flies generally at or above the height of vehicles. Speed limits in all areas of potential habitat should apply. Induction and oversight of construction personnel should ensure this is adhered to.	High
Disturbance during construction (noise, activity and dust)	Minor	Peak activity at any locality expected to last up to several weeks, with several periods of construction to install each component of the transmission line (towers and foundations, then stringing wires, then site rehabilitation and revegetation). Dust suppression measures to be used during this construction period.	High
Disturbance during operation	Minor	New access tracks may permanently increase recreational vehicle activity and associated noise, activity and dust. Unauthorised track access may occur during the operational phase of the project. New access tracks should be effectively locked and public access restricted.	High

Impact Event	Consequence	Comments	Certainty
Regent Parrot			
Removal of habitat	Minor	Mallee woodland foraging habitat for the Regent Parrot is widespread. Historical and current survey records show occurrence along alignment is limited.	High
Fragmentation and degradation of habitat	Minor	Additional tracks and temporary widening of existing tracks is unlikely to limit the movements of this highly mobile species. Temporarily cleared areas will be revegetated.	High
Environmental weed invasion	Minor	The Construction Phase EMP will reduce the likelihood that weeds will be introduced. Revegetation of temporarily disturbed areas will reduce weed invasion opportunities. Use of new access tracks by recreational vehicles may accelerate weed introduction to adjacent habitat. New access tracks should be effectively locked and public access restricted.	High
Increased risk of predation	Minor	The Construction Phase EMP will include protocols for waste control that prevent foxes from accessing waste food. New access tracks may increase fox and other predator activity in immediately adjacent habitat but the extent of this will be limited to the track and its immediate environs.	High
Injury or mortality of birds.	Minor	Speed limits in all areas of potential habitat should apply. Induction and oversight of construction personnel should ensure this is adhered to.	High

Impact Event	Consequence	Comments	Certainty
Disturbance during construction (noise, activity and dust)	Minor	Peak activity at any locality expected to last up to several weeks, with several periods of construction to install each component of the transmission line (towers and foundations, then stringing wires, then site rehabilitation and revegetation). Dust suppression measures to be used during this construction period.	High
Disturbance during operation	Minor	New access tracks may permanently increase recreational vehicle activity and associated noise, activity and dust. Unauthorised track access may occur during the operational phase of the project. New access tracks should be effectively locked and public access restricted.	High

7. Conclusions

This report presents the results of a detailed targeted threatened mallee bird survey of the proposed 205-kilometre South Australian component of Project Energy Connect. The surveys focussed on the Murray Mallee region of the state, representing the central and eastern parts of the surveyed alignment. A total of 56 sites were surveyed and 112 kilometres of transect walked (2 km per site). Five species of concern were targeted: Malleefowl, Black-eared Miner, Red-lored Whistler, Striated Grasswren and Regent Parrot. Of these, Black-eared Miner was found in seven places, Red-lored Whistler in one and indirect evidence (footprints) of Malleefowl in one. No Striated Grasswren or Regent Parrot were recorded.

These records supplemented existing records, which were also mapped. Based on these findings, it was concluded that the central and eastern parts of the current alignment that supported more or less continuous mallee woodland vegetation were the most important areas for these threatened species. The alignment of October 2019 was altered to avoid areas of dense mallee habitat in the central part of the alignment with records of Black-eared Miner from the last 20 years, significantly reducing impacts on the core habitats of this endangered bird.

This report also identified potential impact events associated with both the construction and operational phases of the project. Most impacts during construction (e.g. disturbance) could be readily managed through appropriate control measures and were considered mostly temporary and manageable. Permanent impacts were restricted to the disturbance of approximately 1.5 hectare of habitat per kilometre of the alignment. In view of the extensive availability of habitat nearby and having regard to the choice of route, which follows existing, cleared access tracks and has been realigned to avoid recently used habitats in the central part of the alignment and the proposed control measures, it was concluded that the project is unlikely to lead to unacceptable increased impacts to threatened mallee birds.

A key control measure during construction and operational phases will be the prevention and control of fire. Many mallee birds, including the threatened species, depend on particular stages in post-fire succession and in many cases, very much on old-growth mallee vegetation up to 40 or more years since burning. Whereas all other impacts were considered localised to the alignment, an outbreak of fire has the potential for catastrophic consequences for threatened mallee birds, particularly if it broke out during high fire risk weather and caused extensive habitat loss and death of birds. The development and strict implementation of a fire prevention and control plan for the project is considered essential if this key residual risk of the project is to be controlled effectively.

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Review of Potential Impacts to Wetland Birds

JBS&G

project energy connect

EnergyConnect

Review of Potential Impacts to Wetland Birds

ElectraNet

29 March 2021

Jacobs

EnergyConnect, SA

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Contents

Executive Summary

ElectraNet are proposing a high voltage transmission line between South Australia and New South Wales known as Project EnergyConnect. The transmission line will comprise a 275 kV double circuit single conductor transmission line between the existing Robertstown and proposed Bundey substations, and a 330kV double-circuit transmission line with twin conductors between Bundey substation to the SA/NSW border. The line will be supported by steel lattice towers, typically 45-65 m in height. Approximate distances between towers would be 400-600 metres.

A number of environmental studies have been undertaken for the project to date, including initial desktop and field ecological constraints assessments and a significant impact assessment report (which was submitted as a component of the EPBC Act referral) (Jacobs 2019a). These studies along with a previous Environmental Impact Assessment in 2002 for the South Australia to NSW Interconnector (SNI), which did not proceed (SKM 2002) discussed the proximity of the proposed alignment to an internationally important Ramsar Wetland (the 'Riverland' wetland complex) and potential impacts to birds that may occur in the wetland as a result of bird strike. An earlier working paper for the original impact assessment, Carpenter (2002) provided more context and detail about potential impacts to bird types and species that would utilise the Riverland wetland habitat, but concluded that significant impacts as a result of the SNI project were unlikely. Birds that were considered included waterbirds, migratory and resident shorebirds and raptors.

This report builds on the information and discussion provided in Carpenter (2002), summarising more recent bird count data, bird recovery data, inundation extent and frequency of the key lakes in the Riverland wetland complex, and considers the likelihood and consequences of potential impacts to birds of the Riverland wetland as a result of Project EnergyConnect. Whilst it is acknowledged that there are a number of direct impacts that could affect wetland birds in the vicinity of the project (e.g. habitat impacts, alienation, barriers and fragmentation) the focus here is collision with the transmission line. This report considers the potential for collision impacts (the Project alignment avoids direct impacts to wetlands of the Riverland wetland complex). Mitigation measures which have been employed on transmission line and electrical infrastructure projects elsewhere are also discussed.

Seventy three species with previous records of occurrence in the Riverland wetland complex were considered here (plus an additional species with known regional records), although only 38 of these species have been regularly recorded during monthly count surveys at key lakes within the complex. The 38 species that are more regularly recorded at the complex are considered to be more likely to be at potential risk of interaction with the project (e.g. via bird strike with the transmission line) as a result of their regular presence. Factors considered to influence the likelihood of collision are considered, including body size, dispersal timing, flight type, maximum local counts within the wetland lakes and historical evidence of collision with powerlines within Australia and South Australia. Factors which influence the consequences of any collisions are also considered per species, including conservation status and population estimates (based on IUCN criteria).

Similar to earlier discussion papers for this project (e.g. Carpenter 2002), species considered at elevated likelihood of collision here include those with large wing span / body size, heavy non-agile or flocking fliers and those that disperse at night. Also as per previous investigations, the consequences of any infrequent collisions for the majority of these species is considered to be low, given their large global and regional population numbers (i.e. impacts are proportionately very small). Species that are considered to have elevated consequence of a collision (should one occur) are generally conservation significant species with smaller global or regional populations sizes. The high level risk assessment presented here considered likelihood and consequence factors to determine an overall risk to each species from collision with transmission lines. Based on this approach, species with the highest elevated risk would be those with higher likelihood of collision and higher consequence of any collision to the species.

The high level risk assessment (i.e. factors were not weighted) determined that no threatened species were considered to be at an overall high risk from collision with powerlines. Species with medium overall risk from collision included state-rated species Freckled Duck and White-bellied Sea-eagle. Species with low overall risk from collision included three EPBC listed species (Curlew Sandpiper, Australian Bittern, Painted Snipe) and two

state-rated species (Banded Stilt, Peregrine Falcon). In addition, whilst low (to moderate) risks were determined for these species, the potential impacts from collision with the transmission line are not expected to represent significant impacts to any of the threatened species when considering EPBC significant impact criteria, or applying similar principles to state listed species.

The risk assessment also considered migratory species. No migratory species were considered to be at overall moderate or high risk from collision. Four migratory species were considered to be at low risk from collision. Similar to threatened species, when considering overall risk to migratory species against DoEE (2017) significant impact criteria, the Project is not considered likely to have a significant impact on migratory species, as a result of collision with powerlines.

In addition to species-specific features mentioned above, further factors considered to influence the likelihood of collision include inundation frequency of wetland habitat within the site and distance to the powerline. Infrequent inundation and larger distances to the line are considered to reduce the likelihood that birds that inhabit the wetland will collide with the transmission line. Infrequent inundation across large portions of the wetland site results in bird presence at the site not being constant, and partial inundations generally result in increased distances of water bodies from the transmission line, with only the rarest inundation events filling the wetland's outer extents. The highest likelihood of collision (thus elevating overall risk) would be during widespread inundation events which are very infrequent. The vast majority of the wetland complex is well over 1 km from the transmission line corridor, with only small portions of the wetland complex (which are periodically inundated) being closer.

Documented studies indicate that impacts to birds from transmission lines can be lowered through implementation of mitigation measures including installation of line markers (reflective and non-reflective), conductor configuration and spacing of towers. A number of these mitigation measures are available to ElectraNet for Project EnergyConnect and are expected to reduce risks of collisions if implemented.

As with previous studies undertaken for transmission lines in this location (e.g. Carpenter, 2002), it is concluded that with the implementation of effective mitigation measures, the likelihood of collision with a transmission line is considered to be relatively low, although remains a possibility. However, consequences to individual species are not considered to be significant when overall population numbers are considered. Available evidence from bird strike data indicates no substantial mortality rates directly attributable to transmission lines from collisions, and the project does not directly or indirectly disturb or alter habitat or hydrological regime within the Riverland Ramsar site. Species present within the Riverland Wetland complex are generally present in relatively low numbers compared with regional, national and global populations estimates, and the possibility of occasional mortality as a result of the project does not represent a significant impact to any species present, when assessed against with EPBC Significant Impact Criteria (for both threatened and migratory species).

1. Introduction

1.1 Description of project and proposed route

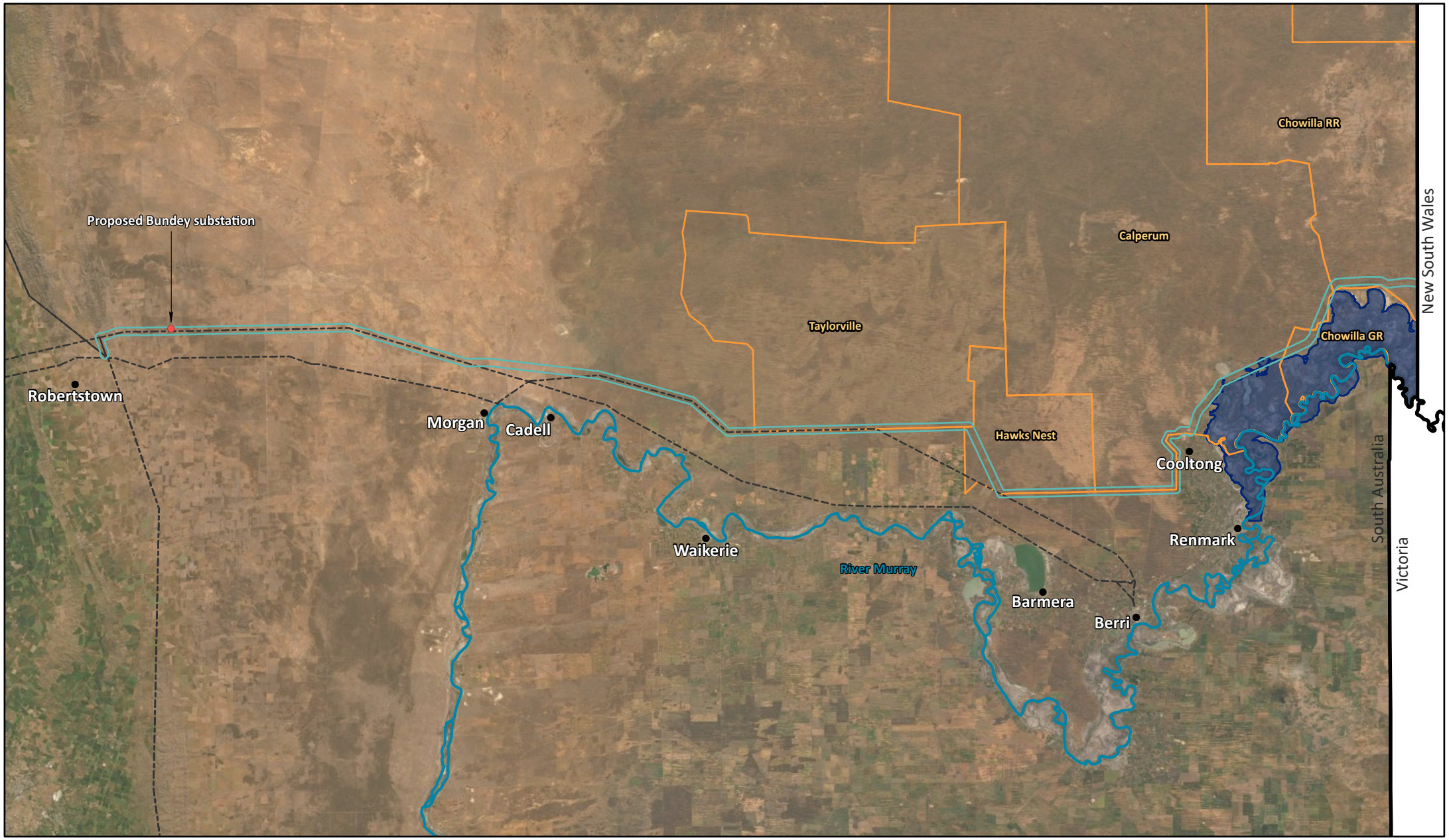
Project EnergyConnect is proposed to strengthen the national electricity transmission network by providing connection between SA and NSW. The preferred alignment for Project EnergyConnect runs between Robertstown in South Australia to Wagga Wagga in New South Wales (NSW), ElectraNet would be responsible for constructing and operating the SA component of Project EnergyConnect from Robertstown to the SA / NSW Border (the Project). In South Australia, the length of the project is approximately 205 km. The transmission line will comprise a 275kV double circuit single conductor transmission line between the existing Robertstown and proposed Bundey substations, and a 330kV double-circuit transmission line with twin conductors between Bundey substation to the SA/NSW border. The line will be supported by steel lattice towers, typically 45-65 m in height. Approximate distances between towers would be 400-600 metres.

Whilst the majority of the alignment in SA traverses agricultural land and follows existing transmission line easements, the alignment does traverse or run adjacent to a number of conservation reserves. Stations within the eastern part of the Riverland Biosphere Reserve in particular represent potential elevated ecological risk, as they include a wetland site of international importance (Ramsar listed), the Riverland Wetland complex. The complex, and the avifauna supported by it, is the focus of this report. The proposed EnergyConnect transmission line corridor is located predominantly north of the floodplain and the northern boundary of the Riverland Wetland complex, where the line corridor traverses, on higher ground on the northern side of the Old Wentworth Road / Renmark-Wentworth Road, for approximately 36 km. It does not cross any areas that are regularly inundated, but crosses three areas of upper floodplain (approximately 170 m, 480 m and 1.3 km in length) that are inside the Ramsar site boundary, and were flooded in the 1956 flood and may be flooded again in extreme flood events. A total of approximately 12.2 km of the proposed alignment is located within 1 km of lakes and swamps subject to reasonably frequent inundation (i.e. 1 in 10 (or less) years). Figure 1 below presents an overview of the study area.

1.2 Purpose of report

The aim of this report is to summarise available avifauna data and relevant information to assist with better understanding the potential risks to wetland avifauna as a result of Project EnergyConnect (Robertstown to SA/NSW border). This will be achieved by:

- Review of existing data and previous studies for the Ramsar listed Riverland wetland site and surrounding areas in proximity to the EnergyConnect project alignment (e.g. South Australian to NSW Interconnector Environmental Impact Studies (SNI EIS) studies (SKM 2002), relevant literature from various Chowilla studies, Biological Database of South Australia (BDBSA) data, Protected Matters Search Tool (PMST) tool data, bird count data, bird recovery data) to provide a consolidation of recent migratory bird / wetland bird information.
- Develop summary tables of important species previously recorded at the Riverland wetland site, and provide information on maximum counts reported at the site, along with global and/or regional population context.
- Review available literature and other data regarding risks posed by transmission lines and electrical infrastructure on avifauna.
- Based on risks identified, develop species specific risk factors for the important species identified as occurring at the Riverland wetland site.
- Considers the collated information in the context of potential risks to avifauna known to occur at the Riverland Wetland site as a result of the project.



Transmission line corridor
Riverland Ramsar wetland
Pastoral lease
Existing ElectraNet transmission line
River Murray
Proposed Bundey substation

Figure 1
Study Area - Ramsar listed Riverland wetland complex

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2. Methods

A desktop assessment was undertaken to inform this report, along with insight obtained from vegetation and habitat assessments of the proposed alignment. The assessment involved collation of relevant data for the site, including *Environment Protection and Biodiversity Conservation* (EPBC) Act Protected Matters data (as reported in Jacobs 2019a, b and c), SNI EIS data (e.g. Avifauna Working Paper, Carpenter 2002), BDBSA data for target wetlands, floodplains and riparian areas in close proximity to the site, and other relevant data such as data reports from the Ecological Character Description (ECD) for the site, data collected as part of national shorebird and migratory bird surveys, and national bird recovery data. The aims of the desktop study were to:

- Summarise the project location and conservation context
- Conduct a literature review of risks associated with wetland birds and electrical infrastructure
- Identify key risk factors and potential species at risk for the project location
- Source relevant bird data from target locations where possible, including population estimates or counts and bird impact data
- Tabulate data for birds identified as present within the project area, and collate data regarding global estimates, flight time, reported numbers at target sites, risk factors, where known
- Consider other factors that would influence likelihood and consequence of potential impact (e.g. distance to infrastructure, inundation)
- Consider proposed mitigation measures for the project, revisit and expand upon potential impacts to identified species as a result of the project.

Data reviewed as part of this desktop study included the following:

- EPBC Protected Matters Search Tool (PMST) outputs, as reported in the EPBC Significant Impact Assessment report (Jacobs 2019a).
- BDBSA data for wetlands, floodplain and riparian areas in proximity to the Project EnergyConnect alignment (nominally from Horseshoe Lagoon to the border) (Figure 1).
- SNI EIS and historic technical studies and data, e.g. Carpenter (2002) Avifauna Working Paper.
- Birdlife International Atlas and Birds Australia data and reports, e.g. 2020 shorebird studies and interim reports
- Bird survey data for local lakes within study area (e.g. Ecological Character Description reference, NEWALL et al. 2009)
- ALA bird survey data from aerial surveys (R. Kingsford Eastern Australian Waterbird Survey, ALA 2019).
- General shorebird data from Natural Resource Adelaide Mount Lofty Region (NRALMR)
- Target species information fact sheets and literature for population estimates and life-history information (e.g. Menkhorst et al. 2017, Birdlife International 2019, Birdlife Australia 2019).
- Relevant GIS data, e.g. project footprint, study area,
- Bird banding recovery data from the Australian Bird and Bat Banding Scheme (ABBBS, DAWE 2021).

3. Types of birds occurring in inland wetlands

Wetlands occur in coastal and inland locations and can include a variety of permanent, seasonal or ephemeral freshwater or brackish lakes, with static or flowing water sources. Australian coastal and freshwater wetlands host approximately two million visiting migratory shorebirds from arctic regions during the non-breeding season each year. Coastal habitats and coastal wetlands are known to support shorebirds upon arrival in August (e.g. Roebuck Bay and Eighty Mile Beach in north-western Australian and the Gulf of Carpentaria in Queensland), and by October the birds have dispersed across Australia, either along the coastline (coastal intertidal areas and coastal ephemeral wetlands) or within inland ephemeral wetlands across Australia (DoEE 2019b).

Wetlands typically support a range of bird species that spend all or part of their life cycles within the wetland, providing habitat, food resources and refuge. Bird species which typically occur in wetlands can be split into four broad categories; common waterbirds (e.g. ducks, swans), migratory shorebirds, resident shorebirds, and raptors which predate on both fish in the wetlands and on other birds, eggs or young. Other passerine species that also use wetlands include species such as reed-warblers and grassbirds, along with common woodland species which utilise terrestrial vegetation within the sites, but these species are not considered to be at substantial elevated risk from collision with transmission lines due to their common occurrence, relatively small size and agile flight. They are not considered further here.

Birds that occur in wetland habitats are dependent on a range of food sources within the wetland ranging from aquatic vegetation, aquatic invertebrates and crustaceans, to fish and frogs. Wetland birds can be broadly classified as fish-eaters (large waterbirds which depend on large deep waterbodies, estuaries and lakes); plant eaters (e.g. grazing waterfowl / ducks); invertebrate feeders (e.g. spoonbills, ibis, stilts, sandpipers, plovers, dotterels); diving ducks (e.g. musk ducks, grebes, hardheads); shoreline foragers that feed on invertebrates amongst vegetation (e.g. bitterns, crakes, rails and swamphen) and large waders (e.g. ibis, egret, heron) that feed on a range of prey amongst rushes and sedges.

It is noted that whilst some birds can be classified as both waterbirds and resident shorebirds (e.g. Black Swan, Royal Spoonbill), for the discussion and assessment presented here, birds have been categorised by type separately.

3.1 Waterbirds

Common waterbirds that utilise wetland habitats include ducks, swans, grebes, cormorants, pelicans, egrets and herons, ibis and spoonbills, crakes, rails and waterhens. There are also threatened waterbirds (and shorebirds) that are known to utilise wetland habitats (e.g. Nationally Endangered Australasian Bittern and Australian Painted Snipe). Wetlands can support significant numbers of waterbird species (primarily common species), depending on seasonal conditions or management conditions that alter the hydrological regime of the wetland resulting in preferable conditions.

Colonial nesting waterbirds (e.g. egrets, ibises, pelicans, cormorants and herons) require substantial floods or inundation to support large breeding events in floodplain wetlands. Non-colonial waterbirds (e.g. waterfowl, grebes, crakes, rails and waterhens) do not generally congregate to breed, but are still dependent on wetland habitat for foraging and nesting habitat to raise young (NSW OEH 2018).

Management regimes that can influence waterbird diversity and numbers at wetlands relate to influencing wet and dry cycles, controlling visitor access, removing hunting allowances, predator control and controlling grazing impacts (Carpenter 2002).

3.2 Migratory shorebirds/ marine birds

There are no agreed taxonomic or morphological definitions of a shorebird, but they are generally characterised by their behavioural association with wetlands (coastal and inland). In Australia they are categorised as either migratory or resident (Purnell et al. 2015).

Migratory shorebirds occupy a range of habitats when they visit Australia. Whilst the majority of migratory shorebirds and migratory 'marine' birds which visit wetlands or intertidal areas in coastal areas when they are present in Australia, there are many that will utilise inland wetland habitats. The inland wetland habitats are used as refuge and feeding areas when on route to larger key inland habitats (e.g. Lake Eyre) within Australia, and on route to breeding sites in the northern hemisphere. Common migratory species that utilise inland wetland habitats include greenshanks, sandpipers, turnstone, stints, plovers, terns, and godwits (DoEE 2017, Oldland et al 2009).

There are 37 migratory shorebirds that regularly visit Australia each year which are listed as 'migratory' MNES (Matters of National Environmental Significance) under the EPBC Act (DoEE 2017). Several of these shorebird species are also listed as threatened under the Act, e.g. Curlew Sandpiper, Red Knot, Great Knot, Eastern Curlew. Of these species, only the Curlew Sandpiper is considered to have potential to occur in the Study Area (Jacobs 2019a,b,c; Carpenter 2002).

Migratory shorebirds generally occur in Australia during the non-breeding period from August to late April / May. Upon arrival in Australia they disperse throughout the country to a wide variety of coastal and inland habitats which include:

- Coastal wetlands, estuaries, intertidal mudflats, rocky inlets reefs and sandy beaches (often supporting mangroves)
- Inland wetlands, floodplains and grassland areas, often with ephemeral water sources (including the Riverland wetland complex habitat that occurs near the proposed Project EnergyConnect alignment).

These habitats are important as they allow migratory species to build reserves to support return migration and subsequent breeding, both adult and immature birds. Shorebirds may move between such habitats depending on the time of day, disturbance and environmental conditions. Some of these areas e.g. inland areas, can provide refuge during extreme weather events (e.g. high tides in coastal areas). Some migratory birds aggregate in large multi-species flocks when seeking refuge from high tide, whereas other species (e.g. Latham's Snipe) will disperse in small numbers across wide areas of habitat within Australia (DoEE 2017).

Migratory shorebirds that disperse to non-tidal wetlands (inland systems) tend to show more dispersive behaviour than species that refuge in coastal mangrove areas during high tide (e.g. Whimbrel, Terek Sandpiper and Grey-tailed Tattler). Inland wetlands and grasslands that are important for migratory shorebirds are generally ephemeral, hence occupation varies depending on recent climate and rainfall. Some of these areas may not be used for several years, but are then very important and productive following rain (e.g. Lake Eyre in northern South Australia) (DoEE 2017).

3.3 Resident shorebirds

Seventeen shorebirds spend their entire lives within Australia and are known as residents (Oldland et al. 2009). Resident shorebirds of Australia occupy and breed in a wide variety of different habitats and wetland types. For example some nest exclusively on beaches (Beach Sone-Curlew, Hooded Plover), or rocky coasts (Sooty Oyster Catcher). The Endangered Australian Painted Snipe breeds on ephemeral freshwater wetlands and the Banded Stilt prefers hypersaline lakes. Banded Stilts will only nests in rare years following heavy rains which flood inland salt lakes, and when this occurs the entire Australian population may congregate into a large breeding colony. There are also other resident shorebirds that nest in grasslands (Plains Wanderer), woodlands (Bush Stone-curlew) and urban landscapes (Masked Lapwing) (Oldland et al. 2009).

Whilst individual resident shorebirds spend their entire lifecycle in Australia, most also have global / migratory representation (Birdlife International 2019).

Ten of the 17 shorebirds that utilise inland wetland habitats and have been recorded within the Ecological Study Area in proximity to the transmission line corridor include stilts (Black-winged and Banded), Red-necked Avocet,

Red-capped Plover, Dotterels (Black-fronted, Inland and Red-kneed), Lapwings (Banded and Masked) and the Australian Painted Snipe.

3.4 Raptors

Other bird species that are also dependent on wetlands for part or all of their life cycle include raptors such as the Swamp Harrier and White-bellied Sea-eagle. Whistling Kites also occur in wetlands that are connected to large inland rivers. Raptors will utilise a variety of habitats within wetlands, depending on their specific prey. They will forage (aerially) over well vegetated areas with waterbird nests, preying on young birds, eggs, lizards, fish and amphibians, and (piscivores) (fish-eaters) will depend on large open, deep waterbodies such as estuaries, lakes and waterholes to search for prey. The two main raptors discussed here are those with records within the Ramsar Wetland complex Data.

Swamp Harriers are widespread in wetlands and adjacent areas, rarely far from water. They generally forage low over the water or floodplain ground areas, preying on small mammals, ground-birds and waterbirds. Their nests are on the ground in deep swamps with extensive reedbeds and rushes. Individuals that occur on the mainland (as opposed to Tasmania) make relatively local movements (Menkhorst et al. 2017). Whilst the species' distribution occurs over most of Australia (excluding south to central WA and western SA), the study area is known as an area of regular occurrence (Menkhorst et al. 2017).

White-bellied Sea-eagles are generally coastal, but will occur along inland rivers. Most known nesting pairs occur along the coastlines of Australian (Dennis et al. 2011). They are known to patrol beaches and inshore habitats including coastal reaches of rivers and large inland waterbodies, preying mostly on fish, but will also prey on large waterbirds, turtles, rabbits and flying-foxes. The species' distribution occurs over most of Australia, particularly coastal areas and excludes south to central inland WA and inland NT and most of inland SA, the study area is known as an area of regular occurrence (Menkhorst et al. 2017). At inland sites they also require tall vegetation (e.g. River Red Gums) to perch and roost, or cliff tops similar to coastal habitats.

4. Wetland environments and Project EnergyConnect

4.1 Australian Context

Wetlands occur across Australia ranging from tidal /coastal wetlands to permanent or ephemeral inland wetlands. There are also significant artificial wetlands which provide important habitat to wetland species, particularly shorebirds and waterbirds. In Australia, the most important wetlands are those listed under the Ramsar Convention on Wetlands of International Importance. There are 65 Ramsar listed wetlands in Australia covering greater than 8.3 million hectares (DoEE 2019).

There are six Ramsar Wetlands in SA (DotE 2013), totalling 2,355,529 ha. These include:

- Coongie Lakes (2,178,952 ha)
- Banrock Station Wetland complex (1,375 ha)
- Riverland (30,640 ha)
- Coorong and Lakes Alexandrina and Albert (140,500 ha)
- Bool and Hacks Lagoon (3,200 ha)
- Piccaninnie Ponds Karst Wetlands (862 ha)

There are 904 wetlands listed in the Directory of Important Wetlands in Australia, totalling 57,904,254 ha, which includes the Ramsar wetlands discussed above. Of this estimate, 7.3% occur in South Australia (~ 4,225,000 ha) (DEWR 2006). Wetland habitats are considered internationally important (DoEE 2017) if:

- they regularly support 1% of the individuals in a population of one species or subspecies of waterbird OR
- a total abundance of at least 20,000 waterbirds

Wetland habitats are considered nationally important for migratory shorebirds (DoEE 2017) if they regularly support:

- 0.1% of the flyway population of a single species of migratory bird OR
- 2000 migratory shorebirds OR
- 15 migratory shorebird species

The Ramsar listed Riverland wetland complex is the most relevant significant wetland environment to Project EnergyConnect given the alignment runs within close proximity to this site's northern border and intersects the border in several locations. The Banrock Station Wetland complex is over 10 km from the alignment, and the other Ramsar listed wetlands in South Australia are all distant from the project alignment.

4.2 Riverland Wetland Complex

The Ramsar listed Riverland wetland complex extends 80 km along the Murray River, from the town of Renmark in South Australia to the Victorian and New South Wales border. It is approximately 30,640 ha in size. The site incorporates a series of creeks, channels, lagoons, billabongs, swamps and lakes, bordered by extensive stands of River Red Gums and Black Box. Nationally threatened species include the Regent Parrot, Murray Cod, Murray Tortoise and Southern Bell Frog. The site also contains 11 of the 12 vegetation communities found within the Riverina biogeographical region, such as Black Box woodland (Newall et al. 2009).

The whole of the Riverland site is also within the Riverland Biosphere Reserve and contains land components known as Murtho, Calperum and Chowilla (noting that only fractions of the larger Calperum Station and Chowilla Reserves occur within the complex) (Newall et al. 2009).

The Project EnergyConnect alignment is located predominantly north of the Riverland wetland complex boundary, on the northern side of Wentworth-Renmark Road. It passes near the Ramsar site boundary for approximately 36 km, and crosses three areas (approximately 170 m, 480 m and 1.3 km in length) that are included in the Ramsar wetland boundary. These areas were flooded in the 1956 River Murray flood (the largest flood on record, which was used to define the wetland boundary) and could potentially be flooded in extreme flood events. Portions of the alignment (a total of approximately 12.2 km) run within one kilometre of individual lakes and swamps which can be expected to be inundated regularly (between 1 in 3-5 years and 1 in 10 years, depending on the individual water habitat feature).

4.2.1 Ramsar listing

To qualify for a Ramsar listing, a site must meet one or more of the nine criteria established under the Ramsar Convention which demonstrate the environmental and ecological value of the site. Once listed, each Ramsar site has a documented 'Ecological Character Description' (ECD) which provides background information about the site, and provides the evidence for meeting the Ramsar criteria (Newall et al. 2009). The Riverland wetland site was first listed in 1987 against (then) criteria 1a, 1b, 1c, 3b of the Ramsar Convention. The criteria were revised in 1999 and the site is now listed against criteria 1-8 (see Table 1 below). The ECD for the site was compiled 20 years after the listing, but reflected the site at the time of listing (Newall et al. 2009). It is noted that at the time of the original listing, only two criteria were actually met, and the additional criteria were aspirational targets (e.g. Criterion 5 relating to waterbird numbers or number of species).

Of relevance to this report, the Riverland wetland complex is listed as a Ramsar wetland because it is an important habitat for a large number of migratory and waterbirds. The site provides habitat that regularly supports large populations of Freckled Duck, Red-necked Avocet and Red-kneed Dotterel. Numbers of these species recorded at Lake Merreti have, at times, been greater than 1% of the estimated global population (DEW 2009).

It is noted that the ECD (updated 2009) reported that the hydrological regime of the site since original listing had been influenced by the impacts of riverine regulation, noting that there had been reductions in flooding frequency. It was stated that there had only been one large flood event (e.g. 100 GL/d) in the 20 years post listing compared to three large flood events in the 20 years prior to listing (Newall et al. 2009). This, and a number of other factors, have been influential in the site now being part of a managed inundation program, where parts of the site is 'artificially' flooded every 3-5 years (DEW pers. Comm) to assist with maintaining the long-term health and ecological value of the site.

Table 1: Riverland Wetland Site Ramsar Listing Criteria (Newall et al. 2009)

Criterion #	Criteria Description	Comment
Criterion 1:	A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate bioregion.	The Riverland Ramsar site is a representative example of a major floodplain system within the Murray Scroll Belt Subregion of the Riverina Biogeographical Region of the Murray Darling Basin. One of the only parts of the lower River Murray floodplain not used for irrigation (within the Chowilla Floodplain), preserving much of its natural character. An excellent regional representative of a major floodplain system within the lower River Murray floodplain.
Criterion 2:	A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.	The site supports nationally threatened species such as the Regent Parrot, Southern Bell Frog and threatened fish (Murray Cod, Murray Hardyhead).
Criterion 3:	A wetland should be considered internationally important if it supports populations of plant	The Riverland Ramsar site contains a diverse range of habitat types and supports elements of biological diversity that are rare

	and/or animal species important for maintaining the biological diversity of a particular biogeographic region.	and particularly characteristic of the biogeographical region. In addition, twenty eight species of plants threatened in the state occur in the Ramsar site.
Criterion 4:	A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.	Riverland provides critical summer or stopover habitat for migratory birds listed under international agreements for the protection of migratory birds in danger of extinction and their environment (e.g. Sharp-tailed Sandpiper, Curlew Sandpiper, Red-necked Stint, Eastern (Great) Egret, Caspian Tern, Glossy Ibis, Greenshank). In addition, the site also provides important habitat for nationally significant waterbirds and bush-birds during times of dry climate conditions. Species known to have breeding events at the site include Strawneck Ibis, Australian Ibis, Yellow-billed Spoonbill, Royal Spoonbill, Darter, Pied Cormorant, Little Black Cormorant, Little Pied Cormorant, Black Swan
Criterion 5:	A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.	The site regularly supports 20,000 or more waterbirds involving fifty-nine species. At the time of initial listing there was insufficient data to meet this criteria. However, more recent data indicated occasions where more than 20,000 birds were estimated to be using the site (e.g. in 2002 Goodfellow and Harper *Pers. Comm* cited in Newall et al. 2009). It is noted that the criteria define 'regular' as two thirds of the seasons for which adequate data are available, the total number of seasons being not less than three or the mean of the maxima of those seasons in which the site is internationally important, taken over at least five years, amounts to the required level (means based on three or four years may be quoted in provisional assessments only). Examples include Feb 2002 (>23,000 birds), May 2001 (> 18,500 birds) and (> 19,000) in March 2001 all only at one of the Lakes (Merreti) in the area (Newall et al. 2009, part A p51).
Criterion 6:	A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.	At the time of the initial listing insufficient data was available, but more recent data indicates criteria is met. The Riverland Ramsar site provides habitat that regularly supports large populations of Freckled Duck, Red-necked Avocet and Red-kneed Dotterel. Numbers of these species recorded at the site (at times) represent greater than 1% of the estimated global population. E.g. Freckled Duck 1% of Global populations is 200, Red-kneed Dotterel 1 % of Global Populations is 260, Red-necked Avocet 1% of the Global Population is 1,100. These three species are the key species used to support the listing under this criterion and it was recommended that future monitoring be undertaken to confirm the listing.
Criterion 7:	A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.	Riverland supports 16 of the 26 species of freshwater native fish species represented within the Murray-Darling Basin.
Criterion 8:	A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.	The Chowilla Anabranch within the Riverland wetland is an important pathway for the migration of Golden Perch and Silver Perch around Lock 6 on the River Murray. The site also provides fish breeding and nursery habitats for these and other fish species.

4.2.2 Inundation extent

The Riverland wetland complex includes a number of different wetland types, including permanent rivers / streams / creeks, permanent freshwater lakes, seasonal / intermittent freshwater lakes, seasonal brackish / saline lakes, permanent freshwater marshes / pools and freshwater tree dominated wetlands (refer Figure 2).

The boundary of the Riverland Ramsar site is indicatively the extent of inundation during the 1956 flood (considered to be between a 1 in 150 and 1 in 250 year flood event (Bloss et al. 2015)). The transmission line corridor passes predominantly north of the floodplain and the Ramsar site boundary, on higher ground on the northern side of the Old Wentworth Road / Renmark-Wentworth Road, for approximately 36 km. It does not cross any areas that are regularly inundated, and crosses three areas of upper floodplain (approximately 170 m, 480 m and 1.3 km in length) that were flooded in the 1956 flood and could be flooded in extreme flood events. A total of approximately 12.2 km of the proposed alignment is located within 1 km of lakes and swamps subject to reasonably frequent inundation (i.e. 1 in 10 (or less) years. (refer Figure 3 below which indicatively represents a 1 in 10 year inundation scenario, based on comparison to Figure 3.17d of Newall et al. 2009). Inundation frequency of these lakes individually are described further below, noting that the frequency of inundation at each lake varies due to elevation in the site and managed inundation regimes. More detail per lake is as follows:

- Lake Woolpolool (a seasonal saline / brackish lake): The alignment passes approximately 500 m from the highest water level of this lake for around one kilometre (refer Figure 3), with the main part of the lake over a kilometre from the alignment. Historically (pre River Murray regulation), this lake was inundated 9 in 10 years, however post regulation this reduced to approximately 4 in every 10 years (refer Figure 3.17b of Newall et al. 2009), and is thought to have further reduced since the ECD for the site due to reduced rainfall and higher evaporation. However, this lake is now subjected to managed inundation and receives water every 3-5 years by pumping (Daniel Rogers (DEW) Pers. Comm).
- Lake Merreti (permanent freshwater) and Clover Lake (seasonal / intermittent freshwater): The alignment is approximately 500 m from the northern extent of Lake Merreti and a smaller lake to the west for just over one kilometre (refer Figure 3). Approximately 90% of Lake Merreti is more than one kilometre from the alignment and over two-thirds of the lake is more than 2 km away. The alignment is over one kilometre from Clover Lake (refer Figure 2 and Figure 3). Historically Lake Merreti was inundated every year, and Clover Lake was inundated 1 in 10 years. Under the current scenario these lakes now have a managed inundation every 3-5 years by pumping (DEW Pers. Comm).
- Lake Werta Wert (seasonal / intermittent freshwater): A series of small lakes that requires river flows of more than 45,000 ML/d to fill. The inundation scenario for this lake is estimated to be 1 in 5 years (refer Figure 3.17c of Newall et al. 2009). The alignment comes to within 650 m of this lake at the closest point for the scenario shown in Figure 3.
- Coombool Swamp (seasonal / intermittent freshwater): The alignment passes within ~500 m of the lake for approximately 1020 m (refer Figure 3). The swamp is inundated with flows of around 70-80,000 ML/d, which occurs at intervals of every approximately 1 in 10 years under the regulated river scenario (refer Figure 3.17e of Newall et al. 2009).
- Lake Limbra (seasonal / intermittent freshwater): The alignment is over 1 km from the northern boundary of the lake (refer Figure 3). The lake requires flows of 50-60,000 ML/d, which occur approximately 1 in 5 years (refer Figure 3.17d of Newall et al. 2009).
- Other areas: Extensive floodplain inundation occurs at flows over 100,000 ML/d and total inundation is achieved when flows reach over 150,000 ML/day, which are expected to be very rare events.

Flows have exceeded 60,000 ML/d on three occasions in the period from 2000 to 2020 (MDBA (2021). They have not exceeded 100,000 ML/d in that period and the most recent flow over 100,000 ML/d was in 1993. This means that, in most years, large parts of the Riverland wetland site will be dry and not provide habitat for waterbirds. The most frequently inundated areas are likely to occur in Lakes Woolpolool, Merreti and Clover due to their managed inundation. Over 90% of the surface area of these lakes is more than one kilometre from the proposed alignment. Consequently, although the alignment is close to the Ramsar site boundary for

approximately 36 km, there are comparatively few places where the alignment is in the immediate proximity of waterbird habitat.

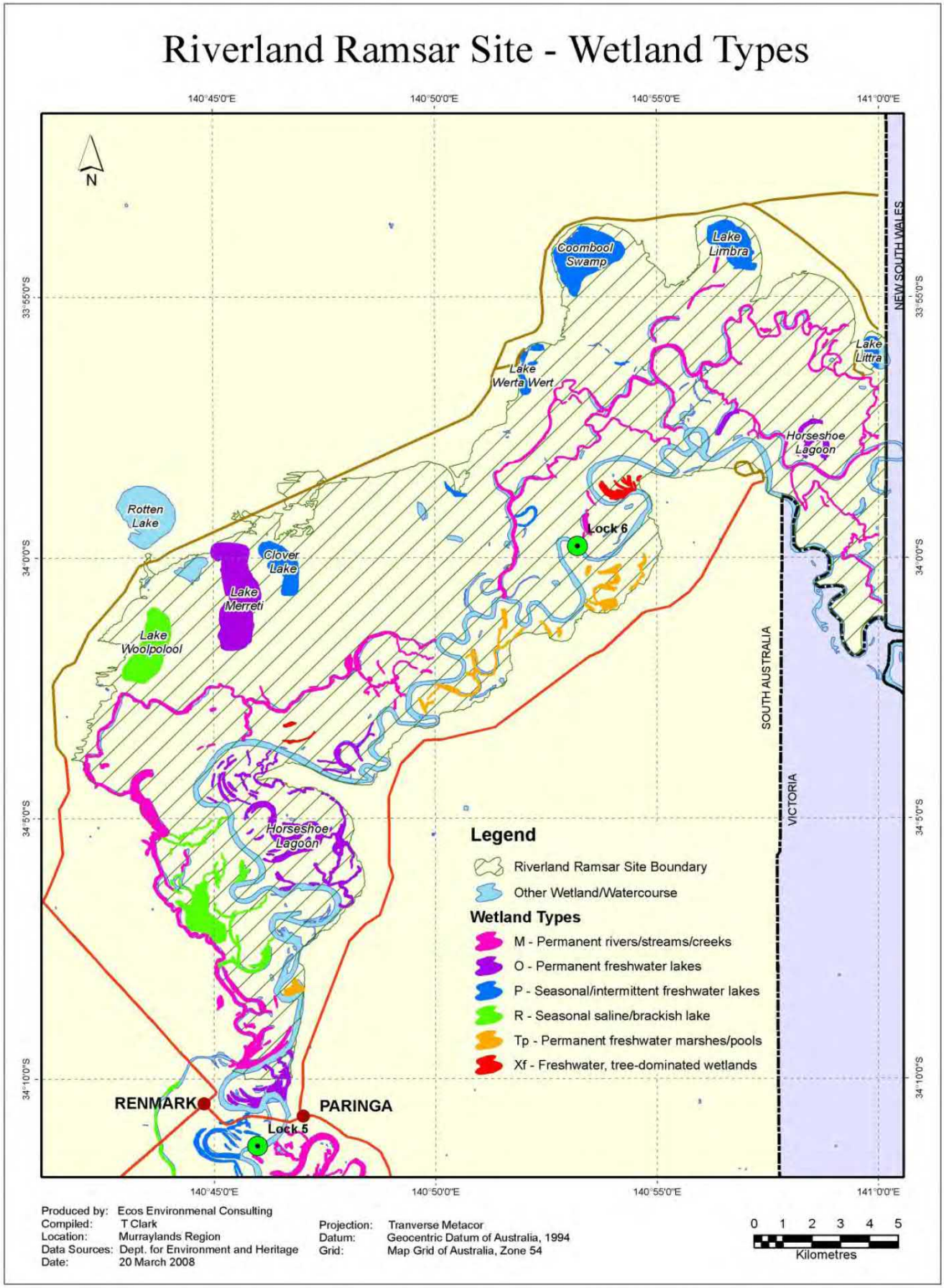
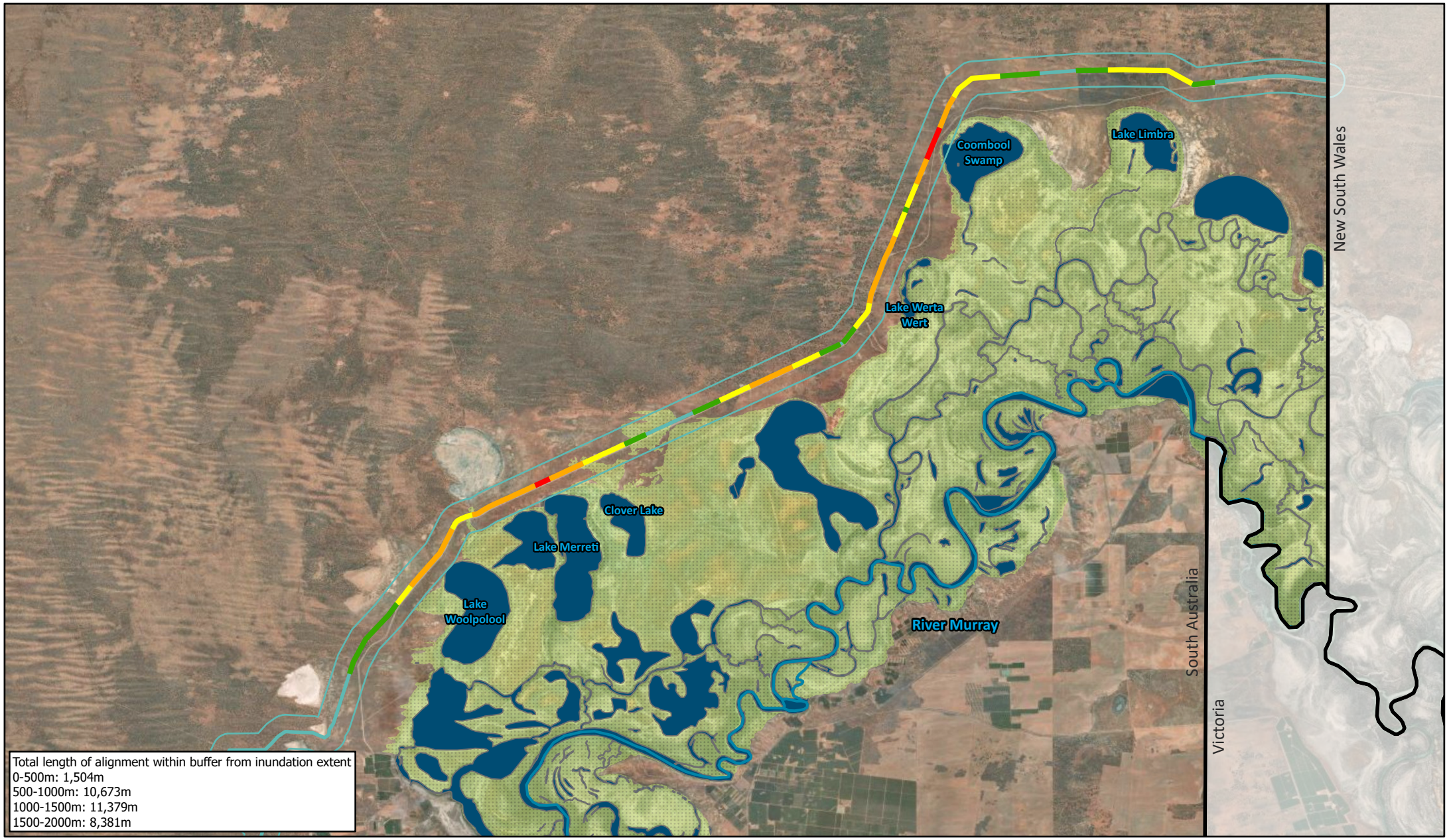


Figure 2: Wetland types within the Riverland Ramsar site, source ECD Newall et al. 2009



Transmission line corridor

Inundation extent for indicative 1 in 10 year scenario

Riverland Wetland Complex (Ramsar)

Proposed alignment

River Murray

Distance from inundation extent

- 0-500m
- 500-1000m
- 1000-1500m
- 1500-2000m

Figure 3
Proximity to inundation extent for indicative 1 in 10 year scenario
(based on Figure 3.17d of Newall et al . 2009)

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N

ElectraNet

energy connect

JBS&G

5. Birds of the Riverland Wetland Complex

This study has identified 73 birds species that have records (BDBSA, ALA or ECD data) or are known to occur in the Riverland Wetland complex. These include wetland birds / waterbirds (41), raptors (2), migratory shorebirds (15) (of the 37 that visit Australia), resident shorebirds (10) and migratory / marine birds (5) (refer summary in Table 8 at end of this section). An additional raptor was also considered given conservation status, bird banding data records relating to death by powerline and records within wider project area. A number of other commonly occurring, predominantly terrestrial and woodland bird species (including Reed-Warbler and Cisticola) occur across the wetland, but are not considered here. BDBSA records for the study area as per EIS Chapter.

5.1 Summary of birds present

5.1.1 Waterbirds

Forty one bird species have records or are known to occur in the study area and have global representation / population estimates (refer Table 8). One of these species, the Australasian Bittern (*Botaurus poiciloptilus*), has a National and State listing as threatened (Aus Endangered, SA Vulnerable). A snap shot of maximum count data is presented here from a range of surveys in wetlands of the Riverland wetland area (e.g. Lake Wolpoolool, Lake Meretti, Coppermine Waterhole, Lake Litra and Lake Werta Wert) over a range of years (11 years) and months (every month). Both observer surveys and aerial surveys, totalling 84 survey events (80 observational, 4 aerial) are included (Newall et al. 2009, ALA 2019) and indicated that species with the largest counts were Grey Teals (9,400), Eurasian Coots (6,080), Pink-eared Duck (4,600), Hardhead (3000), Hoary-headed Grebe (2,000), Australian Pelican (1,200) and Black Swan (1,421) (refer Table 2). It is noted that these maximum counts per species occurred over different years, seasons, and months, and hence the species were not all present in these numbers at the same time. Species recorded in low numbers (e.g. less than 10) included Great Crested Grebe, Blue-billed Duck, Buff-banded Rail, Spotless Crake, Nankeen Night Heron, Musk Duck, Dusky Moorhen, Australasian Bittern (1 record), Eastern Cattle Egret, Intermediate Egret, Little Egret (Refer Table 3). There were no counts recorded for the elusive Australian Painted Snipe. Refer Appendix A for more detail.

Table 2 summarises the data recorded from historical surveys (Carpenter 2002) and more recent surveys included in the ECD (Newall et al. 2009), noting that the more recent survey data includes records from a larger number of surveys. Maximum count data is based on the maximum number of individuals of a species ever recorded at a site throughout monthly surveys over a number of years. As stated above, the maximum counts did not necessarily occur during the same survey or month at all lakes within the wetland at the same time (see Section 5.2 below). Whereas earlier estimates (Carpenter 2002) are based on combining maximum counts across monthly surveys per lake, presenting a conservative estimate of the number of individuals that may occur in the area at any one time. Even combining maximum counts per lake would be an overestimate as birds counted at one lake in one month, may actually be the same birds counted at another lake in the next month, rather than additional birds. The majority of bird count data presented in the ECD reflects maximum counts per month and location for each species, rather than combining.

Table 2: Water bird species with high maximum counts in Riverland Wetland complex surveys

Species	EPBC Act Status[1]	SA (NP&W Act) Status[2]	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	2000-2015, 84 surveys, 5 lakes (Newall et al. 2009, ALA 2019)
			Max count combined across surveys	Max count ever recorded per survey	Max count ever recorded per survey
Grey Teal	-	-	25,000	10,000	9,400
Eurasian Coot	-	-	10,000	1,500	6,080
Pink-eared Duck	-	-	1,500	1,050	4,600
Australian White Ibis	LM	-	1,500	1,000	160
Australian Wood Duck	-	-	1,000	410	400
Pacific Black Duck	-	-	1,000	420	420
Freckled Duck	_	-	500	256	620
Australasian Shoveler		R	500	300	730
Australian Shelduck	-	-	600	300	846
Australian Pelican	LM	-	2,000	1,200	1,200
Black Swan	-	-	2,000	1,000	1,421
Hoary-headed Grebe	-	-	500	320	2,000
HardHead	-	-	200	100	3000

[1] EPBC status, where LM = Listed Marine (protection not applicable to terrestrial location), Mi = Migratory;
[2] National Parks and Wildlife Act, SA NPW status, where En = Endangered, Vu = Vulnerable, R= Rare;
List developed from Carpenter original list and more recent counts.

Table 3: Water bird species with low maximum counts in Riverland Wetland complex surveys

Species	EPBC Act Status[1]	SA (NP&W Act) Status[2]	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	2000-2015, 84 surveys, 5 lakes (Newall et al. 2009, ALA 2019)
			Max count combined across surveys	Max count ever recorded per survey	Max count ever recorded per survey
Little Egret	LM	R	5	2	1
Intermediate Egret	LM	R	1	0	1
Eastern Cattle Egret	LM	R	-	-	1
Australasian Bittern	E	Vu	5	1	1
Dusky Moorhen	-	-	10	5	2
Musk Duck	LM	R	50	20	2
Nankeen Night Heron	LM	-	100	82	2
Spotless Crake	LM	R	10	1	2
Buff-banded Rail	LM	N	10	1	3
Blue-billed Duck	-	R	4	0	6
Great Crested Grebe	-	R	5	2	6
Chestnut Teal	-	-	*20*	*10*	10
Royal Spoonbill	-	-	50	3	10

[1] EPBC status, where E = Endangered, LM = Listed Marine (protection not applicable to terrestrial location), Mi = Migratory;
[2] National Parks and Wildlife Act, SA NPW status, where En = Endangered, Vu = Vulnerable, R= Rare;
Species with '-' were not listed in results

5.1.2 Migratory shorebirds

Fifteen of the 37 migratory shorebird species that visit Australia have been recorded (at some time) in the study area (refer Table 4, Table 8). However, in the last twenty years, only five of these species were recorded during count surveys at the wetlands in proximity to the Project EnergyConnect route; Sharp-tailed Sandpiper (800), Red-necked Stint (25), Common Greenshank (2), and Bar-tailed Godwit (1). The Sharp-tailed Sandpiper is a wide-ranging species that occurs in both fresh and saline inland wetlands and coastal tidal flats. The SA population estimate for this species is 42,821 and the Australian population estimate is 140,000 (Bamford et al. 2008 in SPRAT), suggesting that only a fraction of the SA and national population are likely to occur within the wetland complex at any one time.

As per waterbirds above, count data from the Riverland wetland complex is summarised in Table 4 below. Earlier estimates for these species were in some cases based on combining maximum count data across several sites which were not necessarily recorded at the same time (i.e. reported over different months) and therefore represent conservative maximum estimates. Table 4 shows these initial combined estimates as presented by Carpenter (2002), the maximum counts per survey (month) from that original data pre 2002, and more recent data as presented in the ECD (Newall et al. 2009) or collected during more recent aerial surveys (ALA 2019). It is noted that for ten of these species there have been no records during monthly count surveys within the main lakes between 2000 and 2015. The species recorded in the largest numbers was the Sharp-tailed Sandpiper.

It is also noted that many of the migratory shorebird species that have been recorded in the Riverland wetland are habitat generalists, i.e. they are routinely found in both marine and freshwater habitats (e.g. Black-tailed Godwit, Common Greenshank, Common Sandpiper, Marsh Sandpiper, Pacific Golden Plover, Pectoral Sandpiper,

Red-necked Stint and Sharp-tailed Sandpiper). The Ruddy-turnstone and Curlew Sandpiper have limited records in the Riverland wetland, which is likely because they prefer coastal habitats. The Long-toed Stint and Wood Sandpiper are specialists that prefer freshwater / grassland habitats (Weller and Lee 2017).

Table 4: Migratory Shorebird species maximum counts in Riverland Wetland complex surveys

Species	EPBC Act Status[1]	SA (NP&W Act) Status[2]	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	2000-2015, 84 surveys, 5 lakes (Newall et al. 2009, ALA 2019)
			Maximum count combined across surveys	Maximum count ever recorded per survey	Maximum count ever recorded per survey
Latham's Snipe	LM Mi	R	1	0	0
Black-tailed Godwit	LM Mi	R	1	1	0
Long-toed Stint	LM Mi	R	5	5	0
Ruddy Turnstone	LM Mi	R	1	1	0
Marsh Sandpiper	LM Mi	-	1	1	0
Wood Sandpiper	LM Mi	R	10	-	0
Pectoral Sandpiper	LM Mi	R	2	1	0
Pacific Golden Plover	LM Mi	R	5	5	0
Grey Plover	LM Mi	-	1	1	0
Bar-tailed Godwit	LM Mi	R	1	1	1
Common Greenshank	LM Mi	-	10	5	2
Curlew Sandpiper	CE, LM Mi	-	1	1	7
Red-necked Stint	LM Mi	-	50	25	25
Sharp-tailed Sandpiper	LM Mi	-	50	30	800

[1] EPBC status, where E = Endangered, LM = Listed Marine (protection not applicable to terrestrial location), Mi = Migratory;
[2] National Parks and Wildlife Act, SA NPW status, where En = Endangered, Vu = Vulnerable, R= Rare;
Species with '-' were not listed in results

5.1.3 Resident shorebirds

Ten resident shorebirds have been previously recorded within the study area (refer Table 5, Table 8). This includes BDBSA records for the threatened Australian Painted Snipe (Australian Endangered, SA Vulnerable) which is considered a resident shorebird (Birdlife Australia 2019). Species with the greatest number of counts included Red-necked Avocet (6,220), Red-capped Plover (350), Black-winged Stilts (280), Red-kneed Dotterel (277), and Banded Stilts (210). Black fronted Dotterel and Masked Lapwing were recorded in lower numbers (40 and 70 respectively). There were no records of count data for Inland Dotterel, Banded Lapwing or Painted Snipe between 2000-2015.

As per waterbirds above, count data is summarised in Table 5 below. Initial estimates for these species were in some cases based on combining maximum count data across several sites which were not all surveyed at the same time (month) and are therefore not necessarily reflective of maximum counts at any given time. Table 5 shows these initial estimates (presented by Carpenter 2002), the maximum count data from that original (pre

2002 data), and more recent data as presented in the ECD (Newall et al. 2009) or collected from more recent aerial surveys (ALA 2019).

Table 5: Resident shorebird species maximum counts in Riverland Wetland complex surveys

Species	EPBC Act Status[1]	SA (NP&W Act) Status[2]	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	2000-2015, 84 surveys, 5 lakes (Newall et al. 2009, ALA 2019)
			Max count combined across surveys	Max count ever recorded per survey	Max count ever recorded per survey
Inland Dotterel	-	-	2	-	0
Australian Painted Snipe	E	Vu	-	-	0
Banded Lapwing	-	-	60	56	0
Black-fronted Dotterel	-	-	100	40	55
Masked Lapwing	-	-	4,000	3,650	70
Banded Stilt	-	Vu	200	100	210
Red-kneed Dotterel	-	-	500	250	277
Black-winged Stilt	-	-	1,000	284	280
Red-capped Plover	LM	-	160	80	350
Red-necked Avocet	LM	-	3,000	290	6,220

[1] EPBC status, where E = Endangered, LM = Listed Marine (protection not applicable to terrestrial location), Mi = Migratory;
[2] National Parks and Wildlife Act, SA NPW status, where En = Endangered, Vu = Vulnerable, R= Rare;
Species with '-' were not listed in results.

5.1.4 Migratory Marine

Five species of migratory / marine bird have been recorded within the study area (refer Table 6). Species with the greatest number of counts at one time included Silver Gull (324) and Whiskered Tern (156). The maximum number of Caspian Terns recorded at one time during the surveys was 76. Crested Terns and Gull-billed Terns were only recorded in low numbers (1).

As per waterbirds above, count data is summarised in Table 6 below. As above, initial estimates presented in Carpenter (2002) for these species were in some cases based on combining maximum count data across several sites, which did not necessarily occur at the same time (month). Table 6 shows the initial estimates, the maximum counts from that original data pre 2002 and more recent data as presented in the ECD (Newall et al. 2009) and data from aerial surveys (ALA 2019).

Table 6: Migratory/ marine species maximum counts in Riverland Wetland complex surveys

Species	EPBC Act Status[1]	SA (NP&W Act) Status[2]	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	1981-2001, 16 surveys, 4 lakes (Carpenter 2002)	2000-2015, 84 surveys, 5 lakes (Newall et al. 2009)
			Max count combined across surveys	Max count ever recorded per survey	Max count ever recorded per survey
Crested Tern	LM, Mi	-	2	2	0
Gull-billed Tern	LM, Mi	-	1	1	1
Caspian Tern	LM, Mi	-	100	12	76
Whiskered Tern	LM	-	100	50	156

Silver Gull	LM	-	600	324	324

5.1.5 Raptors

Three raptors with EPBC or NPW status have been recorded in the Ramsar study area or close to the transmission line corridr (refer Table 7). Maximum count data recorded a maximum of two at any one time for the Swamp Harrier and the White-bellied Sea Eagle (Carpenter 2002, DEH 2004). Whilst White-bellied Sea-eagle has occurred in the study area and will forage in wetlands and along inland rivers, the majority of the key population / nesting pairs in South Australian occur in coastal areas (e.g. Eyre Peninsula and Kangaroo Island (Dennis et al. 2011, 2015, 2018, pers. Com). Both the maximum count data (maximums ever recorded per site) and the combined counts across monthly surveys (Carpenter 2002) suggest that no more than two individuals of each of these species occur in the wetland at any one time. An additional raptor, Peregrine Falcon is highlighted because it has a state rating (Rare), and there are deaths in Australia associated with transmission lines (refer Section 6.3 below). Carpenter 2002 also cited Emison *et al.* 1998 had determined that flying accidents including collisions with banded Peregrine Falcons had occurred in Victoria. Whilst there are records for this species in the wider region of the project (Ecological Study Area), they were not recorded during wetland count surveys.

Table 7: Raptor species maximum counts in Riverland Wetland complex surveys

Species	**EPBC Act Status[1]**	**SA (NP&W Act) Status[2]**	**1981-2001, 16 surveys, 4 lakes (Carpenter 2002)**	**1981-2001, 16 surveys, 4 lakes (Carpenter 2002)**	**2000-2015, 84 surveys, 5 lakes (Newall et al. 2009)**
			Maximum count combined across monthly surveys	**Maximum count ever recorded per survey**	**Maximum count ever recorded per survey**
Swamp Harrier	LM	-	2	2	2
White-bellied Sea Eagle	LM	En	2	1	2
Peregrine Falcon		R	-	-	-

[1] EPBC status, where E = Endangered, LM = Listed Marine (protection not applicable to terrestrial location), Mi = Migratory;
National Parks and Wildlife Act, SA NPW status, where En = Endangered, Vu = Vulnerable, R= Rare;
Species with '-' were not listed in results.

5.1.6 Summary

Summary data for all 73 species that have been recorded in the Riverland Ramsar site is provided in Table 8 below. Note initial list of species is based on BDBSA records occurrence within the last 20 years (2019 extract), the list in Carpenter (2002) and birds listed in annual aerial waterbird data – Kingsford (ALA 2019). It is acknowledged that there are other wetland waterbirds (e.g. Plumed Egret, Plume Whistling Duck, Nightjars) and a number of raptors which commonly occur at wetlands across Australia that are not considered here, but these birds were not represented in the bird count data used at the time of the study.

It is noted that Carpenter (2002) suggested that significant numbers of several conservation significant fauna were supported by the Riverland wetland, namely Great Egret (350), Glossy Ibis (20), Freckled Duck (500) and Australasian Shoveler (500). More recent data indicates there are changes for both the conservation status and counts for these species. i.e. The Great Egret is now only Listed Marine under the EPBC Act and maximum counts recorded more recently at the site have been 204, and the global population is considered very large, therefore impacts to this species as a whole are unlikely to be significant (aligning with EPBC significant impact criteria). The Glossy Ibis is still listed as Migratory, but maximum in more recent years have been 16 and the global population is considered to be extremely large. The Freckled Duck has an SA rating and maximum counts in the region have been as high as 620. Similarly, larger counts of Australasian Shoveler have been recorded in the last

20 years (i.e. 730). Freckled Duck are considered to have a stronghold in eastern Lake Eyre and are known to disperse to coastal areas when inland conditions are dry, and based on recent counts, there is still potential for large numbers to congregate at the Riverland wetland, as has occurred in the past (Carpenter 2002). Carpenter (2002) considered the Freckled Duck to be potential at risk of bird strike with a transmission line given numbers, dispersal direction and dispersal time and this situation is still likely for the current scenario. Whilst the Australasian Shoveler had still been recorded in large numbers, and they are night dispersers they are also considered to be at potentially at risk, however similar to Carpenter (2002), given dispersal is likely to be from sub-coastal wetlands, likelihood of collision with the transmission line is likely to be low.

Table 8: Summary data for relevant birds of the Riverland Wetland complex

Common name	Species Name	EPBC Act status[1]	SA (NPW Act) status[1]	Size (wing length / weight)[10]	Global population estimates[2] (000s)	Aus pop[4]/ EAAF (000s)	SA pop (000s)	Local Max # counts[8] 2000-2015
Waterbirds / wetland birds								
Little Egret	*Egretta garzetta*	LM	R	M	Very large			1
Intermediate Egret	*Ardea intermedia*	LM	R	M	unknown, but not <10			1
Eastern Cattle egret	*Ardea ibis / Bubulcus coromandus*	LM	R	M	100[3] / extremely large			1
Australasian Bittern	*Botaurus poiciloptilus*	En	Vu	L	0.1-2.5			1
Dusky Moorhen	*Gallinula tenebrosa*	-	-	M	unknown, not < 10			1
Musk Duck	*Biziura lobata*	LM	R	L	13-33			2
Nankeen Night Heron	*Nycticorax caledonicus*	LM	-	M / L	Very large			2
Spotless Crake	*Porzana tabuensis*	LM	R	S	unknown, not < 10			2
Buff-banded Rail	*Hypotaenidia philippensis*	LM	-	S	Moderately small to large			3
Great Crested Grebe	*Podiceps cristatus*	-	R	M / L	Very large			6
Blue-billed Duck	*Oxyura australis*	-	R	M / L	12			10
Chestnut Teal	*Anas castanea*	-	-	M	Very large			10
Royal Spoonbill	*Platalea regia*	-	-	L	Moderately Small to large			10
Glossy Ibis	*Plegadis falcinellus*	LM, Mi	R	L	Extremely large			16
White-necked Heron	*Ardea pacifica*	-	-	L	6.7-67 (Moderately small to large)			18
Australasian Darter	*Anhinga novaehollandiae*	-	ssp is R	L	22			20
Purple Swamphen	*Porphyrio porphyrio (melanotis)*	LM	-	M / L	Large to Very large			30
Australian Spotted Crake	*Porzana fluminea*	-	-	S	500-999			32
White-faced Heron	*Egretta novaehollandiae*	-	-	M / L	Moderately Small to large			49
Australasian Grebe	*Tachybaptus novaehollandiae*	-	-	S	Moderately small to very large			78
Pied Cormorant	*Phalacrocorax varius*	-	-	L	Moderately small to large			78
Little Black Cormorant	*Phalacrocorax sulcirostris*	-	-	M	Very large			92
Great (Black) Cormorant	*Phalacrocorax carbo*	-	-	L	extremely large			150
Australian White Ibis	*Threskiornis moluccus*	LM	-	L	Very large			160
Great Egret	*Ardea modesta*	LM	-	VL	590-2200 (Ex large)			204
Yellow-billed Spoonbill	*Platalea flavipes*	-	-	L	Moderately Small to large			267

Common name	Species Name	EPBC Act status[1]	SA (NPW Act) status[1]	Size (wing length / weight)[10]	Global population estimates[2] (000s)	Aus pop[4]/ EAAF (000s)	SA pop (000s)	Local Max # counts[8] 2000-2015
Straw-necked Ibis	*Threskiornis spinicollis*	LM	-	L	Extremely large			300
Little Pied Cormorant	*Microcarbo melanoleucos*	-	-	M	Very large			364
Australian Wood Duck	*Chenonetta jubata*	-	-	M / L	Very large			400
Pacific Black Duck	*Anas superciliosa*	-	-	M / L	Very large			420
Freckled Duck	*Stictonetta naevosa*	-	Vu	M / L	7300-17000			620
Black-tailed Native-hen	*Tribonyx ventralis*	-	-	S / M	Very large			720
Australasian Shoveler	*Anas rhynchotis*	-	R	M / L	Mod small to very large			730
Australian Shelduck	*Tadorna tadornoides*	-	-	L	Very large			846
Black Swan	*Cygnus atratus*	-	-	VL	Very large			908
Australian Pelican	*Pelecanus conspicillatus*	LM	-	VL	Very large			1200
Hoary-headed Grebe	*Poliocephalus poliocephalus*	-	-	S	Mod small to very large			2000
Hardhead	*Aythya australis*	-	-	M / L	Very large			3000
Pink-eared Duck	*Malacorhynchus membranaceus*	-	-	S / M	Extremely large			4600
Eurasian Coot	*Fulica atra*	-	-	M	Extremely large			6080
Grey Teal	*Anas gracilis*	-	-	M	Extremely large			9400
Migratory Shorebirds								
Latham's Snipe	*Gallinago hardwickii*	LM, Mi	R	S / M	30[4]	30[4]		0
Black-tailed Godwit	*Limosa limosa*	LM, Mi	R	M	112.2-1500[3]	1620 / 160[4]		0
Marsh Sandpiper	*Tringa stagnatilis*	LM, Mi	-	S	186-1242[5]	130[4]		0
Wood Sandpiper	*Tringa glareola*	LM, Mi	R	S	3055-430[5]	130[4]		0
Ruddy Turnstone	*Arenaria interpres*	LM, Mi	R	S	475 -713[6]	30[4]		0
Long-toed Stint	*Calidris subminuta*	LM, Mi	R	S	230[4]	230[4]		0
Pectoral Sandpiper	*Calidris melanotos*	LM, Mi	R	S	Moderately Small to large	1,220 – 1,930[4]		0
Common Sandpiper	*Actitis hypoleucos*	LM, Mi	R	S	2455-4030[5] / extremely large	190[7] / 55.4[4]		0
Pacific Golden Plover	*Pluvialis fulva*	LM, Mi	R	S	170-220[3]	120[4]		0
Grey Plover	*Pluvialis squatarola*	LM, Mi	-	M	325-690[3]	80[4]		0
Bar-tailed Godwit	*Limosa lapponica*	LM, Mi	R	M	1060-1110[5]	286 (inc NZ)[5] 325[4]		1
Common Greenshank	*Tringa nebularia*	LM, Mi	-	M	440-1500[3]	18-19[5] / 110[3]	0.6-0.7 Coorong[3]	2
Curlew Sandpiper	*Calidris ferruginea*	CE, LM, Mi	-	S	1,850[5]	115[5] / 90[4]		7

Common name	Species Name	EPBC Act status[1]	SA (NPW Act) status[1]	Size (wing length / weight)[10]	Global population estimates[2] (000s)	Aus pop[4]/ EAAF (000s)	SA pop (000s)	Local Max # counts[8] 2000-2015
Red-necked Stint	*Calidris ruficollis*	LM, Mi	-	S	309[5]	353[6] / 475[4]		25
Sharp-tailed Sandpiper	*Calidris acuminata*	LM, Mi	-	S	154[5]	140[5] / 85[4]	42.8[5]	800
Resident Shorebirds								
Australian Painted Snipe	*Rostratula australis*	En	Vu	S	0.300-5[3] / .600-1.7	0.3-5		0
Inland Dotterel	*Charadrius australis*	None	-	S	Moderately Small to large			0
Banded Lapwing	*Vanellus tricolor*	None	-	M	Moderately small to large			0
Black-fronted Dotterel	*Elseyornis melanops*	None	-	S	Moderately Small to large			55
Masked Lapwing	*Vanellus miles*	None	-	M	unknown, but not <10			70
Banded Stilt	*Cladorhynchus leucocephalus*	None	-	S	Very Large			210
Red-kneed Dotterel	*Erythrogonys cinctus*	None	-	S	Moderately Small to large (26)[8]			277
Black-winged Stilt	*Himantopus himantopus*	None	-	S	Very Large			280
Red-capped Plover	*Charadrius ruficapillus*	LM	-	S	Very large			350
Red-necked Avocet	*Recurvirostra novaehollandiae*	LM	-	M	Very large (110)[8]			6220
Marine / Migratory								
Crested Tern	*Thalasseus bergii*	LM, Mi	-	M	Very large			0
Gull-billed Tern	*Gelochelidon nilotica*	LM, Mi	-	M	Very large			1
Caspian Tern	*Hydroprogne caspia*	LM, Mi	-	M	240-420 / very large			76
Whiskered Tern	*Chlidonias hybrida*	LM	-	S	Very large			158
Silver Gull	*Chroicocephalus novaehollandiae*	LM	-	M	Very large			324
Raptors								
White-bellied Sea-eagle	*Haliaeetus leucogaster*	LM	En	VL	0.670-6.7		0.16[9]	
Swamp Harrier	*Circus approximans*	LM	-	L	Mod small to large			2
Peregrine Falcon	*Falco peregrinus*	-	R		Very Large			#

[1] EPBC Act status E (Endangered), V (Vulnerable), R (Rare), Mi (Migratory), LM (Listed Marine – noting that EPBC status not relevant to terrestrial location); SA Status (NPW Act) E (Endangered), V (Vulnerable), R (Rare).

[2] BirdLife International (2019) IUCN Red List for birds. Species Specific Fact Sheets. Downloaded from http://www.birdlife.org (all species listed); global population estimates based on IUCN criteria (IUCN Standards and Petitions Subcommittee. 2016. Guidelines for Using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee. Downloaded from http://www.iucnredlist.org/documents/RedListGuidelines.pdf. ***Where minimum estimate for mature individuals in a population is: Small = < 10,000 (dependent on conservation status); moderate > 10,000; Large 20,000-99,000; Very Large 100,000 – 500,000; Extremely large > 500,000.*** More detailed estimates from references 3, 4, 5. [3] SPRAT (1994); [4] EAAF (East Asian-Australasian Flyway) Hansen et al. (2016) [5] Bamford et al. (2008) in SPRAT; [6] Watkins (1993) in SPRAT; [7] Geering et al. (2007) in SPRAT; [8] ECD (NEWALL ET AL. 2009) / ALA (2019); [9] Dennis et al. (2011, 2015, 2018). [10] Approximate size reference based on wing length (not span) and weight as per Menkhorst et al. (2017), acknowledging some overlap, particularly for heavy bodied species like ducks, where categories are; Small =25 – 200 g, wing length 80 mm –

236 mm, Medium = 201 - 799 g, wing length 174 - 450 mm, Large = 800 g -3.9 kg, wing length 285 -633 mm, Very Large > 4 kg, wing length 430 - 680 mm. # - Peregrine Falcon not recorded in Wetland count surveys, or within transmission line corridor, but 75 records within the broader ecological study area and a wide ranging species.

5.2 Totals per lake/ year within Riverland Region

Table 9 below summarises the maximum counts of birds reported within individual lakes within the Riverland wetland complex over years (where data is available). It is noted that these numbers are from surveys throughout the year, but the records at different lakes are not necessarily recorded during the same month. For example, in 2002 a maximum count of 23,266 birds were recorded at Lake Merreti during the February survey, whilst the maximum count of 14,620 at Lake Woolpolool was recorded in October. It is also noted that maximum counts have been lower in the years following 2002, which may be related to climate / drought conditions, or potentially the method of estimating numbers applied. Managed inundation events only occur at Lakes Merreti and Woolpolool every 3-5 years, and there are years in between when these lakes are often dry and do not provide habitat for waterbirds. Hence risks to waterbirds of collisions with transmission lines would be reduced in such years, when regional numbers are fewer.

Table 9: Ranges for max counts of birds per lake over years within the Riverland wetland complex (1989-2008, ECD / Newall et al. 2009)

Site	**ECD[1]**							**ALA[2]**		***Max Count per lake***
Year	1989-2004	2000, 2001	2002	2004 / 2005	2005 / 2006	2006 / 2007	2006-2008	2014	2015	*1989-2015*
Lake Merreti		1,641-18,554	3,078-23,266					6,225	2,255	*23,266*
Lake Woolpolool		1,234-8,224	1,339-14,620					4,871	12,488	*12,488*
Coppermine Waterhole						199-7,215				*7,215*
Lake Werta Wert				400-3,066			146-3,161			*3,161*
Lake Littra	50-1,500				422-6,767					*6,767*
Max combined totals across the Riverland Wetland complex	*1,500*	*26,778*	*37,886*	*3,066*	*6,767*	*7,215*	*3,161*	*11,096*	*14,743*	

5.3 Flightpaths

Paths that migratory shorebirds traverse on an annual basis are known as 'flyways'. Flyways represent collective migration routes for shorebirds between breeding and non-breeding grounds (Hansen et al. 2016). There are nine major flyways around the world, of which two pass through or around Australia. The main corridor of the East Asian – Australasian Flyway (EAAF) passes south of New Zealand and south of the southern coastline of Australia (EAAFP 2018), but the EAAF boundary includes all of Australia (Hansen et al. 2016). Key known 'staging areas' include Roebuck Bay and Eighty Mile Beach (north west WA) and Gulf of Carpentaria (Qld), which the shorebirds land at on their southward migration. The birds then disperse from these locations across Australia, reaching the southern states by around October each year. Some birds travel to ephemeral inland

wetlands, others spread out along the coastline. By March the birds gather again at staging areas to prepare for the northward migration (Birdlife Australia 2019b).

In SA, the Adelaide International Bird Sanctuary (AIBS) to the north of Adelaide sits at the southern end of the EAAF and is one of the key feeding and roosting sites for migratory birds in SA who use the flyway each year. The southern gateway (St. Kilda) and the northern gateway (Thomson Beach) are located at the northern and southern extents of the AIBS respectively.

The West Pacific Flyway broadly passes through the centre of Australia from the west coast of Tasmania through SA / Vic border and out through the Northern Territory. This flyway broadly crosses the Riverland Area from south to north according to high level digitisations, but is not recognised in the ECD for the site (Newall et al. 2009) as of significant importance.

Bird movements in the Riverland wetland complex could broadly be described as follows:

- Migratory birds enter Australia on southward migrations through staging areas in northern WA and northern QLD before they disperse across southern Australia to the coast and inland habitats, thus traversing the Riverland from north to south.
- Migratory birds enter the southern coast of Australia via key locations (St. Kilda, Thomson Beach) from the EAAF and then disperse across inland Australia (inland and generalist habitat species only), thus traversing the Riverland from the south to north.
- Migratory birds also enter from the north via the West Pacific Flyway, which overlaps with the EAAF, thus traversing the Riverland from the north to south.
- Local waterbirds would enter / exit the Riverland wetland site from nearby permanent or ephemeral freshwater / saline lakes within the Riverland complex itself, or from nearby wetlands outside of the wetland complex from the broader region following flooding events or other environmental triggers e.g. SA northwest Lake Eyre, Lake Torrens, SA west Banrock Station, SA south-east coastal wetlands, NSW east – Lake Victoria.
- Resident shorebirds would enter / exist the site from similar inland locations to the local waterbirds as well as coastal locations.
- Migratory marine birds would likely enter the site from east to west and vice versa, from adjacent wetland areas and from southern coastal areas, where they use multiple habitat types (e.g. terns and gulls using the river corridor itself).
- Raptors could enter the site from all directions depending on territory and range. However local movements are more likely to be east to west and vice versa following the Murray River and between adjacent wetland habitats / lakes given habitat preferences for these species.

In Summary birds could be entering the Riverland Ramsar site from:

- Return migrations from north to south (migratory shorebirds, primarily between spring to summer months – November to March)
- Coastal migration / movement from south to north (during drier periods, during extreme weather events on the coast, waterbirds / resident shorebirds / migratory marine birds / migratory shorebirds (August to November))
- Local east to west and vice versa movement between wetlands and lakes, along the River Murray (e.g. raptors, local waterbirds, resident shorebirds.)

6. Potential Impacts to wetland birds

6.1 General risks

In general, the key threats to wetland birds relate to loss and degradation of wetland habitats caused by clearing and draining of wetlands, alterations of flood and inundation regimes, and disturbance of feeding and roosting habitats (e.g. through human recreation activities, presence of dogs, and introduction of other feral predators such as foxes and cats). For migratory shorebirds key threats relate to coastal development at staging (flyway entry / exit points) and key non-breeding grounds, as well as climate change, pollution, human disturbance, hunting and fisheries by-catch (Birdlife Australia 2019b). Other examples of human disturbance to shorebirds include aircraft over-flight, industrial operations and construction, artificial lighting, and recreational activities (Weller and Lee 2017).

These risks are not relevant to Project EnergyConnect as it will not directly impact wetland habitats or other important sites such as staging or key non-breeding grounds.

6.2 Risks from Power Lines

Documented evidence of risks to birds from electricity infrastructure is relatively limited in Australia. Scottish Natural Heritage (2016) describe three main risks to birds (including birds that use wetland habitats) associated with the overhead wires of power lines (high-voltage transmission lines such as Project EnergyConnect as well as smaller distribution lines). These include:

- Mortality via collision with power lines or the guy wires that support meteorological masts. Mortality can occur from the bird either hitting the wires, the ground, or from injuries sustained with either of those events. In general bird collisions with power lines do not occur evenly along the entire length of the line, but are often concentrated near collision 'hotspots'. Multiple factors, that are not always evident to humans, may interact to create such a hotspot.

- Mortality via electrocution from the power lines or supporting structures, e.g. perching or nesting on steel lattice towers, short circuit, touching two live wires or a live and earthed component simultaneously. This generally only occurs where there are smaller gaps between live components, therefore mainly occurs for larger birds species that would nest or perch in the structures (e.g. raptors).

- Displacement / habitat loss to accommodate the infrastructure. This can be clearing for tower construction, indirect loss of habitat if birds avoid the structure and the surrounding area, increased predation (e.g. raptors, corvid, gulls) on ground-nesting birds. Displacement can also occur via barrier effects if birds are deterred from using normal routes to feeding or roosting grounds.

Bird mortality associated with transmission lines is influenced by a range of factors (Scottish Heritage Trust 2016):

- Species-specific morphology / biology: Birds are considered to be at higher risk of mortality from transmission lines if they have larger body sizes, high wing loadings or large wing length. Birds that fly in tight or fast moving flocks or disperse at periods of low visibility, and birds with limited visual capacity (e.g. related to the location of eyes / peripheral vision – birds that forage at close range) are also considered at higher risk. Other factors include birds which may be behaviourally 'distracted' while engaged in predation (e.g. raptors) or breeding displays (e.g. territorial flights / displays), or younger and more inexperienced birds and migrants not familiar with the landscape. Birds that require a large distance to takeoff / land (e.g. birds with large wing spans) such as swans and large waterfowl, may also be at risk (Taylor et al. 2015, cited in Scottish Heritage Trust 2016; Winnings and Murray 1997).

    - Conversely it is noted that nocturnal species (e.g. Owls, Owlet Nightjars) have specific adaptations to enable visibility in poor light, similarly marine birds such as terns, gulls and

albatrosses have adaptations to their eyes to improve distance vision in hazy conditions (Wikipedia 2019), hence mortality for these bird types associated with transmission lines is unlikely to be associated with poor visibility, but could be associated with other behavioural factors. For example, studies of collisions with terns and windfarms suggested that tern collisions were related to high numbers of terns flying at the locality (due to proximity to breeding colony), only occurring during the breeding season and only including adults (Everert and Stienen 2007).

- Landscape and topography: Where power lines are near or cross important habitats (e.g. wetlands) or flyways regularly used by birds, there is considered to be an elevated risk of bird strike and potential mortality. Birds will fly lower (i.e. down valleys) or higher (i.e. over mountains and hillslopes) to naturally optimise their energy efficiency in travelling, thus when infrastructure aligns with landscape features, collisions are reduced because the birds are already altering flight to avoid landscape features. Similarly, height of vegetation near infrastructure can also affect flight height with presence of short vegetation enabling lower flight and presence of existing taller vegetation facilitating higher flight paths.

- Weather conditions: Unusual weather events, such as very strong winds, dust storms, fog or heavy rain may result in reduced visibility and/or flying agility, and therefore increase the risk of bird strike with electrical infrastructure.

- Technical and design aspects: Conductor spacing, perch availability, location of earth wires in the array, tower or pole guy wires, high visibility plates along wires all have the potential to influence the impact of structures on birds.

Transmission lines and associated structures are known to impact wetland birds, particularly when transmission lines cross wetland areas. While the highest mortality rates occur where transmission lines pass directly through wetlands, lower rates of mortality are still known to occur when transmission lines pass near wetlands (Faanes 1987, cited in Carpenter 2002). Information about the frequency and extent of the impacts can be derived from bird collision studies which involve daily collision observations at established transmission lines (i.e. observations of successful flights over compared to collisions for target species) and ground searches (day and night) for victims beneath transmission lines. It is noted that results from ground surveys also consider undetermined losses attributed to scavengers and birds that may die elsewhere following collision. Carpenter (2002) summarised a range of these studies, reporting that most such studies suggest that waterbird collisions with transmission lines are a relatively low occurrence, and mortalities attributable to electrical lines are relatively low compared to the regional / resident population numbers of target species, with the exception of endangered species that naturally exhibit smaller population numbers.

Carpenter (2002) notes that mortality rates for similar species to those that occur in the Riverland wetland complex (derived from Australian and International studies) indicate that mortality rates (as a function of overall population size) for bird collision with powerlines are generally low compared with other causes. Most studies have shown a reduction in collisions and/or an increase in behavioural avoidance at lines marked with reflective 'diverters' when compared to unmarked lines, but this can vary with location, type of line marking device, and bird species (APLIC 2012). Many studies of transmission lines with high collision rates indicate that collision risk can be lowered by 50% to 80% when these lines are marked, although some studies report much lower levels of reduction, particularly for species which move after dusk.

Table 10 below summarises the key points associated with bird collisions and transmission lines discussed above.

Table 10: Summary of key points associated with bird collisions with transmission lines

Impact	Reasons	Comments
Electrocution	• Smaller earth wires, smaller voltage KV lines.	• Mostly associated with raptors and corvids perching / nesting on towers or unbunded earth wires close to conductors.

Impact	Reasons	Comments
	• Earth wires pose greater risk than bunlded conductor wires that are lower in the array	• More risk for larger birds / larger wing span
Bird collision with wires, conductors and earth wires, or ground following collision with wires	Flight paths ▪ Season – migratory / direction that crosses the transmission line Poor flight behaviour / ability ▪ heavy body e.g. swan, pelican (6.8-8.7 kg) ▪ Distance to take off / landing points required ▪ Body shape / flight type (e.g. ducks) ▪ Newly arrived migrants, weak, ill, fledglings Periods of low visibility ▪ Timing of movement - nocturnal versus day / diurnal (e.g. herons migrate at dawn / dusk; ▪ Weather conditions (e.g. fogs, strong winds) Dispersal numbers / flock forming ▪ breeding concentrations ▪ feeding aggregations ▪ dispersal in tight / large flocks (e.g. ducks) Collision 'hotspots' involving a variety of these factors Distraction due to natural behaviour ▪ predators (e.g. raptors / gulls) ▪ territorial flight displays (e.g. cranes)	Collisions studies summary (Carpenter 2002) ▪ Daily collision observations relative to number that fly over successfully – at established transmission lines ▪ Ground searches for victims under transmission lines (day /night) ▪ Consider undetermined losses attributed to scavengers and birds that may die elsewhere ▪ Most studies suggest waterbird collision as a result of transmission lines are low relative to regional populations (except for endangered species with naturally low populations) ▪ Estimates for transmission lines are lower than collisions with cars / buildings ▪ Estimates for collisions are lower for longer stretches of line ▪ Collisions with transmission lines are a greater threat where large concentrations of birds occur / and / or endangered species occur (e.g. wetlands) ▪ Risks are greater when transmission lines pass through or in close proximity to wetlands ▪ Consequences are greatest to bird species that occur in lower population numbers ▪ Impacts can be difficult to quantify in locations where there is great variability in numbers related to seasons and breeding / flood conditions (e.g. Riverland Complex) ▪ Impacts can be difficult to quantify when there is little known about flight paths of species at a location (e.g. Riverland Complex)
Displacement	▪ Habitat clearance for infrastructure or access tracks ▪ Increased predators (e.g. raptors, gulls) ▪ Barrier effects / change of flight path to feeding / roosting grounds	• No wetland habitat will be cleared as a result of this project. • An increase in the exiting predator level is not anticipated as a result of this project. • Significant alteration of flight paths between feeding and roosting grounds are not expected.

Based on the above information, the highest risks to wetland birds from Project EnergyConnect are considered to be to species which are:

- large bodied
- have poor flying ability, or low agility
- nocturnal, or disperse at dawn or dusk
- likely to migrate into and out of the Riverland Wetland complex from the north, and are therefore required to cross the proposed line
- threatened or conservation significant species which have low population numbers
- require a longer take off / landing distance (e.g. birds with larger wing spans)

Risks to categories of birds are considered further below.

6.2.1 Risks to waterbirds

There is large variance in the number of waterbird species and the number of individuals in the Riverland wetlands given the number of lakes and water habitat areas and species- specific variations. Summary data in Carpenter (2002) and the site's Ecological Character Description (Newall et al. 2009) indicate that large numbers of waterbirds arrive and leave the wetlands on a seasonal, monthly or even daily basis. Although many waterbird species are thought to disperse during daylight (pelicans, cormorants, egrets, ibis, herons, terns, sea-eagles), most of the more abundant species (swans, ducks, grebes, waders) are thought to disperse from the wetlands at dusk or under the cover of darkness. Because studies have not assessed dispersal routes of species that migrate at night, the potential risk to individual species can be difficult to assess (Carpenter 2002). Swans for example will fly at night, often in 'V' formation, and are nomadic, but are also monogamous and build island nests in shallow water, and are therefore likely to remain close to or on the nest between breeding periods (June to November), so would not necessarily be flying from the Riverland wetland past the transmission line every night. Therefore, it may be speculated that these water dependent species are moving between areas of riparian and wetland habitat to roost, broadly following the river corridor, meaning regular (daily) flights to the north and north west across the proposed transmission line may be less frequent. Carpenter (2002) suggested there was limited evidence about movement of birds to and from the site, but that some species, including migratory waders (i.e. local dispersal between habitats), traverse to the study area from the north, however a range of species would also travel to the area from other directions (refer Section 5.3). A high level assessment or the likelihood and consequence of risks to these species is provided in in section 7 below.

Little is known of waterbird dispersal in the survey area. In the Northern Hemisphere most waterbirds undertake regular migrations from breeding to wintering areas along regular and obvious migration routes. In Australia, movements / local dispersal of waterfowl are usually erratic in both direction and timing (Frith 1967, cited in Carpenter 2002). They disperse from breeding areas whenever they become unsuitable. Some species may be abundant in a particular area at one time, but then are not seen again in numbers for years. Rainfall, and its effects on the availability of food, is the most important factor determining waterbird movements in Australia. Nomadism among Australian waterfowl is a response to the erratic climate that characterises Australia. It is possible that some waterbirds disperse to the study area from the north, possibly from the Darling-Warburton or Cooper Creek wetland systems, rather than along the River Murray itself. As wetlands in these highly productive inland systems dry out, waterbirds disperse southwards and eastwards overland towards the coast. This is supported by observations of vagrant waterbirds on station dams north of the River Murray (e.g. Carpenter & de Jong 2001), including large flocks of the South Australian listed vulnerable Freckled Duck (Black 2001). If this is the case, it is possible that large numbers of waterbirds could occasionally cross the route of the proposed transmission line under certain conditions. However, the number of birds, the timing and the frequency of flight movements, cannot accurately be predicted due to the highly variable nature of species-specific population movements resulting from unpredictable climatic conditions. While bird movements to and from the north are apparent, northern dispersal routes are only one of a number of dispersal routes used by species inhabiting the wetlands (refer 5.3 above).

The significance of northerly migration is likely to vary for different species and also vary depending on the landscape features of each water habitat within the wetland complex. For example, Winning and Murray (1997) found that Australian White Ibis typically fly in tight flock at rapid speed, a behaviour that results in an elevated risk of collision. Risk of collision is also related to height of the crossing. E.g. some species will fly through the conductors (e.g. Australian White Ibis) and others will fly above the earth wire (e.g. Straw-necked Ibis) (Winning and Murray 1997). These differences between the species were noted from a wetland in NSW and were related to length of flight path, height gained between the local roost site and respective feeding grounds.

In summary, key risk factors associated with transmission lines for waterbirds are:

- Night / diurnal dispersers (e.g. swans, ducks, grebes)
- Flight paths over transmission line (to and from the north)

- Larger bodied / heavy bodied (swans, ducks, pelicans, ibis)
- Large wing span / take off / landing requirements (swans, ibis, large egrets / herons, pelicans)
- Species in large tight flying flocks (ducks)
- Threatened species that only occur in small local population numbers (e.g. Nationally Endangered Australasian Bittern).

6.2.2 Risks to migratory/ resident shorebirds

Most shorebirds are generally small to medium in size and are therefore considered to have a lower risk of collision with electrical infrastructure. In addition, global population numbers of these species are typically large to very large, meaning that any mortality suffered as a result of the Energy Connect project would be unlikely to significantly influence the population size. Whilst shorebirds have a lower risk profile associated with powerline collision, risks to birds utilising the Riverland wetland site would be generally related to:

- Migration direction (e.g. migratory shorebirds travelling from the north from northern Australia staging areas, or from north eastern Lakes (Eyre / Torrens)
- Migration in flocks or breeding aggregations (e.g. resident shorebirds moving from or to northern lakes, e.g. dotterels, stilts, Red-necked Avocets)
- Poor flight ability (e.g. migratory shorebird juveniles heading southward or northward in first 2 years). Noting that adults and juveniles that arrive in Australia following long southward migration, generally stop in northern coastal staging areas to roost and feed before dispersing further inland and northward migration for juveniles would be following one or two seasons in Australia.
- Unfamiliarity with the site (e.g. adult migratory shorebirds following dispersal from northern staging areas, juvenile migratory shorebirds following inland dispersal from northern staging areas; juvenile resident shorebirds following dispersal from inland breeding sites).
- Threatened species that only occur in small local populations (e.g. Nationally Endangered Australian Painted Snipe or Australasian Bittern).

6.2.3 Risks to migratory marine birds

As mentioned earlier, migratory marine birds include terns and gulls. Most of these species have small to medium body size, and are agile fliers, therefore considered to have a lower risk of collision. However there is evidence of collision for some species, which may be related to distraction and was associated with infrastructure close to breeding locations. These species will also fly in flocks which increases the likelihood of collision. Although there are risks of collision for these species, they all have very large global populations, hence consequences of collision are considered to be lower. Risks associated with powerlines for these bird types are related to:

- Migration between coastal sites and inland sites
- Dispersal in numbers / large flocks (e.g. Crested Tern (primarily coastal / ocean foraging species),
- Distraction (e.g. during breeding periods or when preying on fish or eggs / juveniles of other species).

6.2.4 Risks to raptors

The raptors that were considered have larger body size and less agile flight or heavy and fast flying, also predators that could be distracted by prey they are chasing or carrying, therefore considered higher likelihood of collision. Consequences of collision would also be higher for species with small local and global population numbers.

Specific risks to raptors associated with transmission lines include:

- Roosting in towers to increase field of view for foraging and hunting, resulting in collision with wires or electrocution,
- Location of powerlines to broadcast territory resulting in collision with wires
- Collision / electrocution of juvenile raptors (e.g. less experienced flight agility)
- Wingspan / separation of conductors and conductors to ground – leading cause of electrocution
- Collision with wires associated with distraction (e.g. if power lines are close to prey habitat, over water).

6.3 Historic evidence

The Australian Government (DotEE) under the auspices of the Australian Bird and Bat Banding Scheme (ABBBS) manages the collation of information on threatened and migratory bird and bat species, as well as common species which have been banded by accredited ABBBS banders. A range of data is collected by this scheme about both live and dead birds (and bats) collected in the field. Whilst this data only provides a snapshot view (given that only a subset of birds are banded and re-identified, and that not all dead banded birds are recovered) the data does provide some useful insights.

Historical ABBBS data (pre 2002) present in Carpenter (2002) is presented Table 11 below. The data suggested at that time that deaths of individuals from nine species could be attributed to collisions with power lines in SA. There were a total of 5,196 banded bird deaths reported (in SA) with 14 of those deaths reported as found dead beneath power lines (0.27%). Whilst it is acknowledged that some birds which strike power lines may move beyond the area of impact before dying, the overall percentage of reported deaths which are clearly attributable to power lines is very low. It is also feasible that maintenance tracks beneath power lines represent a more frequently sampled area from which bird deaths are reported. Of the reported deaths attributable to collisions with power lines, the percentage ranged from 0.1% for the Pacific Black Duck, Black-faced Cormorant, and Pied Cormorant to 20% for reported Great Egret deaths (though it is noted that the sample size of reported deaths for Great Egret is very low and this result is potentially skewed) (refer Table 11 below). Of note, the Pelican, Black Swan and Great Egret reported the highest percentages of deaths attributable to collision with power lines, and they are all large wing-span species.

Table 11: Recovery Data for larger water birds in SA (ABBBS data reported in Carpenter 2002, years unknown, but pre 2002)

Waterbird Species	No. of banded birds recovered dead in SA	No. of banded birds found dead under powerlines in SA	% deaths likely to be due to collisions with powerlines
Pacific Black Duck	683	1	0.1
Great Egret	5	1	20.0
Cape Barren Goose	100	1	1.0
Australian Wood Duck	127	1	0.8
Black Swan	30	1	3.3
Australian Pelican	146	5	3.04
Black-faced Cormorant	1560	1	0.1
Pied Cormorant	2505	2	0.1
Straw-necked Ibis	40	1	2.5

More recent recovery data (e.g. dead banded birds, 2000-2020) was provided by ABBBS for 73 birds species that have records from, or are known to occur (i.e. from BDBSA), in the Riverland wetland complex including wetland birds / water birds (42), migratory shorebirds (15), resident shorebirds (9), migratory / marine birds (5) and raptors (2). This data is tabulated in Appendix B.

A summary of this recent data from January 2000 – December 2020) is provided in Table 12 below for the 34 species of the 73 species with ABBBS records for recovered birds. There were a total of 3,861 records (from 47 species) nationally of recovered dead birds during this period. Of these records, 47 deaths (1.2%) were attributed to powerlines. The species with deaths attributed to powerlines were generally large wingspan species (Black Swan, Pelican, White Ibis, Magpie Goose, Bush Stonecurlew), heavy bodied / non-agile species (one Moorhen, Pacific Black-Duck) and fast flying species (terns, Peregrine Falcon). There were records for 277 individual birds (from 20 species) recovered in South Australia, of which 5 were attributed to powerlines (3 Crested Terns, 1 Pelican, 1 Magpie Goose). The species with the greatest number of deaths (not attributed to powerlines) were Crested Tern (1,312), Silver Gull (1,082), Australian White Ibis, (400) and Black Swan (283). Species categorised as 'other' included Australian Bustard (*Ardeotis australis* (2 deaths), Azure Kingfisher (*Ceyx azureus azureus*) (2 deaths) and Bush Stonecurlew (*Burhinus grallarius*) (39 deaths, of which one was attributed to powerline.)

Table 12: ABBBS bird summary data 2000-2019 (DAWE 2021)

Bird Type	Number of Species with records	National Records				SA Records			
		Total Recovered Dead Birds	Total attributed to powerlines	% attributed to powerlines	Species with records attributed to powerlines	Total Recovered Dead Birds	Total attributed to powerlines	% attributed to power lines	Species with records attributed to powerlines
Waterbird / wetland bird	24	1,061	20	1.9	Black Swan (5), Pelican (9), White Ibis (2), Magpie Goose (2), Moorhen (1, Pacific Black-Duck (1))	98	2	2	Pelican (1), Magpie Goose (2)
Raptor	4	83	5	6	Peregrine Falcon (5)	7	0	0	0
EPBC listed Migratory Shorebirds	8	138	0	0	0	4	0	0	0
Resident Shorebirds	2	29	0	0	0	0	0	0	0
Migratory Marine	6	2,507	20	0.8	Crested Tern (17), Silver Gull (2), Caspian Tern (1)	168	3	1.8	Crested Tern (3)
Other	3	43	1	2.3	Bush Stonecurlew (1)	0	0	0	0
Total	**47**	**3,861**	**46**	**1.2**	**11**	**277**	**5**	**1.8**	

Whilst it is acknowledged that ABBBS data only provides an indication of what actually occurs across the country based on recorded incidents, the trends of both historical data (summarised in Table 11) and recent data (Table 12) indicates that deaths attributed to powerlines in SA are infrequent events. Regardless species deaths that have been attributed to powerlines include large-bodied water birds and duck-shaped birds as well as Terns (migratory marine species) and Peregrine Falcons (small fast raptors). These species are all species that are well represented in Australian populations and global populations (including Great Egrets, for which the estimated global population is very large (Birdlife International 2019). There are limited records for threatened species collisions with powerlines; Peregrine Falcon and Bush Stonecurlew (rated rare in South Australia), Crested Tern and Caspian Tern (Migratory). None of the 6 Peregrine Falcon deaths reported in South Australia were attributed to powerlines or interactions with electricity, though 5 deaths nationally were attributed to power lines (of the 4,478 banded in total). One of 45 deaths recorded for Bush Stonecurlew across Australia was attributed to powerlines. Whilst there are deaths of Caspian Tern and Crested Terns attributed to powerlines nationally, they

are a small proportion of total deaths reported for each species (e.g. 4% and 12%, respectively); Crested Terns are primarily a coastal species. There were no records for Elegant Parrot (*Neophema elegans elegans*), Major Mitchell Cockatoo (*Lophochroa leadbeateri*) or Regent Parrot (*Polytelis anthopeplus monarchoides*) having collided with powerlines in Australia (noting that 1,070 individuals of these species are banded).

7. Risk Assessment

The following section provides information regarding risks to wetland bird species identified at the site, presented in a 'risk-based' context, considering both likelihood and consequence factors for individual species where data is available. There are numerous factors which contribute to the likelihood and the consequence of collision with power lines, which make a formalised or structured risk assessment challenging, however the information below is useful in considering which species are considered at elevated risk from the project.

7.1 Likelihood and Consequence of Collision

The overall significance of potential impacts (risks) to bird species which utilise the Riverland wetland complex as a result of Project EnergyConnect can be considered by using a broad risk assessment approach. Under this approach, factors which influence the likelihood of impacts to species are considered along with associated resultant consequences to the species of any impacts which arise. Where the likelihood of impacts to a given species is considered high and the consequence of impacts to that species are also considered high, the overall risk to the species is potentially high, and requires more detailed evaluation.

Based on the information reviewed above, the key factors associated with elevated potential for bird collisions with transmission lines (i.e. increased likelihood of collision) include:

- Large wing-span species
- Species which are non-agile fliers
- Species which disperse in tight flocks, particularly those which fly at high speeds
- Species which disperse at night, or are crepuscular
- Species which are thought to, or known to, regularly traverse the proposed power line location

Elevated consequences for a species would result where:

- The species is considered to be threatened, having a low or reduced regional population estimate.
- The species is migratory and of conservation significance, and has a low global population estimate.

Other factors (discussed further in Section 7.2 below) relevant to the overall risks to birds in the wetland habitat, but which are not necessarily species-specific, include:

- Distance from wetland habitat to the transmission line
- Periodic nature of inundation within the wetland area
- Historic evidence of impacts from transmission lines for particular species
- Amount of similar available habitat elsewhere in the region.

Table 13 below provides a summary of a number of the key likelihood and consequence variables (where data is available) for 38 species that occur regularly at the Riverland wetland complex, based on monthly count surveys. These species represent a subset of the 73 species ever reported at the site, but are those which have been regularly recorded during the ongoing 'count surveys' for the site, and therefore have increased potential for occurrence and hence for impacts. For details on the remaining species, which had very low or no data in the count surveys refer Appendix A.

Classification of data and justification for risk **likelihood** categories are as follows:

- **Higher risk likelihoods are colour coded as red and bold**, ***moderate risk are orange and italics***, and **low risks are green**. Where there is no risk considered, or data is unavailable, the risk has no colour code.

- Size data is based on wing length (not wingspan) and as per Menkhorst et al. 2017, acknowledging that there is some overlap, particularly for heavy bodied species like ducks. Categories are defined in footnote 3 of Table 13 below. Species are considered to have a higher likelihood of collision if their size is large or above. If they are medium / large (usually based on weight, e.g. ducks), they are considered to have a moderate risk of collision.
- Timing of dispersal data is limited for most species, but is based on information broadly provided in Carpenter 2002. Species are considered to have a higher likelihood of collision if they disperse at night or when visibility is lower. It is noted thought that bird vision is adapted to behaviour, particularly for predators, hence these night dispersing species may respond positively to reflective markers (a mitigation measure being used in European countries) (SNH 2016).
- Flight type is based on general information in Menkhorst et al. 2017, fact sheets or information in Carpenter 2002. Species are considered to have a higher likelihood of collision if they are considered or known to be non-agile fliers, heavy bodied, fly in tight flocks. Risks are considered to be high if they exhibit all of these factors, low if they only exhibit one of these factors or only occasionally fly in a flock.
- Count data (from 2000-2015) is based on regular monthly surveys reported in the ECD, along with recent aerial survey data, comprising 84 surveys (of 5 lakes) in total (NEWALL et al. 2009, ALA 2019). Species are considered to have an increased likelihood of collision where there are higher counts (i.e. higher numbers of individuals present) leading to higher potential to collide with the proposed powerline. In addition, this level of risk links to species that are known to fly in flocks.
- Historical evidence of collision with powerlines is based on ABBBS data pre-2002 (Carpenter 2002) and between 1995-2020 (DAWE 2020). Species with historical records of death attributed to powerlines are considered to have a higher likelihood of collision.

Classification of data and justification for risk **consequence** categories are as follows:

- **Higher consequence categories are coded red and bold**, ***moderate consequences are coded orange and italics***, low / no consequence has no colour.
- Conservation status based on EPBC Act (excluding Listed Marine) and NPW Act. Species with conservation status are considered to have a higher consequence from impacts as they generally have lower local population numbers and they are considered to be threatened or protected.
- Global populations estimates are based on minimum estimates of mature individuals of a species as per IUCN categories (Birdlife International (2019), see footnote 4 of Table 13 below). Consequences are considered to be higher for species with small global population and lower for species with large to extremely large global populations.

Table 13: Summary of risk factors for bird species with higher counts / local numbers (e.g. during count surveys) at Riverland Wetland complex

Common name	Likelihood factors					Consequence Factors		
	Size (determined by wing length / weight) [1]	Dispersal timing[2]	Flight type[2]	Local Max # counts (2000-2015) [3]	Recorded deaths attributed to power lines[4] Aus / SA	EPBC status[5]	SA status[6]	Global Population Estimate [7]
Waterbirds								
Purple Swamphen	*M / L*	**Night[2]**	*Non-agile*	30	0 / 0	LM	None	Large to Very large
Australian Spotted Crake	S	?	NA	32	0 / 0	None	None	Extremely Large
White-faced Heron	*M / L*	Daylight[2]	*Non-agile*	49	0 / 0	None	None	Small to Large

Common name	Likelihood factors					Consequence Factors		
	Size (determined by wing length / weight) [1]	Dispersal timing[2]	Flight type[2]	Local Max # counts (2000-2015) [3]	Recorded deaths attributed to power lines[4] Aus / SA	EPBC status[5]	SA status[6]	Global Population Estimate [7]
Australasian Grebe	S	Night[2]	*Fast*	78	0 / 0	None	None	Small to Very Large
Pied Cormorant	L	Daylight[2]	-	78	0 / 0	None	None	Moderate to large
Little Black Cormorant	M	Daylight[2]	*Flock*	92	0 / 0	None	None	Very large
Great (Black) Cormorant	L	Daylight[2]	Flock or single	150	0 / 0	None	None	Extremely Large
Australian White Ibis	L	Daylight[2]	*Flock / non-agile*	160	*2 / 0*	LM	None	Very large
Great Egret	VL	Daylight[2]	Single / non-agile	*204*	0 / 0	LM	None	Extremely Large
Yellow-billed Spoonbill	L	Daylight[2]	Single / small groups / non-agile	*267*	0 / 0	None	None	Moderate to Large
Straw-necked Ibis	L	Daylight[2]	*Flock / non-agile*	*300*	0 / 0	LM	None	Extremely large
Little Pied Cormorant	M	Daylight[2]	Single	*364*	0 / 0	None	None	Very large
Australian Wood Duck	*M /L*	Night[2]	Fast / flock / heavy	*400*	0 / 0	None	None	Very large
Pacific Black Duck	*M / L*	Night[2]	Fast / flock / heavy	*420*	*1 / 0*	None	None	Very large
Black-tailed Native-hen	S / M	Night[2]	Irruptive flocks \ following rain	720	0 / 0	None	None	Very large
Freckled Duck	*M / L*	Night[2]	Fast / flock / heavy	620	0 / 0	None	*Vu*	*Small to Mod*
Australasian Shoveler	*M / L*	Night[2]	Fast / flock / heavy	730	0 / 0	None	Rare	Moderately to very large
Australian Shelduck	L	Night[2]	Fast / flock / heavy	846	0 / 0	None	None	Very large
Black Swan	VL	Night[2]	Pairs / Flocks when wetlands dry[2]	1421	5 / 0	None	None	Very large
Australian Pelican	VL	Daylight[2]	Soar over floodplain permanent water / will flock to inland salt lakes	1200	9 / 1	LM	None	Very large
Hoary-headed Grebe	S	Night[2]	*Fast / Non-agile*	2000	0 / 0	None	None	Moderate to Very Large
Hardhead	*M / L*	Night[2]	Fast / flock / heavy	3000	0 / 0	None	None	Very large
Pink-eared Duck	S / M	Night[2]	Fast / flock / heavy	4600	0 / 0	None	None	Extremely large
Eurasian Coot	*M*	Night[2]	Fast / flock / heavy	6080	0 / 0	None	None	Extremely large

Common name	Likelihood factors					Consequence Factors		
	Size (determined by wing length / weight) [1]	Dispersal timing[2]	Flight type[2]	Local Max # counts (2000-2015) [3]	Recorded deaths attributed to power lines[4] Aus / SA	EPBC status[5]	SA status[6]	Global Population Estimate [7]
Grey Teal	*M*	Night[2]	Fast / flock / heavy	9400	0 / 0	None	None	Extremely large
Migratory Shorebirds								
Curlew Sandpiper	S	Night[2]	*Flock*	7	0 / 0	CE, Mi, LM	None	Extremely large
Sharp-tailed Sandpiper	S	Night[2]	*Flock*	800	0 / 0	*Mi, LM*	None	Very large
Resident Shorebirds								
Black-fronted Dotterel	S	Night[2]	Small flocks during non-breeding	55	0 / 0	None	None	Moderate to large
Masked Lapwing	*M*	Night[2]	Can form aggregations non-breeding	70	0 / 0	None	None	Moderate
Red-kneed Dotterel	S	Night[2]	Small loose flocks	148	0 / 0	None	None	Moderate to large
Banded Stilt	S / M	Night[2]	*Flocks*	*210*	0 / 0	None	*Vu*	Very large
Black-winged Stilt	S / M	Night[2]	Small flocks	*284*	0 / 0	None	None	Very large
Red-capped Plover	S	Night[2]	Single / pairs / flocks	*350*	0 / 0	LM	None	Very large
Red-necked Avocet	*M*	Night[2]	*Flocks*	6220	0 / 0	LM	None	Very large
Marine / Migratory								
Caspian Tern	*M*	Daylight[2]	Agile but forages over water for fish	76	*1 / 0*	*LM, Mi*	None	Very large
Whiskered Tern	S	Daylight[2]	Flocks / agile / forages whilst flying	*156*	0 / 0	LM	None	Very large
Silver Gull	*M*	Daylight[2]	*Flocks*	*324*	*2 / 0*	LM	None	Very large
Raptors								
White-bellied Sea-eagle	VL	Daylight	*Non-agile*	2	0 / 0	LM	E	*Small to Mod*
Swamp Harrier	L	Daylight	*Non-agile*	2	0 / 0	LM	-	Mod to large
Peregrine Falcon	M / L	Daylight	*Agile, but fast*	NA	*5 / 0*	None	*R*	Very Large

[1]: Approximate size reference based on wing length (not span) and weight as per Menkhorst et al 2017, acknowledging some overlap, particularly for heavy bodied species like ducks, where categories are; Small =25-200g, wing length 80mm-236mm, Medium = 201-799 grams, wing length 174-450mm, Large = 800g -3.9 kg, wing length 285-633mm, Very Large > 4 kg, wing length 430-680mm.
[2]: Flight types and dispersal based on Carpenter (2002) and flight types Menkhorst et al. 2017;
[3]: Maximum counts: 0-50 no risk category; 51-150 low; 151-500 moderate; 501+ high risk category (data based on NEWALL et al. 2009, ALA 2019). For wetland surveys refer Appendix A;
[4]: ABBBS data 2000-2021 (DAWE 2021);
[5]: EPBC status, where LM = List Marine (protection not applicable to terrestrial location), Mi = Migratory/;
[6]: NPW status, where En = Endangered, Vu = Vulnerable, R =Rare;
[7]: Birdlife International (2019), global population estimates based on IUCN criteria (IUCN Standards and Petitions Subcommittee. 2016. Guidelines for Using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee. Download from http://www.iucnredlist.org/documents/RedListGuidelines.pdf. Where minimum estimate for mature individuals in a population is: Small = < 10,000 (dependent on conservation status); moderate > 10,000; Large 20,000-99,000; Very Large 100,000 – 500,000; Extremely large > 500,000.

Based on the above information, species with higher 'likelihood' of impacts include:

- Larger birds such as cormorants, egrets, Straw-necked Ibis, Black Swans and Pelicans
- Smaller to moderate, but heavier bodied, flock forming species such as ducks and grebes

Species with moderate 'likelihood' of impacts include:

- Larger birds such as raptors which have good eyesight, but may be 'behaviourally distracted' when swooping for or carrying prey, some are also fast fliers and have less time to change course (e.g. Peregrine Falcon).
- Smaller night dispersing species such as migratory shorebirds and resident shorebirds that sometimes occur at the site in large numbers (e.g. Red-necked Avocet).

Species with elevated consequence of impacts include:

- Species with smaller global or local populations such as the White-bellied Sea-eagle.
- Species with conservation ratings such as threatened species (White-bellied Sea-eagle, Freckled Duck, Australasian Shoveler, Banded Stilt, Peregrine Falcon, Curlew Sandpiper) and Migratory Species (Curlew Sandpiper, Sharp-tailed Sandpiper and Caspian Tern).

Species with both elevated likelihood and elevated consequence risk factors represent those species with an overall elevated risk of collision with powerlines. These species are listed below with further consideration of overall risk:

- Freckled Duck; as they are state-listed (Vulnerable) and have a small to moderate estimated population. In addition, they have a higher likelihood of impacts as they are night dispersers, a flocking species, and known to occur at the site in large numbers. To date there have been no recorded deaths of these species attributed to powerlines (which may be related to the number of this species that are actually banded, e.g. only 64 have been banded). Overall, this species is considered to be at moderate risk from the transmission line.
- White-bellied Sea-eagle; as they are state-listed (Endangered) and have small to moderate global populations and may be behaviourally distracted whilst swooping on carrying prey (mainly eat fish, but will also eat waterbirds, rabbits, flying foxes). They are also known to have a small local population in SA. However, whilst they also have a moderate likelihood of impacts related to size and flight agility, they occur less frequently at this inland wetland habitat (being primarily considered a coastal species, e.g. no records in the TLC, 26 records in the wider ESA from riverine habitats) and have not had any recorded deaths attributed to powerlines. Overall, this species is considered to be at moderate risk from the transmission line.
- Peregrine Falcon; as they are state-listed (Rare) and have medium to large wingspans. They are considered agile fast flyers and like other raptors have good eyesight but are potentially distracted whilst capturing or handling prey. There are 5 records across Australia of deaths attributable to power lines, but none in South Australia. However, the consequences to the species in the event of a collision are considered to be low given the very large population size. Overall, this species is considered to be at low risk from the transmission line.
- Migratory and resident shorebirds with conservation status; including Curlew Sandpiper (EPBC Critically Endangered, Migratory), Sharp-tailed Sandpiper (Migratory), and Banded Stilt (SA Vulnerable). Whilst these species have moderate likelihood of impacts due to night dispersal times, flocking behaviour and presence at the site in large numbers (for Sharp-tailed Sandpiper), they also have very large global populations and have not had any recorded deaths attributed to colliding with powerlines in Australia or SA. The Curlew Sandpiper also has only been recorded in very low numbers in the wetlands, given the Ramsar Wetland complex is not significant habitat for the species (Carpenter 2002). Therefore, the overall risk to these species is considered to be low from the transmission line.

- Migratory marine species; including Caspian Tern, due to its conservation status as a listed Marine species. Whilst there is previous evidence of collision with powerlines (1 record in Australia), they have not been recorded at the site in large numbers, and the global population is very large. Therefore, the overall risk to this species is considered to be at low from the transmission line.

It should be noted that two conservation significant species, Australian Bittern (Endangered EPBC, Vulnerable SA) and the Australian Painted Snipe (Vulnerable, Migratory EPBC, Rare SA) were not in the list (Table 13) because of extremely low, or no counts, at the site during the 84 count surveys that were assessed. The Australian Bittern was only recorded once in the 84 surveys with only one individual reported. The likelihood of collision for this species is considered low to moderate due to large / heavy body size but uncommon occurrence, and the consequence is considered high given the conservation status and small global populations (see Table 8 or Appendix A). The Australian Painted Snipe has no records at the site during the 84 surveys but has 3 BDBSA records within the broader Project ecological study area and was considered a possible occurrence in suitable wetland habitats in the likelihood assessment for the EIS. It is small sized, but heavy in flight, however considered to have a low likelihood of collision based on uncommon occurrence at the site. This species however would have higher rating for consequence if a collision occurs given its conservation status and small global population size. Overall, risk to these two species is considered to be low from the transmission line.

One migratory species (Crested Tern) was also not in Table 13 because it is a common coastal species that would be considered a vagrant in the study area, and is unlikely to be impacted (Carpenter 2002). However, it was noted in Section 6.3 that there have been 17 deaths in Australia attributed to powerlines and 3 deaths in South Australia attributed to powerlines. Whilst this species has higher likelihood of collision (based on death data), there are no records for the species in the annual wetland count data, and the global population for the species is very large (Refer Appendix A), hence the consequence to the species as a whole would be low. Overall, risk to this species is therefore considered to be low from the transmission line.

7.1.1 Significance of potential impacts

In further considering the overall risks of bird collisions that may occur as a result of the project, the significance of any potential impact is important to consider.

Threatened species summary

Of the threatened species that were considered to have some risk of collision with the transmission line, the following levels of risk were determined:

- Low Risk – Curlew Sandpiper, Australian Bittern, Painted Snipe, Banded Stilt, Peregrine Falcon
- Moderate Risk - Freckled Duck, White-bellied Sea-eagle
- High Risk – No threatened species were considered to be at high risk (i.e. none had both high likelihood and high consequence factors).

Whilst low to moderate risks were determined for some species, the potential impacts from collision with the transmission line are not expected to represent significant impacts to any threatened species when considering EPBC significant impact criteria, or applying similar principals to state listed species. The Freckled Duck was determined to be at moderate risk from the project due to elevated likelihood of collision factors of medium to large body size, high maximum count numbers at the site, and fast flocking behaviour at dusk. It was determined to represent elevated consequence ratings due to its conservation status (state Vulnerable) and small to moderate population size. However, when considering significance of potential impacts to the species as a whole as a result of the Project, a rare mortality from the transmission line will not reduce the area of occupancy of the species, disrupt breeding attempts, or substantially reduce the population numbers.

Similarly, White-Bellied Sea Eagle was determined to be at moderate risk from the project due to the elevated likelihood of collision factors of very large body size, and potentially no-agile/distracted flight when diving on

prey. It was determined to have an elevated consequence rating due to its conservation status (state Endangered) and small to moderate population size. However, when considering significance of potential impacts to the species as a whole as a result of the Project, the species has only ever been recorded at the site in very small numbers, and a rare mortality from the transmission line will not reduce the area of occupancy of the species, or substantially reduce the population numbers.

Overall, risks to conservation significant species are not considered to be significant.

Migratory species summary

Similar to threatened species, consequences to individual migratory species are not considered to be significant when overall population numbers are considered. Of the migratory species that were considered to have some risk of collision with the transmission line, the following levels of risk apply:

- Low Risk – Curlew Sandpiper, Sharp-tailed Sandpiper, Caspian Tern, Crested Tern
- Moderate Risk – no migratory species were considered to be at moderate risk of collision
- High Risk – no migratory species were considered to be at high risk of collision

In addition, DoEE (2017) outline criteria for assessing whether impacts to migratory shorebirds within important habitats should be considered significant under the EPBC Act, and these criteria can broadly be applied to the wetland birds discussed here for the Riverland wetland complex. Table 14 below summarises the potential consequences based on the data provided above against the DoEE (2017) criteria for significant impacts to migratory shorebirds that occur in important habitats (e.g. a Ramsar site such as the Riverland wetland complex). Both the risk assessment summary above and the outputs in Table 14 demonstrate that the Project is not likely to have a significant impact on migratory species.

Table 14: Migratory Shorebird thresholds of significant impact criteria and assessment for 'important habitat'

Criteria	Comment
Loss of habitat	No shorebird (or waterbird in general) habitat will be lost from the Riverland wetland site as a result of Project EnergyConnect.
Degradation of habitat leading to a *substantial reduction* in migratory shorebird numbers	No shorebird (or water bird in general) habitat will be degraded in the Riverland wetland site as a result of the project.
The number of migratory birds in total that occur at these sites	15 migratory shorebird species have been recorded at the site, but there are only regular counts for 4 of these species at the site. Maximum reported count numbers for 3 of these 4 species are very low: Bar-tailed Godwit (1), Common Greenshank (2), and Red-necked Stint (16). Sharp-tailed Sandpiper is reported in higher numbers (800),but was considered to have overall low risk of impact to the species from collision. Project EnergyConnect is unlikely to notably reduce the number of any bird species present at the site.
Will the action lead to increased disturbance (e.g. via collision) that will lead to a substantial reduction in migratory numbers?	Based on above, the likelihood of collision is considered low based on: • Distance from regularly inundated areas to the alignment is generally > 1 km • The site is only periodically inundated and does not receive water in the majority of years. When inundated, it is generally only partially inundated. • Shorebird body type / behaviour is considered to result in a low likelihood of collision compared with large bodies, large wingspan species. • There is no evidence of migratory shorebird mortality from powerlines in Australian from historic data, and evidence of bird mortality directly attributable to collision with power lines represents only a very small proportion (1.2%) of bird mortality from other causes. • There is some evidence of migratory marine species death as a result of collision with transmission line (e.g. Crested Terns (17), Caspian Tern (1) and Silver Gull (1); however these were considered low risk based on either low likelihood of occurrence at the site (Crested Tern) and low consequence given very large global populations.

	• If mortality occurs as a result of collision with the transmission line, it is not expected to significantly impact migratory bird population numbers or recovery plans.
Will the action lead to direct mortality of birds leading to a substantial reduction in migratory shorebird numbers?	No, as above
Does the site contain small populations of some species that are at risk of collision	No.
Does the site contain EPBC conservation Significant Species that are at risk of collision	Sharp-tailed Sandpiper (EPBC migratory) are considered to have an elevated risk due to night dispersal, known to move in flocks, and largest numbers reported at the site is high (800). However, collision impacts are not considered to impact the species as a whole, particularly given they do not breed in Australia, are not in Australia for the whole year, would only be present when conditions are suitable and global population estimates are very large

7.2 Other risk factors

7.2.1 Distance to Transmission line

Highest risk to water birds of collision with electrical infrastructure is documented to occur when power lines directly traverse wetland habitat, or when lines are in close proximity to wetland habitat (i.e. 1 km or less) (Malcom 1982; Faanes 1987, cited in Carpenter 2002; Taylor 2015).

As per Section 4.2.2 above, mapping of distance between the proposed transmission line and the key areas of the Riverland wetland complex indicates that portions of the line are within close proximity to some individual lakes and wetland features which are expected to be inundated with reasonable frequency (i.e. approximately every 3-5 years for a number of lakes within the complex, up to 1 in 10 years for others). In summary:

- The alignment is between 0-500 m of 'regularly' inundated wetland habitat for 1,504 m.
- The alignment is between 500 m and 1000 m of 'regularly' inundated wetland habitat for 10,673 m.
- The alignment is between 1000 m and 1500 m of 'regularly' inundated wetland habitat for 11,379 m.
- The alignment is between 1500 m and 2000 m of 'regularly' inundated wetland habitat for 8,381 m.

The relatively short distance (approximately 12.2 km) of the alignment in close proximity (i.e. within 1 km distance) of wetland habitats which can expect to be inundated with 'reasonable' frequency suggests that the proposed alignment on the north-western side of the Renmark-Wentworth Road (i.e. the far side from the Riverland wetland) represents a limited opportunity for water bird collisions with the line. When considered with the likelihood of *regular* movements (daily dispersals or migrations) across the line, and the periodic nature of inundation at the site (discussed below), the likelihood of collisions with the line is considered low.

7.2.2 Inundation frequency/ fluctuation in bird numbers

The inundation frequency of the wetlands habitats within the Riverland wetland is also a consideration in the overall likelihood of water bird collisions with the proposed EnergyConnect project. During dry periods with little or no water in the Riverland wetland site, the number of water birds is expected to be very low, with reduced movement to and from the site, and therefore the risk of collisions with a transmission line in proximity to the site during these times can be expected to be much reduced.

As per Section 4.2.2 above, the main lakes and wetland habitats within the Riverland wetland site that are within closest proximity (i.e. between 500m to 2km) to the proposed EnergyConnect alignment are only inundated periodically, with some estimated to be inundated every 3 to 5 years, some every 5 years, and some as infrequently as every 10 years or more. It follows that all of the wetland habitats at the site will not be utilised by wetland birds all of the time, reducing the length of alignment in close proximity to wetland habitat, and therefore the risk to waterbirds, in years with no, or only partial, inundation. Risks of impacts to birds at the site would be highest under scenarios of full inundation, which are very infrequent. Lakes Merreti and Woolopolool are currently under managed inundation and nominally receive water every 3-5 years (Daniel Rogers (DEW), pers com), which likely represents the most frequent significant inundation event at the site under the current regulated River Murray conditions. In addition, migratory shorebirds would only be present at the site when there is water and during the months when they have dispersed from staging areas to inland areas following migration (e.g. between October and March).

Large portions of the Riverland wetland site extent south and south-east away from the alignment towards the main River Murray channel, likely beyond the distance where risks from transmission lines are much reduced or negligible. It follows that the proposed transmission line is too remote from most waterbird habitat within the Ramsar site for bird strike to be a significant concern.

7.2.3 Historic Evidence of Impacts from Power Lines

Section 6.3 provided a summary of evidence from available data of impacts of powerlines on birds in Australia and South Australia since 1995. It was noted that of the 3,861 recorded bird deaths in Australia, 1.2% were attributed to powerlines. In South Australia, 1.8% of the 277 recorded bird deaths were attributed to powerlines. The data suggests that the likelihood of bird deaths as a result of the proposed project are low.

Species of bird whose deaths were attributed to powerlines in Australia included:

- Large wing span / non-agile flying birds – Black Swan, Pelican
- Smaller heavy bodied, non-agile, night dispersing – Moorhen
- Flock flying / prone to distraction through foraging technique – Terns (mostly Crested Terns – core habitat is coastal, foraging over coastal seas, roosting on sandy beaches and man-made structures and nesting on islands)

7.2.4 Regional Habitat Availability

As mentioned earlier the Riverland Ramsar wetland has an extent of more than 30,000 hectares and occurs south of the proposed alignment, on the southern and south-eastern side of the Renmark-Wentworth Road. In addition, there are other wetland habitats within the River Murray environs to the west of the site (e.g. Banrock Station 1,375 ha), and lake habitats to the east in NSW (e.g. Lake Victoria, portion of Chowilla floodplains in NSW) which might all be reasonably expected to be inundated with water if the Riverland wetland site is experiencing a significant inundation event. In addition, other significant lake habitats exist further north (e.g. Lake Eyre and Lake Torrens). Whilst in no way reducing the importance and value of the Riverland wetland site, the likelihood that wetland bird species are only utilising portions of the Riverland complex at the northern extent in close proximity to the alignment is very low, and during period of inundation, numerous other environments are also likely to be inundated and supporting significant bird populations also. Any impacts as a result of the project would need to be considered in relation to the overall local and regional (and global) population numbers. Historic data suggests that the frequency of bird mortality directly attributable to collisions with transmission lines is very low compared with other impacting factors, and construction of the alignment does not directly impact upon, or alter, the habitat within the Riverland wetland site (a more significant impacting factor).

8. Mitigation Measures to reduce risks from Transmission Line

A number of mitigation measures have been reported elsewhere (globally) to reduce the likelihood of bird collision risk. These include measures such as location of the transmission line to avoid directly crossing wetland areas or known flight paths, and a range of design measures to minimise the risk of collision. Key mitigation measures that could be considered during detailed design to minimise impacts to birds from transmission lines (based on Scottish Heritage Trust 2016)) are outlined below.

- Consider inclusion of bird-friendly design options, including:
    - Deter perching and nesting on structures.
        - Use perch management techniques (i.e. construct cross-arms, insulators etc. so there is no space for birds to perch or touch energised wires). Use of exclusion devices, or perch discouragers, and providing safe artificial perches / nesting platforms at a safe distance from energised parts. (Prinsen et al. 2011 provide specific design options).
        - Line design / configuration of pole top. Ensure that perching space is well clear of dangerous components so that birds cannot touch them (e.g. for large raptors - > 2.7 m between transmission lines and > 1.8 m between perches and energised parts).
    - Reduce risk of electrification by use of insulated components and / or large air gaps, less vertical cables, no earth wires.
        - Insulation of energised parts / cover grounded parts with materials appropriate for providing incidental contact protection (e.g. suspend insulators and vertical disconnectors or covering of upright insulators / horizontal disconnectors).
    - Install suitable line markers and / or reflectors in conductors to reduce collision where the line is in the vicinity of wetland habitats.
        - Line marking is the most common and practical form of wire collision mitigation worldwide – can reduce bird collisions for some species by 50-95% (Prinson et al 2011) and is particularly useful for swans (Frost 2008).
        - Efficiency varies with species and cannot eliminate mortality for crepuscular or nocturnal species (although new high vision markers are being developed).

9. Conclusion

ElectraNet propose Project EnergyConnect to strengthen the national electricity transmission network by providing connection between SA and NSW. Whilst the majority of the alignment in SA traverses agricultural land and follows existing transmission line easements, the alignment does traverse, or runs adjacent to a number of conservation reserves, including the Ramsar Riverland wetland complex.

Seventy three bird species have previous records from the Riverland wetland site. Of these species, a sub-set of 38 species have been regularly recorded during monthly count surveys at key lakes within the wetland, an additional species was also considered given records within the wider project area (EIS Ecological Study Area). These species are considered to be more likely to be at some level of risk of collision with the EnergyConnect line due to their regular presence at the site. Similar to earlier discussion papers for this project (e.g. Carpenter 2002), species at elevated likelihood of collision include those with large wing span / body size, heavy non-agile or flocking fliers and those that disperse at night. The consequences of any infrequent collisions for the majority of these species is considered to be low, given their large global and regional population numbers, and consequently the proportionately very small potential impact from collisions to the species as a whole.

A high level risk assessment (section 7 above) considered both likelihood and consequence factors (noting weightings were not applied) that contribute to overall risk. Species that were considered to be at greater risk were those with both elevated likelihood and consequence of collisions, and these were generally conservation significant species. For threatened species, those with overall low risk included Curlew Sandpiper, Australian Bittern, Painted Snipe, Banded Stilt, Peregrine Falcon and medium risk species included Freckled Duck, White-bellied Sea-eagle. No threatened species were considered to be at overall high risk of collision with powerlines. In addition, whilst low to moderate risks were determined for some species, the potential impacts from collision with the transmission line are not expected to represent significant impacts to any threatened species when considering EPBC significant impact criteria, or applying similar principals to state listed species.

For migratory species, those with overall low risk included Curlew Sandpiper, Sharp-tailed Sandpiper, Caspian Tern, Crested Tern. No Migratory species were considered to be at moderate or high risk from collision. Similar to threatened species, when considering overall risk to migratory species against DoEE (2017) significant impact criteria, the Project is not likely to have a significant impact on migratory species, as a result of collision with powerlines.

In addition to species-specific features, the overall likelihood of collision with the EnergyConnect line is considered to be influenced by the inundation frequency and inundation extent of the wetland complex. Periodic inundation, and partial inundation are considered to reduces the likelihood that birds that inhabit the wetland will collide with the powerline, since reduced numbers of birds are present at the site during periods of partial inundation, and the distance between the inundated wetland habitats and the transmission line increases when the site is only partially inundated. When the site is not inundated at all, the number of birds present is greatly reduced, thereby reducing the likelihood of collision during these periods. Risk of collision is considered highest during periods of widespread inundation, when water reaches the out extents of the wetland nearer to the transmission line. These periods are expected to coincide with regional inundation of wetland and riparian habitats broadly.

Likelihood of collision has been documented to be reduced when mitigation measures are applied to transmission lines, including line markers (reflective and non-reflective), line design / configuration features, and spacing of towers. A number of these mitigation measures are available to ElectraNet for Project EnergyConnect and are expected to be effective at reducing potential impacts from the line.

As with previous studies undertaken for transmission lines in this location (e.g. Carpenter, 2002), it is concluded that with the implementation of effective mitigation measures, the likelihood of collision with the transmission line is considered to be relatively low. Regardless, collision remains a possibility, given that portions of the line run within 1 km of the wetland habitat which can be expected to be inundated with reasonable frequency through managed inundation or 'natural' flows within the regulated river system. However, consequences to individual species are not considered to be significant when overall population numbers are considered. There is

minimal evidence of substantial mortality directly attributed to transmission lines, rather, the data suggests a very low incidence of death. Species present within the Riverland wetland complex are generally present in relatively low numbers compared with regional, national and global populations estimates, and overall, Project EnergyConnect is not expected to significantly impact any species.

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Appendix A. Summary Statistics for Species with records

Common name	*Species Name*	EPBC status	SA Status	Migratory (resident or global)	Size	wing length (Menkhorst et al 2017	weight (Menkhorst et al 2017	Comments	Population Estimates (where available)				Lake Meretti (maximum counts)				Lake Woolpolool (max counts)				Coppermine Waterhole	Lake Litra	Lake Werta Wert		Max count recorded 84 surveys 2000-2015 (ALA, 2019)
									Global	EAAF	Aus	SA	Oct 2000 - Dec 2001 (DEH 2009) 13 surveys	2002 (DEH 2009) 11 surveys	2014 (ALA 2019) 1 aerial survey	2015 (ALA 2019) 1 aerial survey	2000-2001 (DEH 2009) 13 surveys	2002 (DEH 2009) 6 surveys	5 nov 2015 (ALA 2019) 1 survey	2014 (ALA 2019) 1 survey	2006 / 2007 (DEH 2009) 11 suveys	2005 / 2006 (DEH 2009) 9 surveys	2004/2005 (DEH 2009) 8 surveys	2006/2008 (DEH 2009) 9 surveys	
Waterbirds / wetland birds																									
Little Egret	*Egretta garzetta*	LM	Rare	Aus, but also occurs in Africa, Europe, Asia and PNG	small to medium	255-275mm	250-390g	smaller bodied, daylight disperser, unlikley to be at risk of collision (Carpenter 2002).	Very large (BI 2019)	NA			1	1			1	0			0				1
Intermediate Egret	*Ardea intermedia*	LM	Rare	Aus	medium to large	282-313mm	360-405g	irregular visitor to wetlands, daylight disperser along the floodplain, at low risk of mortality (Carpenter 2002)	unknown, but not <10,000 (BI 2019)	NA			1	0			0	0			0				1
Eastern Cattle egret	*Ardea ibis / Bubulcus coromandus*	LM	Rare	Aus / NZ	medium	241-264mm	290-420g	records last 20 years. Winter vistor in Aus, occurs in small parties to groups of hundreds, roost and nests colonially in trees (Menkhorst et al. 2017).	extremely large	NA			1	0											1
Australasian Bittern	*Botaurus poiciloptilus*	En	Vu	Aus, NZ / NC	large	299-386mm	0.6-2.0kg	Usually soliary, but nests in isolated pairs,oose congregations or 12 r so birds, secretive, observed flying over wetlands (Menkhorst 2017). Owl-like, broad wings, slow steady, shallow wing beat, legs extended;	1000-2499 (BI 2019)	NA			0	0			1	0							1
Dusky Moorhen	*Gallinula tenebrosa*	None	None	Aus, Indonesia, PNG	small-medium	195-215mm	480-700g	breeding groups 2- to 7 birds; mostly sedentary at location, i.e.e little dispersal	unknown, not < 10,000 (BI 2019)	NA													0	1	1
Musk Duck	*Biziura lobata*	LM	R	Aus only	Large	185-240mm	1-3.1kg	Disperses at night (Carpenter 2002) heavy bodied	13,000-33,000 (BI 2019)	NA			1	2		1	0	0			2		1	0	2
Nankeen Night Heron	*Nycticorax caledonicus*	LM	None	Aus	medium / large	276-313mm	550-900g	disperses at night to forage, nests colonially in trees, some populations are resident others are nomadic / partially migratory ; higher in southern Aus in Summer than in Winter (Menkhors 2017). Often migrate at dusk when visibility is poor (Carpenter 2002).	Very large (BI 2019)	NA			0	2			0	0			0				2
Spotless Crake	*Porzana tabuensis*	LM	Rare	Aus and Pacific / NZ	small			Forages in exposed mud, dashing for cover (Menkhorst 2017).	unknown, not < 10,000 (BI 2019)	NA												2			2
Buff-banded Rail	*Hypotaenidia philippensis*	LM	None	Aus, also SE Asia, PNG, NZ, Norfolk & Lord Howe Island	small	138-154mm	150-210g	Occurs singly or in pairs, feeds in the morning and evening (birdlife). Resident, dispersive, possibly migratory - can colonise offshore islands (Menkhorst 2017). Short flights - heavy with dangling legs, sustained flights - direct, rapid wing beats with trailing toes beyond tail.	Mod Small to large (BI 2019)	NA			0	0			3	0							3
Great Crested Grebe	*Podiceps cristatus*	None	Rare	Aus, also Europe, Africa, Asia	medium / large	166-197mm	0.6-1.2kg	monogamous. Occurs in small numbers in the Riverland Complex, disperses at night (Carpenter 2002). Flight is laboured and hump-backed with rapid wing beats (Menkhorst 2017); fast, but poor manouverability (Carpenter 2002).	Very large (BI 2019)	NA			6	0							1		2	0	6
Blue-billed Duck	*Oxyura australis*	None	Rare	Aus only	medium / heavy	145-163mm	0.62-1.17kg	disperses at night from north / northwest of route to southern coastal areas; large flocks in Lake Eyre (Carpenter 2002); flies low over water with rapid, noisy wing beats	L2,000 (BI 2019	NA			0	0			6	0			0		0	10	10
Chestnut Teal	*Anas castanea*	None	None	Aus	medium	195-227mm	505-800g	breed in monogamous pairs, mostly sedentary, but moves to drought refuges as necessary, gregarious in small to large flocks (Menkhorst 2017). Historically low numbers occur at Riverland Wetland sites (Carpenter 2002).	Very large (BI 2019)	NA			4	0			10	0			4		0	2	10

Royal Spoonbill	*Platalea regia*	None	None	Aus, also NZ, Indonesia, PNG, some pacific islands	large	350-385mm	1.5-2kg	daylight disperser, high collision rates recorded for Winning and Murray Study; significant numbers / breeding colonies known to occur in the region (Carpenter 2002) Monogamous pairs, nest in colonies among other similar species (Birdlife)	Mod Small to large (BI 2019)	NA	3	1		1	1		10	1		0	10
Glossy Ibis	*Plegadis falcinellus*	LM, Mi	Rare	Aus	medium / large	256-295mm	485-580g	roosts in trees near water, sometomes in large flocks (rookeries) (Menkhorst 2017). Breeding colonies supported in the region, significant numbers / small numbers?? in the region, daylight disperser - unlikley to be at risk of collision with transmission line (Carpenter 2002). Flight - appears slim, head low, feet trail beyond, fast wing beats with glides	Extremely large (BI 2019)	NA	16	0		6	0		3				16
White-necked Heron	*Ardea pacifica*	None	None	Aus	large	380-430mm	600-1200g	mostly in tidal areas; nests are solitary or in loose colonies (BirdLife). Forage in pairs / singly, can congregate in loose flocks or erupt in larger numbers following exceptionally wet season in arid areas	6700-67000 (Mod small to large) (BI 2019)	NA	18	2		15	0		7	2			18
Darter	*Anhinga novaehollandiae*	None	cies *A. r*	has global distribution	large	320-375mm	1.3-2.1 kg	Long broad wings, neck outstretched with kink; nest in trees overwater solitarily or colonially. Wings out stretched, strong and high flight, rides thermals	22000 (BI 2019)	NA	20	3	1			1	1	1	2		20
Purple Swamphen	*Porphyrio porphyrio (melanotis)*	Listed Marine	None	Aus, also NZ / PNG / Pacific islands	medium / large	265-285mm	0.7-1.3 kg	forages in and adjacent water, also flies over open water with trailing legs and toes; generally sedentary in location (Menkhorst 2017). Occur in small groups (birds in backyard). Accomplished flier to avoid danger, long legs trail behind or hang under.	Very large (BI 2019)	NA	30	0		10	6		0	3	1	0	30
Australian Spotted Crake	*Porzana fluminea*	None	None	Aus	small	95-105mm	25-35g	Singles to small parties forage adjacent shallow water, dashing for cover (Menkhorst 2017)	500,000-999,999 (BI 2019)	NA		2		32	15		1				32
White-faced Heron	*Egretta novaehollandiae*	None	None	Aus / PNG / NZ / Indonesia	medium / large	300-345mm	450-690g	susceptible to collision (Carpenter 2002). High collision rates for Winning and Murray Study (Carpenter 2002).	Mod Small to large (BI 2019)	NA	49	7	2	45	4		41	21	6	2	49
Australasian Grebe	*Tachybaptus novaehollandiae*	None	None	Aus / NZ / Pacific	small	102-112mm	170-270g	occurs singly or in pairs, seldom seen flying, though flocks of 100s have been known to congregate when roosting (Menkhorst 2017). Disperse at night (Carpenter 2002). Flight is laboured and hump-backed with rapid wing beats (Menkhorst 2017); fast, but poor manouverability (Carpenter 2002).	Mod small to very large (BI 2019)	NA				1	0		78	23	14	16	78
Pied Cormorant	*Phalacrocorax varius*	None	None	Mostly Aus / plus NZ	large	285-355mm	1.4-2.2kg	breeds colonially on coastal islands or flooded trees in inland wetlands. Flight is strong, rapid and shallow wing beats; groups will fly in V formation	Mod small to large (BI 2019)	NA	0		78					1		4	78
Little Black Cormorant	*Phalacrocorax sulcirostris*	None	None	has global distribution	medium	225-265mm	575-1000g	can occur in large flocks, several thousand; can feed cooperatively around schools of fish; breeds colonially in waterside trees	Very large (BI 2019)	NA	92	28		25	0		4	10			92
Great (Black) Cormorant	*Phalacrocorax carbo*	None	None	global distribution	large	325-360mm	1.2-3 kg; medium-large aquatic bird	Occurs singly or in flocks, breed colonially in waterside trees or ground of rocky islands. Flight has strong, direct, shallow wing beat, short glides; flocks fly in V formation	Extremely large (BI 2019)	NA	150	11		3	35	0	3	1	10	24	0	1	150
Australian White Ibis	*Threskiornis moluccus*	LM	None	Aus	large	350-395mm	1.3-2.3kg	breeding colonies occur in the region, daylight disperser (Carpenter 2002).	Very large (BI 2019)	NA	119	160	5	1	65	23		1	17	10	1	2	160
Great Egret	*Ardea modesta*	LM	None	global distribution	large	343-393mm	0.60-1.2kg	forage alone or in small flocks, roost at night in groups (Birdlife) Nest colonially in wetlands, or mangroves (Menkhorst 2017) large numbers historically at the wetlands, breeding nearby has occurring historically, nesting colonies expeceted at Lake Merreti with new water regime, daylight disperser, unlikley to be at risk of collision	590000-2200000 (very large) (BI 2019)	NA	204	8		1	103	0	3		10	0	1	1	204
Yellow-billed Spoonbill	*Platalea flavipes*	None	None	Aus, also vagrant in NZ / Lord Howe Island	large	400-410-mm	1.7-2kg	Daylight disperser, wetlands in the region known to support significant numbers (Carpenter 2002); Known to use the site in times of drought (DEH 2009).	Mod Small to large (BI 2019)	NA	145	267	16	2	60	35	65		22	14	13	22	267

Straw-necked Ibis	*Threskiornis spinicollis*	LM	None	Aus / also found in Indonesia, PNG, Norfolk & Lord Howe Island	large	351-415mm	1.1-1.6kg	breeding colonies occur in the region, daylight disperser (Carpenter 2002)	Extremely large (BI 2019)	NA	230	2	20		7	0	11	25	62	300	1	0	300
Little Pied Cormorant	*Microcarbo melanoleucos*	None	None	Aus	medium	225-245mm	490-830g	Flies and forages alone, roosts in flocks; nest in loose flocks in waterside trees	Very large (BI 2019)	NA	364	92			88	0			33		1		364
Australian Wood Duck	*Chenonetta jubata*	None	None	Aus	medium / large	254-290mm	665-980g	pairs breed in tree hollows above or near water; gather in large flocks after breeding (Menkhorst 2017)	Very large (BI 2019)	NA	400	10	54		50	7		20	105	12	180	320	400
Pacific Black Duck	*Anas superciliosa*	None	None	Aus / Pacific	medium / large	230-284mm	0.87-1.14kg	nomadic and dispersive, gregarious in small groups (Menkhorst 2017)	Very large (BI 2019)	NA	420	280	134	18		20	52	2	204	120	18	30	420
Freckled Duck	*Stictonetta naevosa*	None	Vu	Aus	medium / large	214-255mm	0.75-1.13kg	Disperses at night (Carpenter 2002); usually sedentary around permenant freshwater, dispersing when conditions deteriorate, gregarious in small flocks up to several hundred (Menkhorst 2017). Known to use the site in times of drought (DEH 2009).	7300-17000 (BI 2019)	NA		620	20	10	20	32		8	4	73	28	122	620
Black-tailed Native-hen	*Tribonyx ventralis*	None	None	Aus, vagrant in NZ	small-medium	205-225mm	350-430g	Seldom fly, but following rain or suitable conditions may move into an area in large numbers (irruptive influxes), generally run across the landscape (Birdlife). Takes longer flights at night, dispersive and irruptive (Menkhorst 2017). Night disperser (Carpenter 2002). Known to use the site in times of drought (DEH 2009). Flight - short run up, flight strong purposeful with trailing feet.	Very large (BI 2019)	NA	720	600			60	80			79	165	63	0	720
Australasian Shoveler	*Anas rhynchotis*	None	Rare	Aus / NZ	medium / large	210-265mm	545-852g	Can be a breeding resident in wetlands, nomadic elsewhere (Menkhorst 2017); large numbers recorded in the SA wetlands, where they congregated after breeding in subcoastal wetlands of SE Australia, disperses at night to the south and south east, therefore collisions likely to be low (Carpenter 2002). Known to use the site in times of drought (DEH 2009).	Mod small to very large (BI 2019)	NA	300	730	1			240	20		75	86	32	100	730
Australian Shelduck	*Tadorna tadornoides*	None	None	SE / SW Aus	large	320-390mm	0.9-2kg	Breed in isolated pairs, after breeding congregate (flocks) in moulting site (no flight for ~26 days); nests in ground or tree hollow (Menkhorst 2017). Flight strong, direct, flies in v formation	Very large (BI 2019)	NA	547	846	16	16	90	200	89	338	15	45	0	2	846
Australian Pelican	*Pelecanus conspicillatus*	LM	None	Aus / PNG / NZ / Pacific	large	560-680mm	4-6.8kg	**Disperse daylight;** annecdotal evidence of notifications of collisions (Birding Australia site); rely on thermal soaring over flood plain / areas of permanent water, therefore little risk from collision with trans line if not over water (Carpenter 2002). Generally coastal and riverine habitat; breeding in coastal areas, but will flock to inland salt lakes in the 1000s to breed if conditions suit, wing span 2.3m-2.5m (BirdLife). Powerful, soars on thermals, glides above water, but heavy bodied at risk of collision with transmission lines.	Very large (BI 2019)	NA	1200	430	5	10	540	11	26		60	6	80	40	1200
Black Swan	*Cygnus atratus*	None	None	Aus / NZ	large	430-545mm	4.6-8.7kg	Sedentary most of year, disperse when wetlands dry out; occurs in family groups or flocks of thousands, breeds in winter, pair for life (Menkhorst 2017).	Very large (BI 2019)	NA	730	708	475	427	806	173	1421	4	77	45	4	14	1421
Hoary-headed Grebe	*Poliocephalus poliocephalus*	None	None	Aus / NZ	small	106-121mm	175-305g	Sigificant numbers occur in the Riverland wetlands, disperse at night (Carpenter 2002). Known to use the site in times of drought (DEH 2009). flight is laboured and hump-backed with rapid wing beats (Menkhorst 2017); fast, but poor manouverability (Carpenter 2002).	Mod small to very large (BI 2019)	NA	2000	317			240	53		80	282	840	565	405	2000

Hardhead	*Aythya australis*	None	None	Aus	medium / large	200-230mm	0.53-1.10kg	Nomadic during droughts, can occur anywhere is Aus, can be gregarious in large rafts on wetland waters, wary keeps away from shore (Menkhorst 2017). Known to use the site in times of drought (DEH 2009). Flight - fast, pointed wings.	Very large (Bl 2019)	NA		3000	225	415	5	600	8	65		345	1010	660	240	3000
Pink-eared Duck	*Malacorhynchus membranaceus*	None	None	Aus	small / medium	152-210mm	275-480g	Gregarious, sometimes in large flocks, nomadic, can occur anywhere in inland Aus, filter feeder (Menkhorst 2017). Breeding is dependent on floodwaters / year round, monogamous (BirdLife Fact sheet). Known to use the Riverland site in times of drought (DEH 2009). When disturbed, flocks may circle over wetlands before re-alighting	Extremely large (Bl 2019)	NA		1800	4600	3157	420	500	4200	764		846	350	500	970	4600
Eurasian Coot	*Fulica atra*	None	None	Eurasia, Indonesia, PNG, Aus	small / medium	175-190mm	480-650g	Night disperser, lrage numbers known to occur in the region (Carpenter 2002). Known to use the site in times of drought (DEH 2009). Flight - long pattering run across water surface, purposeful and direct with trailing legs and feet.	Extremely large (Bl 2019)	NA		5200	5400	111	521	2550	550	6080		400	1350	176	76	6080
Grey Teal	*Anas gracilis*	None	None	Aus, but also NZ / New Guinea	medium	185-220mm	350-670g	opportunistic / nomadic, congregateon permanentcoastal wetlands, gregarious in small groups to very large flocks (Menkhorst 2017); large numbers (25,000) have been known to occur in the region (Carpenter 2002). Known to use the site in times of drought (DEH 2009)	Extremely large (Bl 2019)	NA		9400	8900	1714	660	6500	6500	3470	3620	5330	2400	1080	1550	9400
Migratory Shorebirds																								
Latham's Snipe	*Gallinago hardwickii*	LM, Mi	Rare	Global non-breeding Migrant from Japan to SE Aus	small-medium	151-168mm	150-230g	Migrants from Asia, in Aus from Late Sept to April, occur singly or in small coveys; marsh dwelling, in dense cover by day, venture onto open mud to forage at dawn / dusk / night (Menkhorst et al. 2017). Flight - long winged, generally no toe trailing, but tips of toes trail behind tail tip at take-off. Males conduct spectacular courtship display flights and defending territory, rising in air and then to ground (birdlife) - however this is likely in breeding territory only, which is not in AUS.	nsen et al. 201	3,000 Hansen et al. 2016	30,000 (Hansen et al. 2016)											0
Black-tailed Godwit	*Limosa limosa*	LM, Mi	Rare	Global Migrant from Siberia	medium	180-211mm	210-300g	Gregarious shorebird, breeds in Siberia, most common in northern Aus, small to large flocks before wet season rains on the coast, smaller subspecies occurs in Aus. Forage by wading (Menkhorst et al. 2017). Arrive in Aus (august), more numerous in north Aus (birdlife). W*ould migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002).* Flight - graceful.	112200-1500000 SPRAT	160,000 Hansen et al. 2016	162,000 (Watkins 1993 in SPRAT)											0
Marsh Sandpiper	*Tringa stagnatilis*	LM, Mi	None	Global migrant, breeds in Europe to Siberia	small	127-147mm	65-90g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Arrive in Aus Sep-Nov, inland wetlands and tidal flats before wet season rains, roost in mixed flocks (Menkhorst et al. 2017). Occur singly or in small to large flocks in brackish wetlands / rivers (Birdlife).	186,000-1242000 Bamford et al. 2008 in SPRAT	130,000 Hansen et al. 2016											0

Wood Sandpiper	*Tringa glareola*	LM, Mi	Rare	Global migrant breeds in Siberia	small	118-132mm	57-86g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). More common in north than south Aus, Aug-Apr, forage singly or in small clusters, when flushed will fly high before wheeling and gliding back to ground (Menkhorst et al. 2017). Flight - toes trail in flight, strong flight with clipped wing beats.	3055,000-430,000 Bamford et al. 2008 in SPRAT	130,000 (Hansen et al. 2016)					0
Ruddy Turnstone	*Arenaria interpres*	LM, Mi	Rare	Global migrant breeds in Siberia	small to medium	143-161mm	100-175g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Coastal migrant, prefers pebbly beaches, occurs singly or in small groups (Menkhorst et al. 2017). Trans pacific route to Aus.	475,000-713,000 Watkins 1993 in SPRAT	30,000 (Hansen et al. 2016)					0
Long-toed Stint	*Calidris subminuta*	LM, Mi	Rare	Global migrant breeds in Siberia	small	88-102mm	20-32g	occurs singly or in small groups, will join other wader flocks, occur in muddy fringes of wetlands; arraive early aug-sept, most records from SE Aus are Jan-March (Menkhorst et al. 2017).	nsen et al. 201	230,000 (Hansen et al. 2016)					0
Pectoral Sandpiper	*Calidris melanotos*	LM, Mi	Rare	Global migrant breeds in Siberia	small	125-149mm	52-70g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Uncommon, but regular visitor to Aus, singly or rarely in loose groups (Menkhorst et al. 2017).	Mod Small to large (BI 2019)	1,220,000-1,930,000 (Hansen et al. 2016)					0
Common Sandpiper	*Actitis hypoleucos*	LM, Mi	Rare	Global, breeds in Europe / Asia, visits Aus, less often NZ	small	103-115mm	47-70g	Jacobs assessment suggested possible occurrence. Prefers freshwater lakes and shallow rivers. (BirdLife) Usually solitary or in very small groups, not particularly common (Menkhorst et al. 2017).	2455,000-4030,000 / extremely large (BI 2019)	190,000 (Hansen et al. 2016)	190000 Geering et al. 2007 in SPRAT				0
Pacific Golden Plover	*Pluvialis fulva*	LM, Mi	Rare	Global migrant, breeds in Siberia / Alaska in June / July	small	155-174mm	130-190g	mainly coastal associated with tidal flats,, small proportion occur inland; found in small to moderate flocks (Menkhorst et al. 2017). Flight - slight toe trail behind tail tip.	170,000-220,000 (SPRAT)	120,000 (Hansen et al. 2016)					0
Grey Plover	*Pluvialis squatarola*	LM, Mi	None	Global migrant,	medium	190-212mm	220-350g	strictly coastal in Aus, large tidal flat systems, mostly females in Aus; gregarious roost with other flocks (Menkhorst et al. 2017). Occasionally found inland, studies have tracked key sites in Aus (BirdLife). Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Flight - horizontal body carriage, slight toe trail behid tail tip.	325,000-690,000 (SPRAT)	80,000 (Hansen et al. 2016)					0
Bar-tailed Godwit	*Limosa lapponica*	LM, Mi	Rare	Global non-breeding migrant from Siberia / Alaska	medium	206-244mm	330-450g	large flocks (1000s) restricted to coastal sites, inland records are likely transitory migrants, roost with wader species in flock at coastal sites (Menkhorst et al 2017). *Therefore whilst there may be small numbers recorded at inland sites, the majority of population are coastal and impacts to the species would not be significant.* Arrive in Aus (august), more numerous in north Aus, breed in Alaska / norht Asia, non-breeding and young can remain in Aus year round (birdlife). Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Flight - longest migration route of any shorebird.	1060,000-1110,000 Bamford et al. 2008 in SPRAT	325,000 Hansen et al. 2016	286,000 (inc NZ) (Bamford et al. 2008 in SPRAT)	0	1		1

Common Greenshank	*Tringa nebularia*	LM, Mi	None	Global migrant, breeds in Siberia	medium	174-198mm	170g-250g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Arrive in Aus from Aug-Oct (north), more commonly in coastal areas, solitarty feeder, roosts in small flocks or on edges of other flocks (Menkhorst et al. 2017).	440,000-1500,000 Birdlife International 2009 in SPRAT	110,000 (Hansen et al. 2016)	18,000-19,000 (Bamford et al. 2008 in SPRAT)	557-717 Coorong (SPRAT)	0	2		2	4		9	2			2
Curlew Sandpiper	*Calidris ferruginea*	CE, LM, Mi	None	Global migrant breeds in Siberia	small	126-136mm	55-93g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Occurs in flocks with other species, largest numbers are in tidal flat systems (feeds on marine inverts), but also use freshwater systems (Menkhorst et al. 2017).	1850000 Bamford et al. 2008 in SPRAT	90,000 (Hansen et al. 2016)	115000 Bamford et al. 2008 in SPRAT					7						7
Red-necked Stint	*Calidris ruficollis*	LM, Mi	None	Global migrant breeds in Siberia	small	98-112mm	25-40g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Prefer coastal habitats, but will occur inland, arrive Aug-Oct (juv Sept to Nov), gregarious, usually in flocks (Menkhorst et al. 2017). Follows east Asian-Australasian flyway.	nford et al. 200	475,000 (Hansen et al. 2016)	353,000 (Watkins 1993 in SPRAT)		12	16		25	14					25
Sharp-tailed Sandpiper	*Calidris acuminata*	LM, Mi	None	Global migrant breeds in Siberia / North America	small	122-143mm	57-100g	Would migrate at night, likely to arrive from the north, would be at risk of collision, but numbers are low compared to elsewhere, Riverland Wetland Complex is not a significant habitat for these species (Carpenter 2002). Common summer visitor, occurs in flocks, with other shorebird species, most numerous in fresh to saline inland wetlands, but also coastal tidal flats (Menkhorst et al. 2017).	154500 Bamford et al. 2008 in SPRAT	85,000 (Hansen et al. 2016)	ford et al. 2	42,821 (Bamford et al. 2008 in SPRAT) 4000 (Lake Eyre only) (Bamford et al. 2008 in SPRAT)		45		17	800		10	8		800
Resident Shorebirds																						
Inland Dotterel	*Charadrius australis*	None	None	Aus	small	133-149mm	64-107g	Usually in small flocks, that bunch together in flight, sometimes singly or in flocks > 100; most active at night (forage for spiders etc), roost or forage in veg by day (Menkhorst et al. 2017).	Mod Small to large (BI 2019)	NA												0
Banded Lapwing	*Vanellus tricolor*	None	None	Aus	medium	185-205mm	185g	Usually in pairs or small flocks (5~20 birds), some populations are highly sedentary others make nomadic movements in arid zones (Menkhorst et al. 2017). Data defficient.	Mod Small to large (BI 2019)	NA												0
Australian Painted Snipe	*Rostratula australis*	En	Vu	Aus	small	140-162mm	123-132g	Our assessment suggested possible occurrence; Feeds at night amongst wetland vegetation while foraging (Birdlife); Secretive nomad of temporary wetlands, disperses widely when not breeding	300-5000 (SPRAT) / 600-1700 (BI 2019)		300-5,000											0
Black-fronted Dotterel	*Elseyornis melanops*	None	None	Aus	small	105-119mm	26-39g	Not gregarious but can form small flocks during in non-breeding season; nests near wetlands Sep-Feb and after suitable rains in the north (Menkhorst et al. 2017). Jerky, deep flicking wing beats,	Mod Small to large (BI 2019)	NA		40	34		2	4	4	26	6	55	55
Masked Lapwing	*Vanellus miles*	None	None	Aus, but also PNG, NC, NZ	medium	236-259mm	297-425g	solitary pairs when nesting or small flocks; when non-breeding can form aggregations of several hundred (Menkhorst et al. 2017). Significant numbers have been recorded in the wetlands of the region (Carpenter 2002). Flight - territorial flight, broad winged in flight.	unknown, but not <10,000 (BI 2019)	NA		67	70	2	10	26	22	24	15	14	70
Banded Stilt	*Cladorhynchus leucocephalus*	None	Vu	Aus	small	187-211mm	200-290g	Breeding locations are sensitive info / guarded. Prefer saline waters of inland / coast (Birdlife). Occur in large single-species flocks 10s to 1000s, nest on islands, inland salt lakes after floods have initiated boom prey (Menkhorst et al. 2017). Known to use the site in times of drought (DEH 2009).	Very large (BI 2019)	NA		2	2		80	210	0	0			210

Red-kneed Dotterel	*Erythrogonys cinctus*	None	None	Aus /sth PNG	small	106-117mm	46-66g	resident of freshwater wetlands, often occurs at habitats with Australian Painted Snipe, gregarious can be found in small loose flocks (Menkhorst et al. 2017). Significant numbers have been recorded in the wetlands of the region (Carpenter 2002).	Mod Small to large (BI 2019)	NA	114	277		0	15			2	148	40	70	277
Black-winged Stilt	*Himantopus himantopus*	None	None	Aus resident, but has global distribution	small	209-245mm	140-220g	Refer Agreement on the Conservation of African-eurasian Migratory Waterbirds / IUCN Least Concern. Form large noisy feeding flocks with banded stilts and red-necked avocets; nest in small colonies (Birdlife). Known to use the site in times of drought (DEH 2009).	Very large (BI 2019)	NA	284	295		164	280	53	60	87	165	33	30	280
Red-capped Plover	*Charadrius ruficapillus*	LM	None	Aus	very small	100-110mm	30-46g	prefers saline / brackish wetlands in arid areas (Birdlife). Resident at some sites, but some move between wetlands and coast in response to rainfall; occur alone or in pairs when nesting or are gregarious in flocks of 100s, joinging other shorebirds species (Menkhorst et al. 2017). Known to use the site in times of drought (DEH 2009).	Very large (BI 2019)	NA	80	70		15	350			0	2	2		350
Red-necked Avocet	*Recurvirostra novaehollandiae*	LM	None	Aus / vagrant NZ	medium	235-275mm	270-390g	Nest in pairs or colonies, gregarious foraging with stilts in scattered flocks (Menkhorst et al. 2017). Breeds in SW interior of Aus (birdlife) Significant numbers of Avocets have been recorded in the wetlands of the region (Carpenter 2002). Known to use the site in times of drought (DEH 2009).	Very large (BI 2019)	NA	620	3600	80	420	6220		695	24	1000	18	122	6220
Marine / Migratory																						
Crested Tern	*Thalasseus bergii*	LM, Mi	None	Aus	medium	311-368mm	275-371g	terns in general are known to have collisions with power lines in studies from other countries; however a common coastal species that would be considered a vagrant in the study area and is unlikley to be affected (Carpenter 2002). Breeds in colonies on rocky islands, common coastal tern, forages over seas (Menkhorst et al. 2017). Globally important nesting sites occur in the north of Australia (e.g. Lord Howe Island and Norfolk Groups) (temperate-east-marine doc DSEWPaC 2012). well adapted to flight.	Very large (BI 2019)	NA												0
Gull-billed Tern	*Gelochelidon nilotica*	LM, Mi	None	Global	medium	321-357mm	220-290G	terns in general are known to have collisions with power lines in studies from other countries; (Carpenter 2002). Breeds colonially on ephemeral wetlands and lakes, forages on the wing (Menkhorst et al. 2017). Hawk-like when feeding, well adapted to flight.	Very large (BI 2019)	NA	1	0									1
Caspian Tern	*Hydroprogne caspia*	LM, Mi	None	Australasia / North America, Eurasia and Africa	medium	380-450	400-750g	Terns in general are known to have collisions with power lines in studies from other countries; (Carpenter 2002). Occurs in coastal areas, but will also use lrage rivers, temporary wetlands etc.can be resident to partly dispersive; nests in small solitary pairs or small colonies on offshore islands; occurs singly or in small flocks and may roost with other terns / shorebirds (Menkhorst et al. 2017). Inland SA they occur along the Murray River, breeding recorded at the Coorong and inland at Lake Eyre / Lake Goyder (SPRAT profile). Known to use the site in times of drought (DEH 2009).	240,000-420,000 / very large (BI 2019)	NA	76	0		35	48			7	1			76
Whiskered Tern	*Chlidonias hybrida*	LM	None	Aus, but breedsin Europe and Asia	medium	208-236mm	60-110g	terns in general are known to have collisions with power lines in studies from other countries; (Carpenter 2002). Commonly associated with shallow terrestrial wetlands; gregarious typically in flocks; summer visitor in southern Aus, migrate to non-breeding groundsin northern Aus / Indonesia (Menkhorst et al. 2017). Known to use the site in times of drought (DEH 2009). Well adapted to flight, flies buoyantly 5-10m with frequent changes in direction, 'hawks' to forage for insects on the wing.	Very large (BI 2019)	NA	142	156	14	68	140	65		5	0			156

Silver Gull	*Chroicocephalus novaehollandiae*	LM	None	Aus, also NZ / NC	medium	271-314mm	220-355g	known to have collisions with power lines in studies from other countries (Carpenter 2002). Gregarious, occurs in large flocks (Menkhorst et al. 2017). Nest in large colonies on offshore islands (BirdLife).	Very large (BI 2019)	NA		233	56	6	324	10	17	23	4		324
Raptors																					
White-bellied Sea-eagle	*Haliaeetus leucogaster*	LM	En	Aus and PNG, Indonesia, China, SE Asia, India	large	527-633mm	2.2-3.4kg	Disperse during daylight hours; susceptible to electrocution from perching on transmission structures; at risk of collisions (Carpenter 2002). Flight - soaring, wide wingspan	670-6700 (BI 2019)	NA	160 (Dennis et al 2011)	2	1		0	0		0	0		2
Swamp Harrier	*Circus approximans*	LM	None	Australasia / South Pacific	medium	380-444mm	0.5-1kg	Seasonal migration, breed in Tasmaina, winter on Mainland; nest in pairs, non-breeding can gather in communal roosts with dozens of birds (Menkhorst 2017). Slow sailing flight on upswept wings.	Mod small to large (BI 2019)	NA		2	2		2	2		1	1		2
Perergrine Falcon	*Falco pererginus*	None	Ra	Aus, but 2 global subspecies	medium	270-342mm	560-965g	Inhabits most environments with suitable nest sites; cliff faces preferred. Commonly uses stick nests created by other species. Two subspecies occur globally. Fast powerful flight, soars for extended periods, then high-speed swoop on prey (Menkhorst et al. 2017	Very Large 100,000-499,999 (BI 2019)	NA											0

References

BirdLife International (2019) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 27/03/2019.

(EAAF) East Asian-Australasian fly-way estimate, VU = Vulnerable, En = Endangered, CE = Critically Endangered, LM = Listed Marine (not relevant to terrestrial location)

Hansen, B.D., Fuller, R.A., Watkins, D., Rogers, D.I., Clemens, R.S., Newman, M., Woehler, E.J. and Weller, D.R. (2016) Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species. Report for the Department of the Environment. BirdLife Australia, Melbourne

Coppermine Waterhole (Nunthung) located 2.5 km south of Wentworth Rd

nce Lloyd, Peter Gell and Keith Walker of Lloyd Environmental for the Department of Environment and Heritage.

NRAMLR shorebird matrix

EDC (Newell)- Lake Merreti permanent fresh water; Lake Woolpoolool seasonal saline /brackish; Lake Clover (Werta, Limbra, Littra) seasonal fresh

Bamford et al. 2008 in SPRAT

Watkins 1993 in SPRAT

Appendix B. ABBBS data per species summary

Common name	*Species Name*	*EPBC [1] (excludes Listed Marine)*	Total ABBBS recovered dead (all Aus) from 1995 to December 2020	Total ABBBS recovered dead / electricity / powerline related (all Aus) from 1995 to December 2020	Total ABBBS recovered dead (SA) from 1995 to December 2020	Total ABBBS recovered dead / electricity / powerline related (SA only) from 1995 to December 2020	National % caused by powerlines	species with records yes = 1
Waterbirds / Wetland Birds								
Musk Duck	*Biziura lobata*		1	no records	no records	no records	0.00	***0***
Blue-billed Duck	*Oxyura australis*		no records	no records	no records	no records	0.00	***0***
Freckled Duck	*Stictonetta naevosa*		no records	no records	no records	no records	0.00	***0***
Black Swan	*Cygnus atratus*		283	5	1	no records	1.77	***1***
Australian Shelduck	*Tadorna tadornoides*		16	no records	4	no records	0.00	***1***
Australian Wood Duck	*Chenonetta jubata*		39	no records	10	no records	0.00	***1***
Pacific Black Duck	*Anas superciliosa*		83	1	16	no records	0.00	***1***
Australasian Shoveler	*Anas rhynchotis*		no records	no records	no records	no records	0.00	***0***
Grey Teal	*Anas gracilis*		24	no records	11	no records	0.00	***1***
Chestnut Teal	*Anas castanea*		9	no records	no records	no records	0.00	***1***
Pink-eared Duck	*Malacorhynchus membranaceus*		no records	no records	no records	no records	0.00	***0***
Hardhead	*Aythya australis*		no records	no records	no records	no records	0.00	***0***
Australasian Grebe	*Tachybaptus novaehollandiae*		no records	no records	no records	no records	0.00	***0***
Great Crested Grebe	*Podiceps cristatus*		no records	no records	no records	no records	0.00	***0***
Hoary-headed Grebe	*Poliocephalus poliocephalus*		no records	no records	no records	no records	0.00	***0***
Darter	*Anhinga novaehollandiae*		2	no records	no records	no records	0.00	***1***
Little Pied Cormorant	*Microcarbo melanoleucos*		no records	no records	no records	no records	0.00	***0***
Pied Cormorant	*Phalacrocorax varius*		20	no records	5	no records	0.00	***1***
Little Black Cormorant	*Phalacrocorax sulcirostris*		no records	no records	no records	no records	0.00	***0***
Great (Black) Cormorant	*Phalacrocorax carbo*		3	no records	no records	no records	0.00	***1***
Australian Pelican	*Pelecanus conspicillatus*		85	9	37	1	10.59	***1***
White-faced Heron	*Egretta novaehollandiae*		1	no records	no records	no records	0.00	***1***
White-necked Heron	*Ardea pacifica*		no records	no records	no records	no records	0.00	***0***
Great Egret	*Ardea modesta*		1	no records	no records	no records	0.00	***0***
Little Egret	*Egretta garzetta*		no records	no records	no records	no records	0.00	***0***
Intermediate Egret	*Ardea intermedia*		no records	no records	no records	no records	0.00	***0***
Eastern Cattle egret	*Ardea ibis / Bubulcus coromandus*		1	no records	no records	no records	0.00	***1***
Nankeen Night Heron	*Nycticorax caledonicus*		no records	no records	no records	no records	0.00	***0***
Australasian Bittern	*Botaurus poiciloptilus*	En	no records	no records	no records	no records	0.00	***0***
Glossy Ibis	*Plegadis falcinellus*		no records	no records	no records	no records	0.00	***0***
Australian White Ibis	*Threskiornis moluccus*		400	2	no records	no records	0.00	***1***
Straw-necked Ibis	*Threskiornis spinicollis*		10	1	no records	no records	0.00	***1***
Royal Spoonbill	*Platalea regia*		2	no records	no records	no records	0.00	***1***
Yellow-billed Spoonbill	*Platalea flavipes*		no records	no records	no records	no records	0.00	***0***
Buff-banded Rail	*Hypotaenidia philippensis*		1	no records	2	no records	0.00	***0***
Australian Spotted Crake	*Porzana fluminea*		0	no records	no records	no records	0.00	***1***
Spotless Crake	*Porzana tabuensis*		no records	no records	no records	no records	0.00	***0***
Purple Swamphen	*Porphyrio porphyrio (melanotis)*		4	no records	no records	no records	0.00	***1***
Dusky Moorhen	*Gallinula tenebrosa*		10	1	1	no records	10.00	***1***
Eurasian Coot	*Fulica atra*		4		1	no records	0.00	***1***
Black-tailed Native-hen	*Tribonyx ventralis*		no records	no records	no records	no records	0.00	***0***
Waterbird Totals			***556***	***6***	***19***	***0***	1.08	
Raptor								
White-bellied Sea-eagle	*Haliaeetus leucogaster*		4	no records	no records	no records	0.00	1
Swamp Harrier	*Circus approximans*		6	no records	no records	no records	0.00	1
Peregrine Falcon	*Falco peregrinus*		67	5	6	0	7.46	1
Raptor Totals			***10***	***0***	***0***	***0***	0.00	
Migratory Shorebirds								

Latham's Snipe	*Gallinago hardwickii*	*Mi*	no records	no records	no records	no records	0.00	0
Black-tailed Godwit	*Limosa limosa*	*Mi*	1	no records	no records	no records	0.00	1
Bar-tailed Godwit	*Limosa lapponica*	*Mi*	68	no records	no records	no records	0.00	1
Marsh Sandpiper	*Tringa stagnatilis*	*Mi*	1	no records	no records	no records	0.00	0
Common Greenshank	*Tringa nebularia*	*Mi*	no records	no records	no records	no records	0.00	0
Wood Sandpiper	*Tringa glareola*	*Mi*	no records	no records	no records	no records	0.00	0
Ruddy Turnstone	*Arenaria interpres*	*Mi*	14	no records	2	no records	0.00	1
Red-necked Stint	*Calidris ruficollis*	*Mi*	41	no records	2	no records	0.00	1
Long-toed Stint	*Calidris subminuta*	*Mi*	no records	no records	no records	no records		
Sharp-tailed Sandpiper	*Calidris acuminata*	*Mi*	4	no records	no records	no records	0.00	1
Pectoral Sandpiper	*Calidris melanotos*	*Mi*	no records	no records	no records	no records	0.00	0
Curlew Sandpiper	*Calidris ferruginea*	*Mi*	8	no records	no records	no records	0.00	1
Grey Plover	*Pluvialis squatarola*	*Mi*	no records	no records	no records	no records	0.00	0
Pacific Golden Plover	*Pluvialis fulva*	*Mi*	no records	no records	no records	no records	0.00	0
Common Sandpiper	*Actitis hypoleucos*	*Mi*	1	no records	no records	no records	0.00	1
Migratory Shorebirds Totals			***138***	***0***	***4***	***0***	0.00	
Resident shorebirds								
Black-winged Stilt	*Himantopus himantopus*		no records	no records	no records	no records	0.00	0
Banded Stilt	*Cladorhynchus leucocephalus*		no records	no records	no records	no records	0.00	0
Red-necked Avocet	*Recurvirostra novaehollandiae*		no records	no records	no records	no records	0.00	0
Red-capped Plover	*Charadrius ruficapillus*		3	no records	no records	no records	0.00	1
Inland Dotterel	*Charadrius australis*		no records	no records	no records	no records	0.00	0
Black-fronted Dotterel	*Elseyornis melanops*		no records	no records	no records	no records	0.00	0
Red-kneed Dotterel	*Erythrogonys cinctus*		no records	no records	no records	no records	0.00	0
Banded Lapwing	*Vanellus tricolor*		no records	no records	no records	no records		0
Masked Lapwing	*Vanellus miles*		26	no records	no records	no records	0.00	1
Australian Painted Snipe	Rostratula australis	En	no records	no records	no records	no records	0.00	0
Resident Shorebirds Totals			29	0	0	0	0.00	
Migratory / Marine								
Silver Gull	*Chroicocephalus novaehollandiae*		1084	2	5	no records	0.00	1
Gull-billed Tern	*Gelochelidon nilotica*	*Mi*	3	no records	no records	no records	0.00	0
Crested Tern	*Thalasseus bergii*	*Mi*	1329	17	161	3	1.28	1
Caspian Tern	*Hydroprogne caspia*	*Mi*	24	1	2	no records	4.17	1
Whiskered Tern	*Chlidonias hybrida*		4	no records	no records	no records	0.00	1
Migratory / Marine Totals			***2444***	***20***	***168***	***3***	0.82	
		TOTAL	***1832***	***18***	***86***	***0***	**0.98**	**35**
Additional Terresrial Parrots								
Elegant Parrot	*Neophema elegans elegans*	**Rare SA**	**0**	**0**	**0**	**0**	**0**	**0**
Regent Parrot	*Polytelis anthopeplus monarchoides*	***Vu EPBC / SA***	***0***	***0***	***0***	***0***	**0.00**	**0**
Scarlet-chested Parrot	*Neophema splendida*	***Rare SA***	***0***	***0***	***0***	***0***	**0.00**	

[1]EPBCT Act Status; En = Endangered, Vu = Vulnerable, Mi = Migratory

ABBBS (Australian Bird and Bat Banding Scheme) Department of Agriculture, Water and the Environment (DAWE), 2020.

EIS Volume 2 Appendix I-6

Native Vegetation Clearance Data Report

JBS&G

project energy connect

Native Vegetation Clearance

Project EnergyConnect
(Robertstown to SA/NSW border)

Data Report

Clearance under the *Native Vegetation Regulations 2017*

March 2021

Prepared by Dr Sonia Croft, Dr Zeta Bull, Jacobs and Stephen Milne JBS&G

Table of contents

1. Application information

Application Details

Applicant:	ElectraNet Pty Ltd
Key contact:	Scott Haynes ElectraNet Land Services Manager / Emergency Liaison Coordinator Telephone: 08 8404 7966
Landowner:	ElectraNet will be acquiring an easement (or equivalent on Crown land) and will effectively be the landholder for land on the transmission line alignment. Any areas outside the formal easement where clearance is required for construction will have written agreements with the landholder in place.
Site Address:	Robertstown Substation, east to the SA/NSW border traversing land north of Morgan and the River Murray. The alignment traverses private and crown land, the latter including White Dam Conservation Park and the northern boundary of Pooginook and Cooltong Conservation Parks and parts of the southern areas of the Riverland Biosphere Reserve.
Local Government Area:	From west to east, the alignment traverses the following Local Government Areas (& approx. length of alignment): Goyder (25 km), Mid Murray (48 km), Loxton Waikerie (36 km), Renmark Paringa (1 km), & the following unincorporated areas: Pastoral Unincorporated Area (81 km) and Riverland Unincorporated Area (13 km)
Hundred	From west to east the alignment traverses the following Hundreds: Bright, Bundey, Maude, Lindley, Stuart, Markaranka Pooginook and Parcoola (east of the Hundred of Parcoola (20 km NW of Barmera) the alignment is Out of Hundreds).
Title ID:	Numerous titles are involved (refer to Appendix F of the EIS). ElectraNet will be acquiring an easement on the numerous land titles involved, or equivalent easement on Crown Land. Calperum and Taylorville Stations are subject to Native Vegetation Heritage Agreements (HA1544 and HA1543 respectively). These will need to be varied to remove the area for the proposed transmission line easement, which would require the approval of the Minister, with the consent of the NVC and the agreement of the landholder. This variation process is progressing in parallel to the environmental approval process.

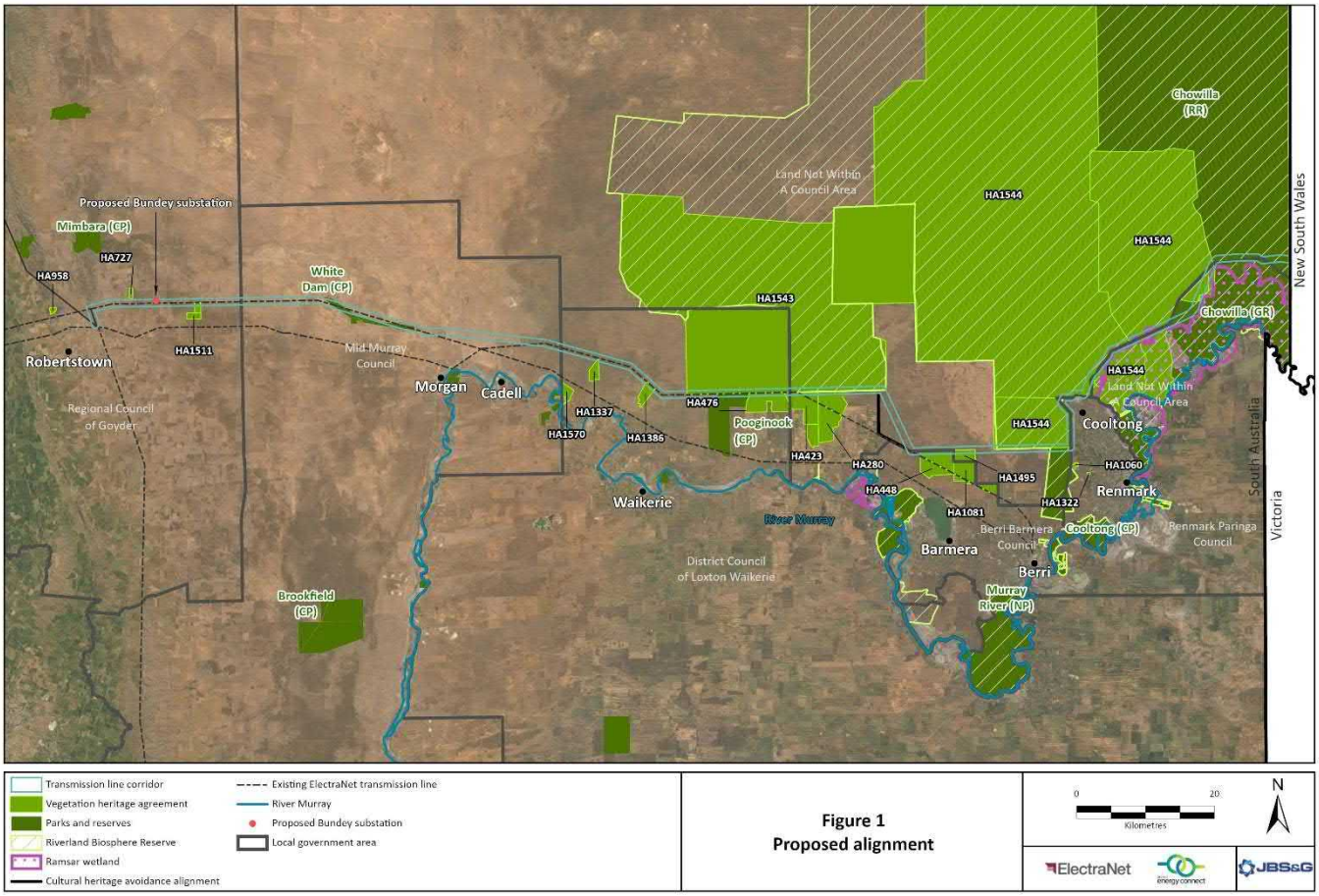
Summary of proposed clearance

Purpose of clearance	Clearance is required for the construction of a 205 km high voltage electricity transmission interconnector from the Robertstown substation to the SA/NSW border, and associated infrastructure, including the construction of a new substation at Bundey, approximately 15 km NE of Robertstown
Native Vegetation Regulation	Clearance for major developments and projects: Part 3, Division 5, Regulation 12 & 13.
Description of the vegetation under application	

Broad Habitat Description	**Km[1]**
Austrostipa (Spear-grass) and/or sparse shrub regrowth of previously cropped paddocks – western end of alignment	17
Chenopod Open Shrubland	49
Low Open Woodland (*Casuarina pauper* (Black Oak), *Myoporum platycarpum* (False Sandalwood) and/or *Alectryon oleifolius* (Bullock Bush) over chenopod undestorey	25
Mallee over *Triodia* (Spinifex) dominated understorey (of various ages since last fire)	58

	Old growth mallee over open sclerophyll and chenopod shrub understorey (primarily *Eucalyptus oleosa* (Red Mallee)*, E gracilis* (Yorrell),) over open sclerophyll and chenopod shrub understorey		47
	Hopbush (*Dodonaea viscosa ssp angustissima*) Tall Open Shrubland		7
	Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey		3
	[1]km rounded	Total	205
Total proposed clearance - area (ha)	Upper estimate for proposed clearance is approximately 413 ha along the length of the proposed alignment (135 ha permanent and 278 ha temporary, that will be subject to rehabilitation). The clearance estimate is likely to be higher than the final vegetation clearance required, as it uses upper estimates for all project components, and does not take into account the preferential use (where feasible) of disturbed areas with no or poorer quality native vegetation. In addition, the vegetation condition and biodiversity assessments do not account for existing tracks and disturbance areas, hence the quality of the vegetation, and Total Biodiversity Score proposed for impact is conservative.		
Level of clearance	Level 4		
Overlay (Planning and Design Code)	State Significant Native Vegetation Overlay (this overlay applies to Wilderness Protection Areas, National Parks, Conservation Parks and areas subject to Heritage Agreements (plus a 50 m buffer). The proposed alignment traverses 118 km of State Significant Native Vegetation Overlay Native Vegetation Overlay (namely those areas of the alignment not subject to the State Significant Vegetation Overlay): The proposed alignment traverses 87 km.		

Figure 1: Map of proposed clearance area (red line)



Mitigation hierarchy	**Avoidance**: The vegetation communities present on the transmission line corridor are common and widespread in the region and extensively represented in areas managed for conservation. The estimated vegetation clearance represents a very small proportion of remnant vegetation in the region. The mallee vegetation present along the central part of the transmission line corridor provides valuable habitat, particularly for threatened mallee birds, however the potential impacts are mitigated as far as practicable by the route selected as well as the very small proportion of habitat that will be impacted. A comprehensive route selection process has been undertaken to ensure that technical, engineering, environmental, social, land access, and economic factors have been appropriately considered. The Project has used the mitigation hierarchy as a driving principle throughout the route selection process to minimise impacts on flora and fauna. The resulting alignment predominantly follows existing disturbance corridors and follows the boundary of the mallee habitats and the Heritage Agreements that are part of the Riverland Biosphere Reserve, which will minimise potential impacts as a result of clearance and fragmentation. A range of measures will be implemented during detailed design and construction to minimise vegetation clearance, including the following: • detailed design of the alignment will aim to avoid traversing isolated patches of vegetation (e.g. at the western end of the transmission line corridor) • pre-clearance surveys will be undertaken to 'micro-site' towers and other infrastructure to avoid occurrences of threatened plants or other significant features (e.g. active Malleefowl mounds)

	• areas where native vegetation is degraded or has been previously cleared will be utilised in preference to clearing vegetation wherever practicable • existing access tracks will be used for access along the easement as far as possible • tracks will be designed to take the shortest route (with the potential to use short spur tracks off existing roads or access tracks) and with as little impact as possible to native vegetation, existing land uses and landholders **Mitigation** • areas of lesser quality vegetation will be cleared wherever practicable. • track widths minimised, typically to 5m (to allow safe access) • temporary worker camps will be sited in disturbed / cleared areas or in areas with limited native vegetation • other temporary facilities (e.g. temporary laydown areas / staging sites) will be sited in disturbed areas or in areas with limited native vegetation as far as practicable • where feasible, vegetation will be rolled or trimmed rather than being completely removed • preparation of the stringing access corridor between tower locations will typically be undertaken using a dozer with blades raised to remove larger trees while keeping shrubs, grasses and topsoil largely intact, or rolled where possible • larger trees in the stringing access corridors may be cut off above ground level with rootstock left intact to allow regeneration rather than being removed where practicable • removal of larger trees (e.g. trunk diameter over 30 cm) will be avoided where possible (noting that sites such as access tracks, tower locations, helicopter staging sites and some break and winch sites will require complete removal of vegetation) • pads for tower assembly will be restricted to the minimum size necessary for safe access • the line will be designed to span across mature vegetation (with minimal clearance required) where feasible. • Use of helicopters during construction will be considered during detailed design and may be used through sensitive areas with difficult access, such as Calperum Station and Taylorville Station, subject to health and safety, commercial and technical feasibility. It is expected that this method would reduce construction footprints and required vegetation clearance. • ElectraNet will incorporate vegetation management requirements in the Construction Environmental Management Plan (CEMP), which will detail the requirements for pre-clearance micro-siting and post clearance audits, exclusion zones and NVC approved clearance areas. Monitoring will be undertaken during and following construction to ensure that vegetation management measures are effective and remediation will be undertaken if required. **Rehabilitation** • Following the completion of construction activities, areas of temporary disturbance will be rehabilitated (approximately 278 ha). For example, pads used for tower construction would be reduced in size, as a much smaller cleared area (typically 25% or less) is required around towers for operation. Topsoil and subsoil would be re-spread over cleared areas with cleared vegetation, and sites allowed to naturally revegetate. The areas of mallee in the middle third of the transmission line corridor are expected to regenerate well, particularly if rootstock is left in place, based on the low levels of weeds present and level of regeneration observed in field surveys. Control of exotic vegetation (particularly grasses) may be required around towers in other areas.

SEB Offset proposal	Payment of $4,214,394.68 or on-ground works to achieve 25,249 SEB points. ElectraNet are investigating potential on-ground projects with landholders and SEB credit providers, with the aim of achieving some or all of the SEB via on-ground works. If this is not feasible, ElectraNet will make a payment into the Native Vegetation Fund.

2. Purpose of clearance

2.1 Description

The proposed Project involves the construction and operation of the South Australian portion (Robertstown to SA / NSW border) of Project EnergyConnect which comprises:

- approximately 10 km of 275 kV transmission line supported by steel towers from the existing Robertstown substation to a proposed new substation located towards the western extent of the transmission line at Bundey, near Robertstown
- approximately 195 km of 330 kV transmission line supported by steel towers from the new Bundey substation to the SA / NSW border
- associated telecommunications infrastructure
- associated access tracks
- associated temporary facilities (e.g. temporary construction compounds, site offices, laydown areas and mobile construction camps).

Clearance associated with the project comprises clearance required for access tracks, tower installation (tower pads), stringing and other temporary construction activities (e.g. construction camps, laydown, brake and winch sites and helicopter staging sites) and the Bundey substation.

Information on the Project justification and alternatives is provided in Chapter 2 and Chapter 3 of the EIS.

Additional detail on the Project is summarised in Section 2.2, 2.3 and 2.4 below.

2.2 Background

Project EnergyConnect is a proposed high voltage electricity transmission interconnector to be constructed between Robertstown in South Australia (SA) and Wagga Wagga in New South Wales (NSW), with an added connection from Buronga in NSW to Red Cliffs in north-west Victoria. The transmission line would be the second major interconnector between SA and the National Electricity Market (NEM). The objective of Project EnergyConnect is to improve the affordability, reliability and sustainability of electricity supply in the NEM through increased electricity transmission between SA, NSW and Victoria

ElectraNet would be responsible for constructing and operating the SA portion of Project EnergyConnect from Robertstown to the SA / NSW Border. This South Australian section of Project EnergyConnect is referred to as 'the Project' for the purposes of the South Australian assessments and approvals processes. TransGrid will develop the line from the SA-NSW border through to the Buronga sub-station, and then ultimately to Wagga Wagga in NSW and Red Cliffs in Victoria. This report concerns only the South Australian component of Project EnergyConnect, from Robertstown to the SA-NSW border.

The Project was declared a Major Development under the *Development Act 1993* (SA) by the Minister for Planning on 24 June 2019 requiring preparation of an Environmental Impact Statement (EIS). The Project was also declared a Controlled Action by the Commonwealth Environment Minister, on 17 July 2019, requiring assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

An EIS has been prepared in accordance with the guidelines issued by the South Australian State Planning Commission (EIS Guidelines) for the consideration of both governments. Approval from both the South Australian and Commonwealth governments is required before the South Australian portion of Project EnergyConnect can proceed.

Route selection

ElectraNet, together with TransGrid, commenced studies in mid-2018 to identify an initial investigation corridor between Robertstown in South Australia and Wagga Wagga in New South Wales. This corridor was subsequently refined through the route selection process outlined in Chapter 4 of the EIS.

The route selection methodology included specialist flora, fauna and cultural heritage studies, along with stakeholder and other community feedback, the latter including: stakeholder surveys, individual and small group meetings, community drop-in sessions, one-on-one meetings with landholders, Traditional Owner group workshops, engagement with other directly affected parties, and feedback collected through the Project EnergyConnect website and public facing interactive mapping and feedback collection tool. The route selection process was overseen by the Project's steering committee, which includes representatives from multiple State and Government Departments and Agencies.

The overall objective was to develop a balanced approach to defining the proposed alignment, including due consideration of environmental, social, engineering, schedule and cost factors, so that the proposed alignment:

- is broadly supported by and acceptable to stakeholders
- avoids areas of significant environmental sensitivity or restricted access and reduces environmental disturbance as far as practical
- avoids (if reasonable) or minimises impacts on areas of particular environmental or social (including cultural heritage) sensitivity or where environmental planning approvals are considered complex
- preferentially follows areas of existing disturbance (e.g. roads and tracks, utility easements, fence lines and cadastral boundaries)
- is suitable from an engineering and construction perspective
- maximises buffer distances to residences and other sensitive land uses
- will allow the transmission line to be accessible for ongoing maintenance requirements
- considers and adheres to all relevant regulatory requirements (international, Commonwealth and State).

Proposed alignment

The proposed alignment presented in the EIS is shown in Figure 2 below. The proposed alignment will be subject to ongoing refinement at the local level as the design phase progresses and engagement continues with landholders, Traditional Owners and other stakeholders. The alignment is expected to remain largely within the nominal 1 km wide transmission line corridor shown in Figure 2 (which is centred on the alignment as at January 2021).

The proposed alignment traversing Hawks Nest Station was adjusted late in the in the preparation of this EIS (and this Data Report) to avoid Aboriginal cultural heritage sites, as discussed in detail in Chapter 4 and Chapter 12 of the EIS. This section of proposed alignment deviates from the transmission line corridor to follow the western boundary of Hawks Nest Station and the existing 132 kV transmission line.

Information on this revised section of alignment has been added to this Data Report where appropriate. The SEB requirements for the cultural heritage avoidance alignment on Hawks Nest Station have been conservatively estimated based on vegetation mapping in the adjacent section of the transmission line corridor.

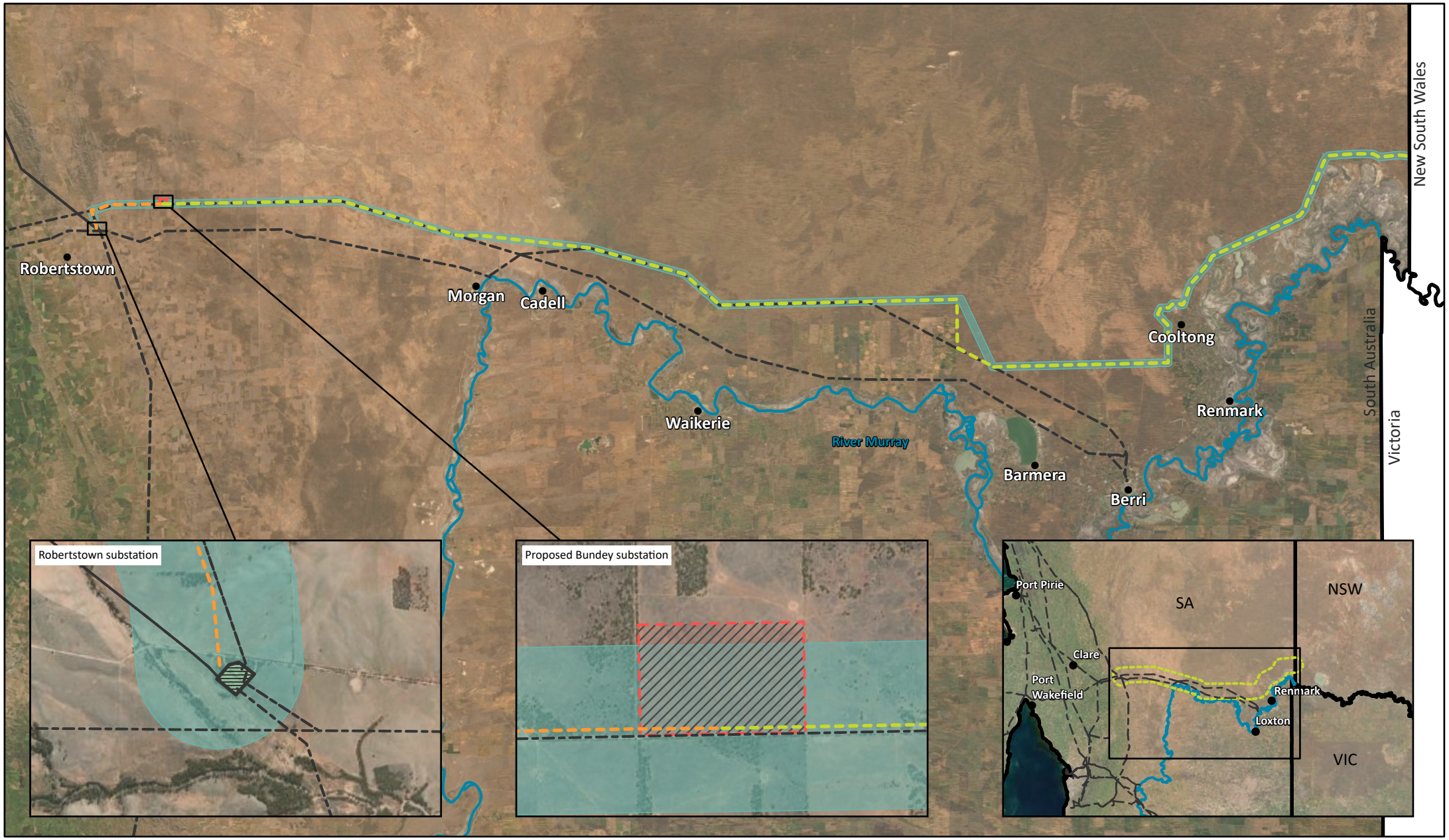
Further minor realignment outside the 1 km transmission line corridor is possible as part of the Project design and stakeholder engagement process that will be ongoing during the consultation phase of the EIS, however significant changes are not expected. These adjustments to the alignment would generally be to reduce or avoid impacts that have been identified as a result of stakeholder engagement, evolution of Project design and delivery options and in response to findings of on-ground surveys and assessments, as discussed in Chapter 4 of the EIS.

Data report

This Native Vegetation Clearance Data Report has been prepared to accompany the EIS for Project EnergyConnect, as required by the EIS Guidelines.

This Data Report provides a preliminary estimate of the SEB requirement for the Project, based on available information at time of lodgement of the EIS. It is expected that a formal application under the Native Vegetation Regulations and an accompanying Data Report will be submitted following submission of the EIS. The Data Report may be updated to incorporate refinements in clearance estimates at the time (e.g. resulting from the EIS process or the progression of detailed design). As is standard for large linear infrastructure projects, it is expected that the clearance areas will remain as estimates in the application and final clearance will be confirmed following construction with in-field audits against approved clearance areas, with the SEB adjusted as necessary to reflect the final clearance.

All proposed native vegetation clearance required for all stages of the Project construction and operation is addressed in this Data Report.



Transmission line corridor
Existing Robertstown substation
Proposed Bundey substation
Proposed alignment - 275 kV
Proposed alignment - 330 kV
Existing ElectraNet transmission line
River Murray

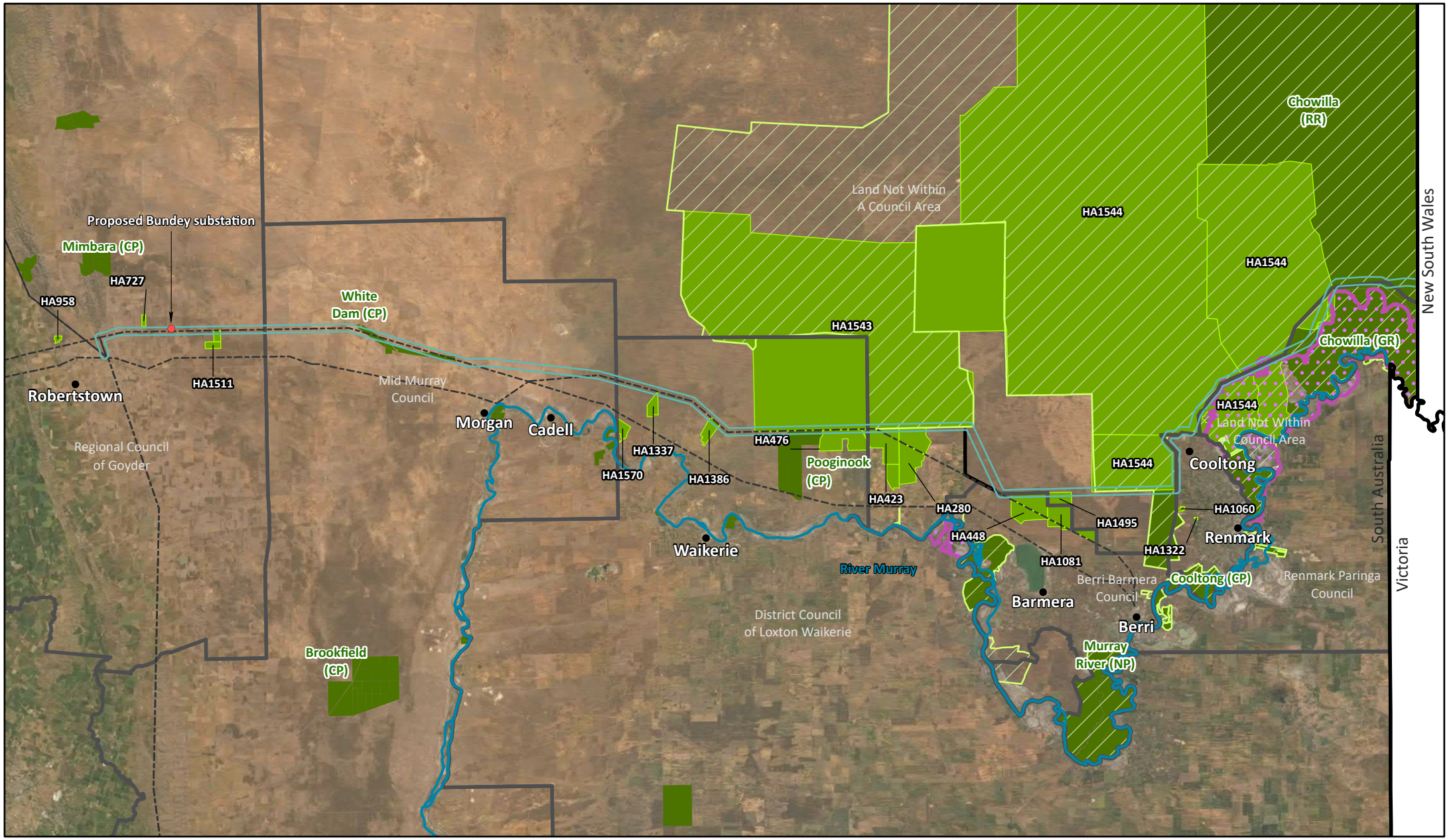
Figure 2
Proposed Project location

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G

2.3 General location map



Transmission line corridor
Vegetation heritage agreement
Parks and reserves
Riverland Biosphere Reserve
Ramsar wetland
Cultural heritage avoidance alignment

Existing ElectraNet transmission line
River Murray
Proposed Bundey substation
Local government area

Figure 3
Proposed alignment

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G

2.4 Details of the proposal

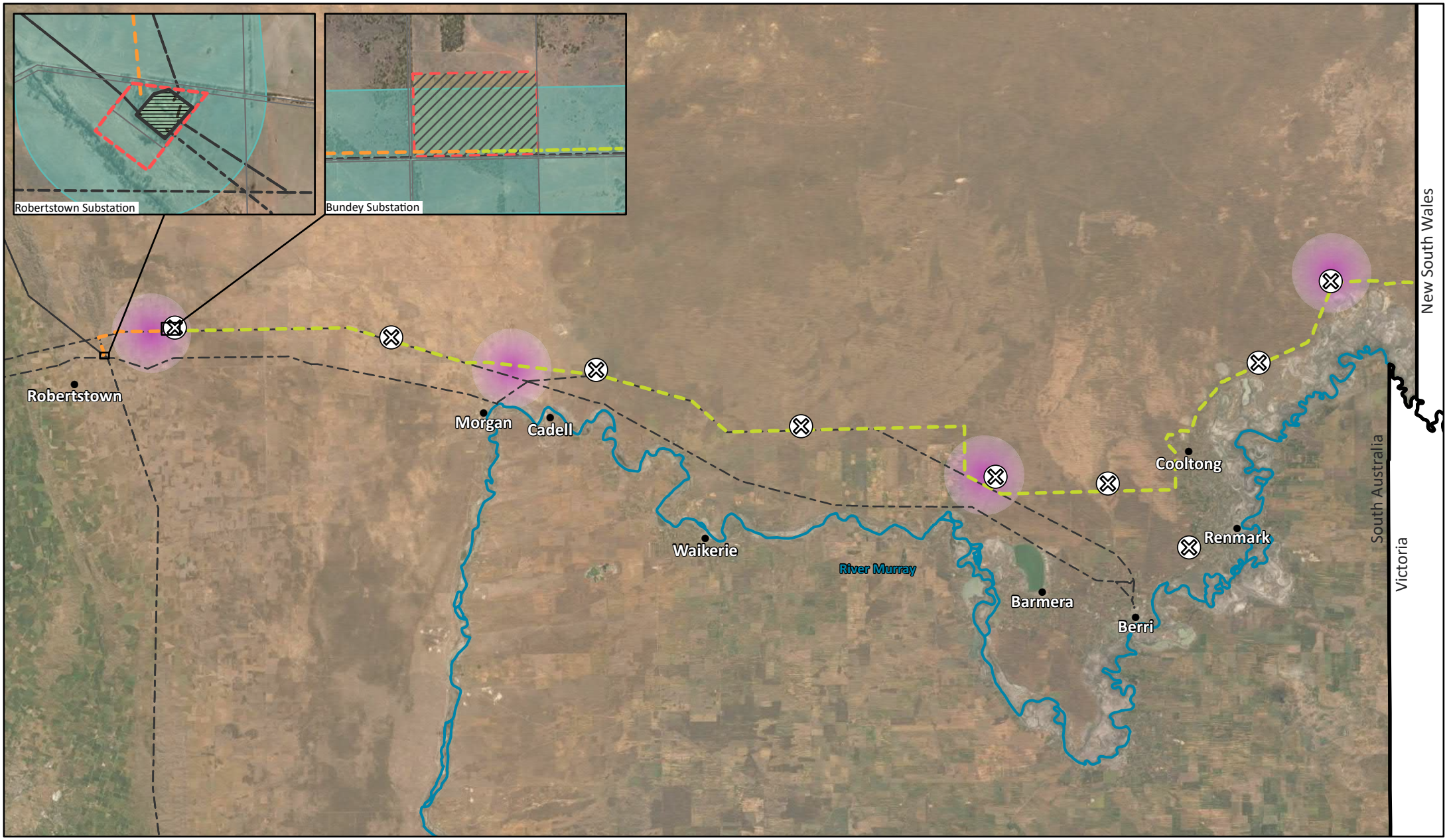
As discussed in Section 2.1 above, the Project comprises:

- a new substation located at Bundey, towards the western extent of the transmission line, approximately 14 km north east of Robertstown, that will facilitate the increase in voltage required from the existing system (from 275 kV to 330 kV) and control the flow between the two systems.
- approximately 10 km of 275 kV overhead transmission line supported by steel lattice towers from the existing Robertstown substation to the proposed new Bundey substation
- approximately 195 km of 330 kV transmission line supported by steel lattice towers from the new Bundey substation to the SA / NSW border at the interface point with TransGrid's NSW portion of Project EnergyConnect
- associated telecommunications infrastructure for operation of the transmission line comprising overhead optical ground wires linked by radio towers (one in SA)
- associated access tracks to provide access to tower sites for construction and maintenance of the transmission line
- associated temporary facilities (i.e. construction compounds, site offices, laydown areas, borrow pits, mobile concrete batching plants, helicopter staging sites, and mobile construction camps).

Augmentation of the existing Robertstown Substation is subject to a separate approval and is not covered by this report.

Figure 4 provides an illustration of the key components of the project and Figure 5 shows the indicative layout of the Bundey substation.

A detailed description of the Project is provided in Chapter 7 of the EIS.



Robertstown substation augmentation
Transmission line corridor
Existing Robertstown substation
Proposed Bundey substation
Potential temporary worker accomodation laydown and staging location

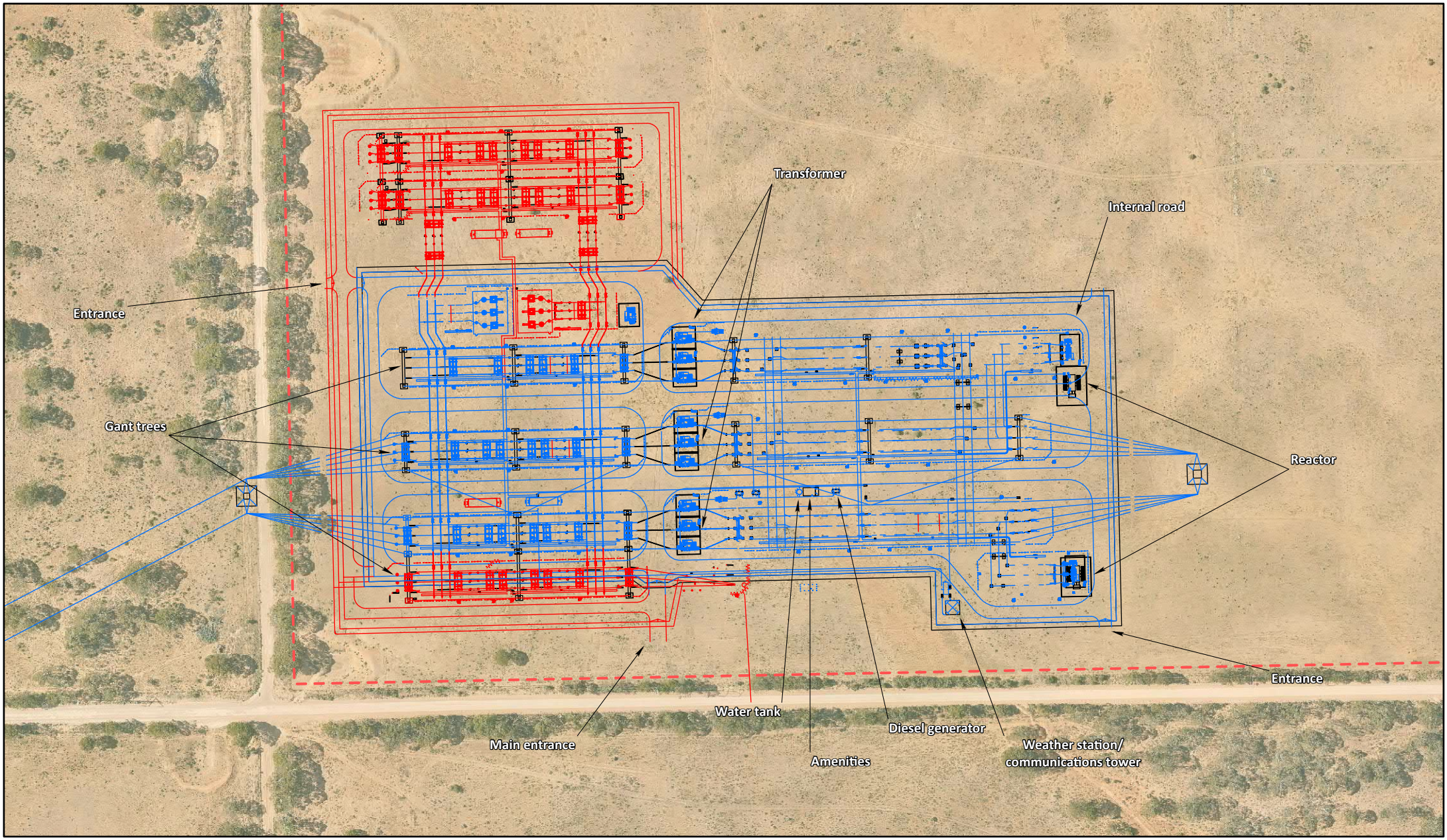
Existing ElectraNet transmission line
Proposed alignment
330 kV
275 kV
River Murray
Potential helicopter staging sites (indicative)

Figure 4
Project components

0 20
Kilometres

N

ElectraNet
energy connect
JBS&G



Proposed Bundey substation Certificate of Title

Indicative Bundey substation layout

Current proposed

Potential future

Figure 5
Indicative layout of the proposed Bundey substation

0 100

metres

N

ElectraNet

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Vegetation Clearance for Construction

In areas where native vegetation is present, clearance will be required for access tracks, tower installation (tower pads), conductor stringing and other temporary construction activities (e.g. construction camps, laydown, brake and winch sites and helicopter staging sites). Areas where native vegetation is degraded or has been previously cleared will be utilised in preference to clearing vegetation wherever practicable. Cleared vegetation will be stockpiled for use in rehabilitation where required.

Conservative estimates of land disturbance for each component of the Project are provided in Table 1. These have been used as a basis for calculation of vegetation clearance in the EIS and this Data Report. It is noted that the total area of land disturbance is significantly higher than the potential vegetation clearance area, as many areas along the proposed alignment are already disturbed and largely devoid of vegetation or comprising only sparse vegetation regrowth (e.g. Bundey substation site, existing access tracks, existing fire break on Calperum Station), which will significantly reduce the actual area of vegetation disturbance.

Where feasible, vegetation will be rolled or trimmed rather than being completely removed, however sites such as access tracks, tower locations, helicopter staging sites and some brake and winch sites will require complete removal of vegetation.

Preparation of the stringing access corridor between tower locations will typically be undertaken using a dozer with blades raised to remove larger trees while keeping shrubs, grasses and topsoil largely intact. Where possible, the stringing access corridor will be rolled to allow access. Larger trees in the stringing access corridor may be cut off above ground level with rootstock left intact to allow regeneration rather than being removed where practicable.

Table 1 provides an estimate of land disturbance (permanent and temporary) for each project component. The total upper estimate of land disturbance is 413 ha (135 ha permanent and 278 temporary). This total disturbance area has been conservatively applied as a blanket 2 ha per km along the whole alignment to estimate vegetation clearance requirements, using these upper estimates and based on the assumption that all land disturbed contains some native vegetation. It is noted that this clearance estimate is likely to be higher than the final vegetation clearance required, as it uses upper estimates for all Project components, and does not take into account the preferential use (where feasible) of disturbed areas with no or poor quality native vegetation. For further detail refer to Chapter 7 of the EIS.

Figures 1 to 5 in Appendix 1 show the proposed alignment and the vegetation associations mapped along the transmission line corridor. Estimated clearance has been applied as a conceptual 20 m wide corridor along the proposed alignment (i.e. 2 ha / km). The actual clearance will involve linear clearance for access tracks and stringing access, and clearance at discrete sites for other project infrastructure, as outlined in Table 1. The location of Project infrastructure and clearance areas will be determined in detailed design.

Table 1: Estimated area of land disturbance for the various project components

Project Component	Assumptions / description	Estimated disturbance area (ha)	Post reinstatement
Access tracks (permanent)	5 m wide access track for entire proposed alignment. This is considered an extremely conservative estimate as existing tracks and minimal clearance is required for much of the line. Alternative access arrangements will be used in sensitive areas*	Approx. 102 ha (0.5 ha per km) permanent disturbance	Light vehicle access
Stringing access corridor (temporary)	5 m wide temporary disturbance alongside 5 m access track for the entire proposed alignment to allow for stringing access and passing bays. This is considered an extremely conservative estimate as existing tracks and minimal clearance is required for much of the line.	Approx. 102 ha (0.5 ha per km) temporary disturbance	Nil – These sites are temporary and will be reinstated post construction. Ongoing maintenance clearance requirements (ElectraNet undertakes periodic vegetation management works on all

Project Component	Assumptions / description			Estimated disturbance area (ha)	Post reinstatement
	Where existing offset access track is used, the temporary stringing access corridor will be up to 10 m in width. Alternative arrangements are covered below*				its easements across the South Australian electricity network, to ensure that mandatory minimum clearance between vegetation and transmission lines are maintained.
Bundey Substation (permanent)	400 m x 250 m			Approx. 9 ha permanent disturbance	9 ha
Worker accommodation camps, laydowns and helicopter staging sites (temporary)	Up to a maximum of 4 temporary construction camps (2 – 5 ha each) Up to 4 main laydown areas (1 – 2 ha each) Between 4 - 9 helicopter staging sites for tower transport (Up to 6 ha each) (this may reduce the footprint of tower pads to 28m x 28m)			Temporary camps - total maximum clearance of ~ 20 ha Temporary laydown areas – total maximum clearance of ~ 8 ha Temporary staging – total maximum clearance of ~ 54 ha	Nil. These sites are temporary and will be reinstated post construction
Concrete batching (temporary)	Up to 3 concrete batching plants			Approx. 3 ha temporary disturbance	Nil. These sites are temporary and will be reinstated post construction
Brake, winch and OPGW sites (temporary)	Assuming every 16 km, 3 brake / winch sites (0.24 ha each) and 2 further OPGW sies (0.18 ha each). This = 1.08 ha per 16 km = 13.84 ha for total alignment, assuming dual use of brake / winch and OPGW sites/helicopter sites			Approx. 17.3 ha (13.84 plus 25% contingency for additional angles anticipated through Calperum Station) temporary disturbance	Nil. These sites are temporary and will be reinstated post construction
TOWERS	#	Assembly Method	Ha per tower		
Strain towers *[includes 4 Medium Terminal towers]*	76	2 stage Assembly method (50 x 50 m) Alternative methodologies are covered in Section 7.8.4 of the EIS. Should helicopters be used smaller pads will be required	0.25	Approx. 19 ha total – 5 ha permanent disturbance and 14 ha temporary disturbance	Partially rehabilitated. Assumed 25% of area remains cleared. Ongoing maintenance clearance requirements will be done under Electricity (Principles of Vegetation Clearance) Regulations 2010
TOWERS	#	Assembly Method	Ha per tower		
Suspension towers *[Assumes heavy, though light is same clearance]*	300	2 stage Assembly method (50 x 50 m) Alternative methodologies are covered in Section 7.8.4 of the EIS. Should helicopters be used smaller pads will be required.	0.25	**Approx. 75 ha total – 19 ha permanent disturbance and 56 ha temporary disturbance**	Partially rehabilitated. Assumed 25% of area remains cleared. Ongoing maintenance clearance requirements will be done under Electricity (Principles of Vegetation Clearance) Regulations 2010
Topsoil stockpiles	376	Topsoil removal of 100mm depth for 76 strain tower locations = approximately 250m3**.** Assume 2m high Topsoil removal of 100mm depth for 300 suspension	0.0125 0.008	3.35 ha temporary disturbance	

Project Component	Assumptions / description			Estimated disturbance area (ha)	Post reinstatement
		tower locations = approximately 160m3. Assume 2m high			
Total (Upper estimate) disturbance for the Project				135 ha permanent 278 ha temporary	

*Potential alternative access arrangements are illustrated in Figure 7-11 in the EIS and may include short spur tracks off existing roads or access tracks where feasible

Easement access and maintenance

Trimming of vegetation to maintain electrical clearance requirements for operation may be required, dependent on detailed design of the line and the height of mature vegetation.

Vegetation clearing or trimming along the easement will only be carried out where necessary to facilitate access to specific locations such as towers and areas where vegetation will encroach on the clearance zone underneath the transmission line conductors.

Vegetation assessments, including canopy height measurement, are used during the detailed engineering phase to design the line profile. Where feasible, conductor heights will be set to avoid or minimise the requirement for vegetation clearance both during construction and ongoing maintenance. Where vegetation clearance is unavoidable and to minimise the risk of power outages, damage to transmission lines or fire starts, vegetation management works are undertaken to make sure that clearance distances between vegetation and transmission lines are established and maintained in accordance with the *Electricity (Principles of Vegetation Clearance) Regulations 2010* (SA).

As much of the native vegetation is relatively low, slow growing and at or near mature height, it is planned to design the line to span across mature vegetation with minimal clearance required where feasible. If this is not feasible, some clearance or lopping of trees may be required under the conductors in some areas. Preliminary calculations have indicated that trees up to a height of approximately 8 m may be able to be spanned without trimming. This will be confirmed when detailed line design is undertaken.

2.5 Approvals required *or* obtained

Detailed information on Project approvals is contained in Chapter 5 of the EIS. A brief overview is provided below.

2.5.1 Native Vegetation Act 1991

The native vegetation clearance requirements of the Project are the subject of this Data Report, and will be addressed under the *Native Vegetation Regulations 2017* (see below).

2.5.2 Planning, Development and Infrastructure Act 2016 / Development Act 1993

The Project has been declared a Major Development under the *Development Act 1993* (SA), requiring preparation of an Environmental Impact Statement (EIS) as noted above. This Native Vegetation Clearance Data Report has been prepared to accompany the EIS for Project EnergyConnect, as required by the EIS Guidelines.

2.5.3 Environment Protection and Biodiversity Conservation (EPBC) Act 1999

The Project was declared a Controlled Action by the Commonwealth Environment Minister, requiring assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), as noted above. Under the Bilateral Agreement on environmental assessment between the Commonwealth and South Australian governments, the Project EIS and the Assessment Report will be used by the Commonwealth Minister to make a decision on the project against the requirements of the EPBC Act.

2.5.4 Other South Australian legislation

Table 5-4 in Chapter 5 of the EIS provides a summary of other legislation and approvals relevant to the Project.

2.6 Native Vegetation Regulation

As the Project has been declared a Major Development, the clearance of native vegetation is being assessed under the "Risk Assessment" pathway of the *Native Vegetation Regulations 2017*. Specifically, it is being assessed under Part 3, Division 5, Regulation 12 & 13. Under these Regulations, the requirements of a proponent to undertake clearance for Major Developments and Projects are as follows:

> **Regulation 13—Clearance for major developments and projects**
> (1) Clearance of native vegetation for the purposes of a development or project of a kind specified in Schedule 1 Part 4 is permitted only if it is undertaken in accordance with—
> (a) the consent granted for the proposed development or project; and
> (b) a management plan, approved by the Council for implementation, that results in a significant environmental benefit.
> (2) Subregulation (1)(b) does not apply if the owner of the land (or a person acting on the owner's behalf) has made a payment into the Fund of an amount considered by the Council to be sufficient to achieve a significant environmental benefit in the manner contemplated by section 21(6) or (6a) of the Act.
>
> **Schedule 1 Part 4—Major developments and projects under Development Act 1993 (regulation 12)**
> **27—Major projects**
> Clearance of vegetation that is incidental to a proposed development to which section 48 of the Development Act 1993 applies, provided that—
> (a) an environmental impact statement, public environmental report or development report, and an Assessment Report, relating to the development have been prepared under the Development Act 1993; and
> (b) the Minister responsible for the administration of the Development Act 1993 referred the environmental impact statement, public environmental report or development report to the Council for comment and report and—
> (i) the Council provided comments that were included (wholly or substantially) in the relevant Assessment Report; or
> (ii) the Council failed to provide comments within 8 weeks after receiving the Minister's invitation for comment and report; and

(c) the Governor has consented to the proposed development under section 48 of the Development Act 1993.

2.7 Development Application information (if applicable)

The Project intersects the following planning overlays of direct relevance to native vegetation:

- State Significant Native Vegetation Overlay (this overlay applies to Wilderness Protection Areas, National Parks, Conservation Parks and areas subject to Heritage Agreements (plus a 50 m buffer) - the proposed alignment traverses 118 km of State Significant Native Vegetation Overlay
- Native Vegetation Overlay (namely those areas of the alignment not subject to the State Significant Vegetation Overlay): The proposed alignment traverses 87 km.

A summary of zones, overlays and policies relevant to the Project is provided in Table 2. Further detail is provided in Chapter 5 of the EIS.

Table 2: Summary of Zones, Overlays and Policies applicable to the Project

Zones, Overlays and Policies	
Zone	Conservation Zone Remote Areas Zone Rural Zone Rural Horticulture Zone Rural Intensive Enterprise Zone
Overlays	Dwelling Excision Hazards (Acid Sulfate Soils) Hazards (Bushfire – General Risk) Hazards (Bushfire – Medium Risk) Hazards (Bushfire – Outback) Hazards (Bushfire – Regional) Hazards (Flooding – General) Heritage Adjacency Key Outback and Rural Routes Limited land Division Murray-Darling Basin Native Vegetation Prescribed Watercourses Ramsar Wetlands River Murray Flood Plain Protection Area State Significant Native Vegetation Areas Water Resources
General Development Policies	Infrastructure and Renewable Energy Facilities Interface Between Land Uses Transport, Access and Parking

3. Method

The methodology associated with flora and fauna assessments is detailed in the following sections. The following terms are used to describe the area of the Project and the study area. These are:

- Transmission line corridor (TLC) (a 1 km wide corridor, 500 m either side of alignment (as at January 2021).
- Ecological Study Area: a 25 km buffer based on the alignment (as at January 2021) i.e. a 50 km wide corridor (referred to more broadly in the EIS assessment, particularly for fauna).

A detailed description of the methodology is provided in Section 11.2.4 of the EIS and Appendix 2 of this report. An overview is provided below.

Database Searches – flora and fauna

Extracts from the Department for Environment and Water's Biological Databases of South Australia (BDBSA) were obtained through the data request (DEW 2020). This provided data from all datasets included in the BDBSA, including Birdlife records. The data request was in November 2020 (Recordset number DEWNRBDBSA201201-1, including all data held in the BDBSA and Birdlife data within a 25 km buffer of the latest project proposed alignment). This data was used to inform the EIS and associated Appendices. The data was also used for 5 km data searches to inform the BAM assessment inputs (see below).

The Protected Matters Search Tool (PMST) was used to generate reports of Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act* 1999, that may occur within a 5 km buffer of the alignment. For this data report / BAM score sheet entry, the alignment was divided into four segments reflecting changes in broad habitat type. A PMST was conducted on a 5 km buffer on each of the four segments. Fauna species (or habitat) 'known to occur' were included, where habitat was considered suitable (for example, shorebirds and wetland birds were excluded from the terrestrial habitats of the alignment). These species are considered in the EIS for bird strike potential, based on flyover, however they would not roost or forage in the vegetation of the transmission line corridor.

3.1 Flora assessment

As per Section 11.2.4 of the EIS, flora assessment included both desktop and field components:

- Desktop review of information from a range of sources
    - previous BDBSA records (from 1995) in the wider ecological study area, 5 km buffer on 7 major habitat types, and within the 1 km transmission line corridor
    - PMST 5 km buffer output (as per 'Database Searches' above)
    - Relevant reports, management plans, reference materials and published papers (Refer EIS Chapter 11.3)
- Likelihood of occurrence assessment for flora species with potential to occur (based on records / PMST output) (Refer Section 11.3.3 of the EIS)
- Significant impact assessment (against DotE 2013 criteria) (Appendix I-3 of the EIS)
- Field Assessments
    - As planning for Project EnergyConnect progressed, constraints (environmental, social) along the alignment were identified and better understood, and a number of changes to the alignment were made

over time to avoid high value areas or particular constraints. As a result, four separate field assessments of vegetation associations within the area of the Project were conducted between November 2018 and January 2021, covering preferred and alternative alignment options (at the time of assessment), as the route was refined over time. Each subsequent survey aimed to fill in gaps in vegetation types surveyed and/or survey new alignments.

- Field assessments were undertaken using the Bushland Assessment Method (BAM) (NVC 2020), as required to assess applications under the *Native Vegetation Act* 1991 (94 BAM sites in total):
    - Survey 1: 19-22 November 2018 (20 BAM sites) (NV Accredited Consultant Rick Barratt and Dr Nick Bull)
    - Survey 2: 3-7 June 2019 (29 BAM sites) (NV Accredited Consultant Dr Sonia Croft and Rose-anne Bell)
    - Survey 3: 28-30 October 2019 (29 BAM sites) (Dr Sonia Croft and Dr Lucy Clive)
    - Survey 4: 6 – 8 January 2021(16 BAM sites) (Rick Barratt and Dr Lucy Clive)
- Field assessments also included targeted searches for EPBC listed flora and Threatened Ecological Communities based on desktop review. During the field surveys, one Nationally rated flora species was recorded at the western end of the alignment; *Dodonaea subglandulifera* (Peep-hill Hopbush). Refer EIS Chapter 11.3.3 and EIS Appendix Vegetation Assessment Summary I-2 for further detail.
- Given some field assessments were conducted in Summer during a drought, some taxa were only recorded to species level.
- As noted in the EIS, micro-siting within the transmission line corridor will occur prior to final vegetation clearance of the approved infrastructure footprint (permanent and temporary areas), hence information provided here represents conservative upper estimates.

Vegetation Mapping

The alignment was mapped into different Bushland Assessment site vegetation associations using aerial imagery, BAM site reference locations and ground-truthing notes. That is, areas of similar floristic composition were mapped as the nearest and most appropriate BAM survey site. Vegetation associations less than 30 m in length, and tracks were included in adjoining BAM associations. It should be noted that condition of vegetation in the BAM sheets is conservative and whilst existing tracks are present (and may be used for the Project), these have not been accounted for in the condition scores.

Of the 94 surveyed BAM sites, 72 BAM sites were used in the mapping of the entire alignment. Alignment vegetation mapping was undertaken by Dr Sonia Croft. EIS Chapter 11 contains mapping of Vegetation Condition across the alignment (Figure 11-3), Bushland Condition Monitoring (BCM) communities across the alignment (Figure 11-2) and broad habitat mapping across the alignment (Figure 11-8). Noting vegetation condition was based on categories assigned to vegetation condition scores from excel BAM sheets, where very low = scores < 20, low = scores 20-35, medium = scores 36-55 and high was for sites with scores >55.

Appendix 1 of this report shows detailed vegetation mapping of vegetation associations and broad habitats for the Project.

3.2 Fauna assessment

As per Section 11.2.4 of the EIS, fauna assessment for the EnergyConnect Project involved the following combination of desktop and field assessments:

- Desktop review of information from a range of sources

- previous BDBSA / Birdlife records (from 1995) in the wider Ecological Study Area, 5 km buffer on 7-10 major habitat types / ends of the alignment (for BAM scoresheet inputs), and within the 1 km transmission line corridor (refer Appendix 3.1 this document for the assessment of species and presence or absence of BDBSA records)

- Protected Matters Search Tool output (5 km buffer on 4 habitat areas for BAM scoresheet inputs). The alignment was divided into four segments reflecting changes in broad habitat type. A PMST was conducted on a 5 km buffer for each of the four segments. BAM sites within each of the four PMST segments were recorded. Fauna species (or habitat) 'known to occur' as per PMST output were included, where habitat was considered suitable (e.g. Shorebirds and wetland birds were excluded from the terrestrial habitats of the alignment). These species are considered in the EIS for bird strike potential, based on flyover, they would not roost or forage in the vegetation of the transmission line corridor. (refer Appendix 3.2 this document for the PMST 'known' species by segment and BAM site; Appendix 3.3 for the final species input to BAM scoresheets; Appendix 3.4 for the species excluded from BAM scoresheets)

- Relevant reports, management plans, reference materials and published papers (Refer EIS Chapter 11.3)

- Likelihood of occurrence assessment for species with potential to occur (based on records / PMST output) (Refer Section 11.3.6 and Appendix I-1 of the EIS, and Appendix 3.1 this document)

- Opportunistic observations / habitat assessment during BAM assessments
  - During each of the four field surveys, an opportunistic fauna assessment was undertaken concurrently with the vegetation surveys, which includes records of birds, mammals and reptiles.

  - The survey also included an assessment of the value of habitat for threatened fauna listed under the EPBC Act and NPW Act.

- Significant impact assessment (against DotE 2013 criteria) (Appendix I-3 of the EIS)

- Targeted Mallee Birds Assessment (Appendix I-4 of the EIS)

- Review of potential impacts to Wetland Birds (Appendix I-5 of the EIS)

Given the linear nature of the project and the fauna information available for the region, detailed fauna trapping was not undertaken. This approach was confirmed with DEW staff in the earlier phases of the project, similar to other linear projects of this nature.

As per above the BAM scoresheet requires input of threatened fauna species to inform the Unit Biodiversity Score. An assessment of species with BDBSA / Birdlife records within 5 km of BAM sites, grouped by broad habitats and species suggested as 'known' in PMST outputs was undertaken and emailed to Adam Schutz for approval, the summary of species per habitat that were included in BAM score sheets to contribute to the Total Biodiversity Score for the vegetation proposed to be impacted is provided in Appendix 3.3 this document.

4. Assessment Outcomes

4.1 Vegetation Assessment

General description of the vegetation, the site and matters of significance

Regional Context

Remnant vegetation within the proposed alignment varies in condition, with higher value vegetation generally located along the eastern portion of the Ecological Study Area, primarily within conservation areas, but also as discrete and isolated patches within cleared or heavily grazed private land towards the western end of the transmission line corridor.

The ESA encompasses a number of the conservation parks / reserves that includes contiguous significant habitat that forms a part of the Riverland Biosphere Reserve (formerly the Bookmark Biosphere Reserve), which has a total reserve area of 900,000 ha. A biosphere reserve incorporates one or more protected areas and surrounding lands that are managed to combine both conservation and sustainable use of natural resources. The Riverland Biosphere Reserve is recognized by UNESCO as providing old-growth mallee woodland and shrubland, habitat for the EPBC listed as Endangered Black-eared Miner, as well as wetlands and riverine communities within proximity to the River Murray.

The majority of conservation areas and the Riverland Biosphere Reserve are avoided by the proposed alignment. Where possible, the proposed alignment parallels existing tracks and roads within the greater Riverland Biosphere Reserve including the Taylorville and Calperum southern boundary tracks (and the existing 132 kV transmission line for over half the Taylorville southern boundary), Cooltong CP northern boundary track and Wentworth-Renmark Road. These tracks / roads already fragment the landscape and include road reserves either side of the track, existing areas of disturbance (e.g. a long history of introduced herbivore grazing) and an existing level of weed and pest fauna presence. There are a number of other conservation areas within the ESA which also protect native vegetation and support threatened species and the majority of these conservation areas are avoided by the transmission line corridor.

In total, 94 vegetation sites were assessed along, or near the alignment, comprising 7 Bushland Condition Monitoring communities (13 sub-communities). In general, the vegetation at the western end contained smaller patches of remnant mallee, interspersed with land cropped at irregular intervals, which supported sparse native regrowth at the time of surveys. This vegetation transitions to chenopod shrubland and low open woodland over chenopod shrubland, before transitioning into extensive tracts of mallee in the centre of the alignment. In the eastern third of the alignment, the vegetation is again dominated by chenopod shrubland, low open woodland, but also interspersed by Hopbush shrubland and patches of old growth mallee. The alignment traverses approximately 2.2 km of White Dam Conservation Park (primarly chenopod shrubland, Black Oak and False Sandalwood woodland) and runs adjacent to boundaries of several other conservation areas. The transmission line corridor follows the Taylorville southern boundary track, following an existing transmission line easement along the northern boundary of Pooginook Conservation Park (mallee) and continues along the southern boundary of Taylorville Station (mallee).

In the eastern portion of the transmission line corridor on Taylorville Station, the alignment diverges from the existing 132kV transmission line easement (where the 132 kV line diverts south-east) to continue east along the Taylorville southern boundary track.

At Hawks Nest Station the transmission line corridor diverts to the south-east through taller open mallee over tall shrubs in swales and sandy loam flats, and smaller mallee over Spinifex on low sandy rises. The proposed alignment (the cultural heritage avoidance alignment) through this area is located further to the west and follows the western boundary of Hawks Nest Station southwards to the existing 132 kV transmission line, which it parallels until it reaches the Overland Corner track. Vegetation along this section is similar to the transmission line corridor, however there is existing disturbance present from tracks, fencelines and the 132 kV line easement and access track.

The proposed alignment then traverses east along the northern boundary of three smaller vegetation Heritage Agreement Areas (448, 1495, 1601) and the southern boundary of Calperum station and the northern boundary of Cooltong CP along the 'Cooltong Track' through remnant mallee. Much of the mallee along this section is regrowth from bushfires in 2006 and/or 2014.

From the north-east corner of Cooltong Conservation park, the alignment traverses north along the eastern margin of the Riverland Biosphere Reserve (also HA 1544), which is the eastern margin of an extensive tract of mallee, and adjoins a mosaic of native vegetation, exotic pastures and irrigated agriculture to the east.

North-east of Cooltong, the alignment veers east and north-eastwards again, with the vegetation transitioning from mallee to broadly Black Bluebush shrubland on loam flats, and Hopbush shrubland on dunes, as it traverses through Calperum Station. Continuing north-east through Chowilla Game Reserve, Heritage Agreement 1544 and Chowilla Regional Reserve, Black Bluebush shrublands and Hopbush shrublands continue, and additionally, there are patches of old growth mallee, Black Oak Woodland and sparsely treed areas of Native Pine.

Vegetation condition at the western end of the alignment was generally low (with cleared agricultural paddocks and heavily grazed shrublands subject to prolonged drought), as was vegetation at the far eastern end (due to prolonged drought, and disturbance within road reserves). Condition of vegetation within large patches of old growth and regrowth mallee found in the central portion of the alignment was in moderate to good condition, as portions of these areas are within areas of land managed for conservation and contain intact remnant vegetation.

No Threatened Ecological Communities (TECs) were identified along or near the alignment. One Nationally threatened flora species (*Dodonaea subglandulifera*, Peep Hill Hopbush) was found along the current alignment. An estimated 50 – 100 individuals were recorded within an area of about 0. 5 ha, associated with rocky slopes and gullies near the western end of the alignment. One Rare state threatened flora species was recorded *Geijera parviflora* (Wilga) at two survey sites of mallee vegetation, in the western third of the project area, and approximately 1 km north of the current alignment, outside the transmission line corridor.

Further detail is provided in Section 11.3.2 of the EIS.

Details of the vegetation proposed to be impacted

Due to the large number of vegetation associations, they have been grouped by major habitat type to facilitate the assessment.

The following includes a description of each major habitat type, along with a list of the BAM associations considered representative of that habitat type along the alignment. Of the 94 BAM sites surveyed, 72 BAM sites have been used to map the vegetation along the alignment. All 94 sites / vegetation associations, however, have been described in the accompanying Vegetation Assessment Summary Report (Appendix 2 of this report). All 94 BAM sites have been grouped into major habitat types, namely vegetation types with similar structural and floristic composition.

Calculations and estimates are as follows:

- 72 BAM sites are grouped by major habitat type
- Vegetation Condition score – corresponds to bar graph in excel BAM scoresheets, where scores < 20 = very low, 20-35 = low, 36-55 = medium, 56+ = high.
- Landscape Context Score, Vegetation Condition Score, Unit Biodiversity Score are presented as an average and range for the BAM sites representative of the major habitat.
- Total Biodiversity Score = sum of TBS for each BAM site per habitat group (based on km mapped per BAM site vegetation x 2 ha of impact per km)
- Note the Bundey Substation sites and impact are included in the above estimates (e.g. Spear-grass (*Austrostipa sp*.) and/or sparse shrub regrowth of previously cropped paddocks– western end of alignment, sites 1c, 3c, 4c)

Major Habitat	***Austrostipa* (Spear-grass) and/or sparse shrub regrowth of previously cropped paddocks – western end of alignment**
General description	At the western end of the alignment, 16.64 km has been mapped as sparse regrowth following clearance for cropping, possibly several years ago. Typically, *Maireana brevifolia* (Short-leaf Bluebush) has been the dominant shrub regrowth, and *Austrostipa sp.* (Spear-grass), *Salsola australis* (Buckbush) and/or *Sclerolaena* (Bindyi) species, the dominant groundcovers. Other scattered shrubs included *Enchylaena tomentosa* (Ruby Saltbush) and *Acacia nyssophylla* (Spine Bush). Species diversity is low, typically < 10 native plant species, and shrubs are widely spaced. Common weed species were *Medicago* (Medic) species, *Carthamus lanatus* (Saffron Thistle), *Asphodelus fistulosus* (Onion Weed) and *Erodium* species (Heron's Bill). The BAM survey sites within this habitat type scored very low or low condition levels. These sites are now grasslands or open shrublands, but are likely to have been mallee vegetation types prior to clearance, based on adjoining roadside vegetation. Despite the lower condition, *Dodonaea subglandulifera* (Peep-hill Hopbush) which is EPBC Listed and NPW listed as Endangered was present at site 101a. Two groups plants that were located are part of a known Robertstown subpopulation of the species and can be avoided by the project with the mitigation measures proposed (Refer EIS Chapter 11 and Appendix I-3 – SIA for further detail). This habitat is also representative of the Bundey Substation sites (sites 1C, 3C, 4C)

Plate 1: Site 3c. Facing West. *Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland

BAM site	BCM	BAM Vegetation Association	Condition Score	Length mapped (km)
1b	9.1	*Salsola australis* (Buckbush) Very Open Herbland with isolated *Eucalyptus porosa* (Mallee Box)	7.5	1.86
1c	3.1	*Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland with sparse emergent shrubs (Bundey Substation)	33.28	0.95
2b	9.1	*Salsola australis* (Buckbush) Very Open Herbland with emergent *Melaleuca brevifolia* (Small-leaved Bluebush)	5.9	1.71
3c	3.1	*Atriplex vesicaria* (Bladder Saltbush) Low Very Open Shrubland (Bundey Substation)	25.71	1.51
4c	10.11	*Austrostipa* (Spear-grass) species Open Grassland with emergent *Atriplex vesicaria* (Bladder Saltbush) and *Senna* spp. (Bundey Substation)	41.43	0.07
101a	3.1	*Austrostipa* sp. (Spear-grass) Open Grassland with emergent shrubs including *Dodonaea subglandulifera* (Peep Hill Hopbush) and isolated mallee trees.	33.31	0.29
101c	3.1	*Maireana brevifolia* (Short-leaf Bluebush) Low Open Shrubland +/- patches of *Austrostipa* sp. (Spear-grass)	16.63	1.81
101d	1.1	*Austrostipa* sp. (Spear-grass) Open Grassland with emergent sclerophyll and chenopod shrubs	23.63	6.02
102b	3.1	*Maireana brevifolia* Low Open Shrubland	18.29	2.37

Threatened species or community	*Dodonaea subglandulifera* (Peep-hill Hopbush) EPBC Listed and NPW listed as Endangered and present at site 101a				
Landscape context score*	Average: 1.15 Range: 1.09 - 1.17	Vegetation Condition Score*	Average: 22.85 Range: 5.9 - 41.4	Conservation significance score	Average: 1.1 Range: 1.1
Unit biodiversity Score	Average: 29.84 Range: 7.6 – 50.7	Area (ha) (Total impact for habitat type)[1]	33.19 ha	Total biodiversity Score	803.75

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	Chenopod Open Shrubland
General description	Chenopod shrubland occurs in the western and eastern thirds of the proposed alignment, with a total of 49.12 km mapped as this habitat type. In the western third of the alignment, 30.94 km has been mapped as chenopod shrubland, dominated typically by *Maireana pyramidata* (Black Bluebush) and/or *Maireana sedifolia* (Bluebush). In localised areas of clay soil depressions *Nitraria billardierei* (Nitrebush) or *Lycium australe* (Australian Boxthorn) are the dominant overstorey shrubs. In the eastern third of the alignment, 18.19 km has been mapped as chenopod shrubland, all north-east of Renmark. *Maireana pyramidata* (Black Bluebush), is typically the sole dominant. *Maireana pyramidata* is associated with heavier textured soils, but in the eastern third of the alignment, often transitions into *Dodonaea viscosa* ssp. *angustissima* (Hopbush) shrubland on sandier rises. These chenopod shrublands have no known mechanical clearance or fire history. However, all sites are grazed by domestic stock and/or native or pest herbivores. Grazing combined with prolonged below average rainfall prior to the surveys, has resulted in most sites having very low native plant species diversity, shrubs of reduced density, and with the litter layer sparse to absent. This is reflected in the low to moderate condition scores for the majority of BAM survey sites. Weeds were also sparsely present, with *Carrichtera annnua* (Ward's Weed), and *Medicago* species (Medics) the most common species recorded.

Plate 2: Site 6c. Facing North. *Maireana sedifolia* (Bluebush) Low Open Shrubland with scattered groves of *Casuarina pauper* (Black Oak)

Plate 3: Site 7c. Facing West. *Lycium australe* (Australian Boxthorn) +/- *Maireana aphylla* (Cottonbush) and emergent *Acacia nyssophylla* (Spine Bush)

BAM site	*BCM*	BAM Vegetation Association	Condition Score	Length mapped (km)
		Chenopod Open Shrubland: Western End of Alignment		
6a	2.2	*Maireana pyramidata* (Black Bluebush) Low Very Open Shrubland	16.03	0.91
6c	2.2	*Maireana sedifolia* (Bluebush) Low Open Shrubland	45.32	2.81
7c	11.6	*Lycium australe* (Australian Boxthorn) Open Shrubland +/- *Maireana aphylla* (Cottonbush) with emergent *Acacia nyssophylla* (Spine Bush)	65.4	1.86
11b	11.6	*Nitraria billardierei* (Nitrebush) – *Maireana pyramidata* (Black Bluebush) Very Open Shrubland	25.8	0.25
12b	2.2	*Maireana sedifolia* Low Open Shrubland	25.8	4.95
13a	2.2	*Maireana sedifolia* Low Open Shrubland	25.8	4.52
13b	2.2	*Maireana sedifolia* +/- *Rhagodia ulicina* (Intricate Saltbush) Low Open Shrubland	28.38	6.10
14b	2.2	*Maireana sedifolia* +/_ *Lawrencia squamata* (Thorny Lawrencia) +/- *Rhagodia ulicina* Open Shrubland	33.12	4.75
102c	2.2	*Maireana sedifolia* Open Shrubland	41.93	1.07
107	2.2	*Maireana sedifolia* Very Open Shrubland	39.35	2.61
		Chenopod Open Shrubland Eastern End of Alignment		

13c	4.3	*Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-Bush)		49.02	0.43
14c	2.2	*Maireana pyramidata* (Black Bluebush) Low Open Shrubland		30.57	8.56
20a	2	*Maireana pyramidata* (Black Bluebush) Very Open Shrubland with emergent *Eucalyptus* species (Mallees), *Casuarina pauper* (Black Oak) and *Myoporum platycarpum* (False Sandalwood)		35.86	0.87
25b	2.1	*Maireana pyramidata* (Black Bluebush) Open Shrubland		23.54	2.64
26b	2.2	*Maireana pyramidata* (Black Bluebush) Open Shrubland		24.48	5.5
112	10.11	*Eremophila sturtii* (Turpentine Bush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)		62.38	0.19
Threatened species or community		No threatened species or communities were present in this habitat (at either the western or eastern end)			
Landscape context score	Average: 1.08 Range: 1.06 – 1.15	Vegetation Condition Score	Average: 35.79 Range: 16.03 – 65.4	Conservation significance score	Average: 1.075 Range: 1.06 to 1.1
Unit biodiversity Score	Average: 41.65 Range: 19.5 – 75.6	Area (ha) (Total impact for habitat type)[1]	96.04	Total biodiversity Score	3510.5

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	Low Open Woodland over chenopod understorey
General description	This habitat occupies extensive plains of sandy loam, often calcareous soils. The dominant overstorey species is typically *Casuarina pauper,* (Black Oak) with *Myoporum platycarpum* (False Sandalwood) occasionally the dominant species in the western third. *Alectryon oleifolius* (Bullock Bush) is often present as small groves. In the western half of the alignment, 14.27 km has been mapped as Low Open Woodland over a chenopod shrubland dominated by *Maireana sedifolia* (Bluebush) and/or *Maireana pyramidata* (Black Bluebush) or in heavier soil depressions*, Lycium australe* (Australian Boxthorn). At the eastern end of the alignment, 11 ha has been mapped as this habitat. The overstorey trees are generally widely spaced but includes localised small groves of trees. Hollows were generally absent. The surveyed areas had no known mechanical clearance or fire history. However, all sites are grazed with domestic stock and/or native or pest herbivores. Grazing combined with prolonged below average rainfall prior to the surveys resulted in most sites having a low plant species diversity, and a very sparse litter layer. Towards the eastern end of the alignment, tree and understorey density are also likely to have been reduced by long term grazing. An ephemeral channel supporting *Eucalyptus largiflorens* (Black Box) over chenopods has also been included in this habitat. This is the only mapped location of Black Box along the alignment.

Plate 4: Site 5c. *Casuarina pauper* Woodland over *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush)

BAM site	BCM	BAM Association	Condition Score	Length mapped (km)
		Low Open Woodland Western Third of Alignment		
5c	2.1	*Casuarina pauper* (Black Oak) Woodland over *Maireana pyramidata* (Black Bluebush) and *Maireana sedifolia* (Bluebush)	50.68	2.75
6b	2.1	*Myoporum platycarpum* (False Sandalwood) - *Casuarina paup*er (Black Oak) +/- *Eucalyptus oleosa* (Red Mallee) Open Woodland mosaiced with *Maireana sedifolia* (Bluebush) Low Open Shrubland	42.73	3.06
8b	2.1	*Casuarina pauper* (Black Oak) Low Woodland over *Maireana pyramidata* (Black Bluebush)	38.03	1.13
9a	2.1	*Myoporum platycarpum* (False Sandalwood) Very Low Open Woodland over *Maireana sedifolia* (Bluebush)	33.79	1.30
11a	2.1	*Casuarina pauper* (Black Oak) Very Low Woodland over *Maireana sedifolia* (Bluebush)	40	3.57
104	11.6	*Casuarina pauper* (Black Oak) +/- *Alectryon oleifolius (*Bullock Bush) Very Open Woodland over *Lycium australe* (Australian Boxthorn) shrubland	74.66	0.39
105	1.1	*Casuarina pauper* (Black Oak) Low Open Woodland over chenopods and mixed tall shrubs	52.85	2.08
		Low Open Woodland Eastern Third of Alignment		
29b	1.1	*Casuarina pauper* (Black Oak) Open Woodland over chenopod and sclerophyll shrubs	56.15	2.75
111	10.8	*Eucalyptus largiflorens* (River Box) - *Melaleuca lanceolata* (Dryland Teatree) Low Open Woodland over *Maireana pyramidata* (Black Bluebush)	49.49	0.23
114	1.1	*Austrostipa* sp. (Spear-grass) Open Grassland/ *Maireana pyramidata* (Black Bluebush) Low Open Shrubland with emergent *Casuarina pauper* (Black Oak) and/or *Callitris* spp. (Native Pines)	34.14	8.02
Threatened species or community		No threatened species or communities were present in this habitat (at either the western or eastern end)		

Landscape context score	Average: 1.07 Range: 1.03 – 1.09	Vegetation Condition Score	Average: 47.25 Range: 34.1 – 74.7	Conservation significance score	Average: 1.1 Range: 1.1
Unit biodiversity Score	Average: 55.16 Range: 36.7 – 84.5	Area (ha) (Total impact for habitat type)[1]	50.56	Total biodiversity Score	2484.72

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	Old growth mallee over open sclerophyll and chenopod shrub understorey
General description	This is one of the major habitats along the alignment, with 46.71 km being mapped. The habitat is characterised by large older mallee trees (no recent fire history), typically with *Eucalyptus oleosa* (Red Mallee) and/or *Eucalyptus gracilis* (Yorrell) the dominant mallees. Most sites contain at least small hollows, with patchy to continuous litter layer. The understorey is generally quite open, with medium to tall shrubs widely spaced. Common shrub species include *Senna artemisioides* ssp. (Senna subspecies), *Enchylaena tomentosa* (Ruby Saltbush), *Atriplex stipitata* (Bitter Saltbush), *Acacia nyssophylla* (Spine Bush) and *Rhagodia ulicina* (Intricate Saltbush). Common herbs and small shrubs included *Roepera* spp. (Twin-leaf species), *Sclerolaena* spp. (Bindyis species) and *Maireana pentatropis* (Erect Mallee Bluebush). Mallee occurs at the far western end of the alignment, throughout the central third, and sporadically in the eastern third

Plate 6: Site 8c. Facing North. Old growth Mallee (*Eucalyptus gracilis, E. oleosa, E. brachycalyx*) over open understorey

BAM site	BCM	BAM Vegetation Association	Condition Score	Length mapped (km)
		Western end of alignment (7.03 km)		
1a	3.1	*Eucalyptus porosa* (Mallee Box) - *Eucalyptus oleosa* (Red Mallee) Mallee over *Senna artemisioides* (Desert Senna) and chenopods	40.5	0.13
3b	3.1	*Eucalyptus oleosa* (Red) Mallee) Mallee over a very sparse chenopod understorey.	44.72	0.68
4b	2.1	*Eucalyptus oleosa* (Red Mallee) Mallee over mid-dense chenopod shrubs	59.13	1.58

5a	2.1	*Eucalyptus oleosa* (Red Mallee) Mallee over chenopod shrubs	40.74	0.07
5b	3.1	*Eucalyptus oleosa* (Red Mallee) Very Open Mallee over open sclerophyll and chenopod shrub understorey	36.78	2.29
7a	1.1	*Eucalyptus oleosa* (Red Mallee) Very Open Mallee over mixed shrubs	36.12	0.30
8a	2.1	*Eucalyptus oleosa* (Red Mallee) Open Mallee over *Maireana sedifolia* (Bluebush)	47.2	1.98
		Central and Eastern end of alignment (39.68 km)		
8c	2.1	*Eucalyptus gracilis* (Yorrell) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus brachycalyx* (Gilja) Open Mallee over low open sclerophyll and chenopod shrubs	65.25	4.23
10c	1.1	*Casuarina pauper* (Black Oak) - *Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Woodland with open tall shrub understorey	59.63	2.78
12c	3.1	*Eucalyptus oleosa* (Red Mallee) Open Mallee over *Atriplex stipitata* (Bitter Saltbush)	50.7	1.59
15b	3.1	*Eucalyptus oleosa* (Red Mallee) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over sclerophyll shrubs and chenopods	53.44	1.82
18c	3.1	*Eucalyptus leptophylla* (Narrow-leaf Red Mallee) +/- *Eucalyptus brachycalyx* (Gilja) Mallee over tall sclerophyll shrubs	60	0.36
19b	4.2	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus dumosa* (White Mallee) +/- *Eucalyptus gracilis* (Yorrell) Open Mallee over an open understorey of sclerophyll shrubs and chenopods	49.19	2.10
19c	3.1	*Eucalyptus oleosa* - *Eucalyptus gracilis* (Yorrell)/ *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a very open understorey	40.74	0.27
23b	3.1	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus brachycalyx* (Gilja) Open Mallee +/- *Myoporum platycarpum* (False Sandalwood) over chenopod and sclerophyll shrubs	56.64	5.42
23c	3.1	*Eucalyptus gracilis* (Yorrell) +/- *Eucalyptus oleosa* (Red Mallee) Open Mallee over tall chenopod shrubs	60.45	4.14
24b	3.1	*Eucalyptus oleosa* (Red Mallee) – *Eucalyptus gracilis* (Yorrell) Mallee over chenopod and sclerophyll shrubs	56.64	3.27
27b	3.1	*Eucalyptus oleosa* (Red Mallee) open Mallee over sparse *Maireana pyramidata* (Black Bluebush) and sclerophyll shrubs	62.56	1.50
108	3.1	*Eucalyptus gracilis* (Yorrell) Open Mallee over sparse chenopod and sclerophyll shrubland	52.65	6.36
116	3.1	*Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) Open Mallee over sclerophyll and chenopod shrubs	66.3	4.15
117	1.2	Se*nna artemisioides* ssp. *filifolia* Open Shrubland with emergent old growth *Eucalyptus gracilis* (Yorrell)	42.22	1.69
Threatened species or community		No threatened species or communities were recorded in this habitat (at either the western or eastern end)		

Landscape context score	Average: 1.09 Range: 1.05 – 1.17	Vegetation Condition Score	Average: 51.49 Range: 35.8 – 66.3	Conservation significance score	Average: 1.09 Range: 1.08 – 1.1
Unit biodiversity Score	Average: 61.76 Range: 44.1 – 81.1	Area (ha) (Total impact for habitat type)[1]	93.42	Total biodiversity Score	6146.93

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey
General description	This community comprises mallee regrowth following bush fires in about 2014. The description is based on one BAM site, where there was vigorous mallee regrowth from basal epicormic shoots to about 3 - 4 m tall. A high diversity and abundance of understorey species were regenerating following the fire, either vegetatively or from seed. Understorey species comprised a mix of sclerophyll and chenopod shrubs, with Triodia naturally absent or very sparse, reflecting the relatively shallow sand layer.

Plate 7: Site 21c. Regrowth mallees (*Eucalyptus socialis* +/- *E.* gracilis) with diverse understorey

BAM site	BCM	BAM Association	Condition Score	Length mapped (km)
21c	3.1	*Eucalyptus socialis* (Beaked Red Mallee) / *E. gracilis* (Yorrell) Open Mallee over *Senna artemisioides* ssp. *artemisioides* (Desert Senna) +/- *S. artemisioides* ssp. *petiolaris* Shrubland	56.15	2.64

Threatened species or community	No threatened species or communities were recorded				
Landscape context score	1.08	Vegetation Condition Score	56.15	Conservation significance score	1.1
Unit biodiversity Score	66.7	Area (ha) (Total impact for habitat type)[1]	5.28	Total biodiversity Score	352.18

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	**Mallee over *Triodia* (Spinifex) dominated understorey**
General description	This broad habitat group occurs in approximately the central third of the alignment, on sandy soils of varying depth, and with Triodia (Spinifex) dominant in the understorey. It is a major habitat type along the alignment, with 57.61 km mapped as this habitat type. Occurring on sandy soils, the mallee trees tend to be multi-stemmed and of smaller habit (5 – 6 m tall) than mallees occurring on the heavier textured soils (up to 8 - 10 m tall on sandy loams or loams soils). Hollows were sparse to absent in the mallees occurring on sand over Triodia. This broad habitat group comprises vegetation with different fire histories, ranging from most recently burnt in 2014 to long unburnt. The majority of mallees in the recently burnt vegetation sites were regenerating from basal epicormic growth. In addition to regenerating Triodia, the understorey plants were represented by a variety of life forms, although of relatively moderate species diversity. The condition of this community (as indicated by the BAM site condition scores) ranged from moderate to high.

Plate 8: Site 16a. *Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland

BAM site	BCM	BAM Association	Condition Score	Length mapped (km)
9c	4.2	*Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	47.7	1.28
16b	4.2	*Eucalyptus dumosa* (White Mallee) Low Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	45.34	18.13

16c	4.2	*Eucalyptus dumosa* (White Mallee)/ *Eucalyptus socialis* (Beaked Red Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland	56.64	0.46
17b	4.2	*Eucalyptus dumosa* (White Mallee) Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	48	3.78
17c	4.2	*Eucalyptus incrassata* (Ridge-Fruited Mallee) +/- *E. leptophylla* (Narrow-leaf Red Mallee) +/- *E. socialis* (Beaked Red Mallee) over *Triodia* (Spinifex) Hummock Grassland	49.24	0.32
18b	4.2	*Eucalyptus incrassata* (Ridge-fruited Mallee) Open Mallee over *Triodia* Hummock Grassland	46.21	1.48
20c	4.2	*Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* (Spinifex) Hummock Grassland	55.15	1.93
22b	4.1	*Eucalyptus dumosa* (White Mallee) - *Eucalyptus incrassata* (Ridge-fruited Mallee) Low Open Mallee (young post-fire regrowth) over regrowth *Triodia* Hummock Grassland	58.63	2.43
22c	4.2	*Eucalyptus incrassata* (Ridge-fruited Mallee) +/- *Eucalyptus socialis* (Beaked Red Mallee) +/- *Eucalyptus dumosa* (White Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland	56.55	2.26
24c	4.2	*Eucalyptus dumosa* (White Mallee) +/- *E. leptophylla* (Narrow-lead Red Mallee) Open Mallee over *Triodia* (Spinifex) Hummock Grassland	43.23	0.24
29c	4.2	*Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) Open Mallee over a *Triodia* (Spinifex) Hummock Grassland	63.1	12.95
109a	4.2	*Eucalyptus oleosa* (Red Mallee) - *Eucalyptus gracilis* (Yorrell) - *Eucalyptus dumosa* (White Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) Hummock Grassland	52.65	5.17
115	4.2	*Eucalyptus gracilis* (Yorrell) - *Eucalyptus dumosa* (White Mallee) - *Eucalyptus leptophylla* (Narrow-leaf Red Mallee) - *Eucalyptus oleosa* (Red Mallee) Low Open Mallee over *Triodia* sp. (Spinifex) and mixed shrubs.	64.59	7.18

Threatened species or community	No threatened species or communities were recorded in this habitat				
Landscape context score	Average: 1.76 Range: 1.06 – 1.11	Vegetation Condition Score	Average: 52.85 Range: 43.23 – 64.6	Conservation significance score	Average: 1.1 Range: 1.1
Unit biodiversity Score	Average: 62.56 Range: 51.36 – 75.3	Area (ha) (Total impact for habitat type)[1]	115.22	Total biodiversity Score	7376.47

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Major Habitat	**Hopbush (*Dodonaea viscosa* ssp. *angustissima*) Tall Open Shrubland - eastern half of alignment**
General description	At the eastern end of the alignment, 6.69 km has been mapped as Hopbush (*Dodonaea viscosa* ssp. *angustissima*) Tall Open Shrubland. This habitat occurred on sandy soils, often associated with, or intergrading with Black Bluebush, *Maireana pyramidata* shrubland. In other locations, there were scattered Native Pine (*Callitris* species). The dominance of Hopbush in this habitat type is likely to have become more pronounced following a long history of grazing, reducing the abundance and diversity of more palatable species, allowing the unpalatable Hopbush to colonise new areas. Species diversity was generally low to moderate, as reflected in the mapped BAM site condition scores

Plate 9: Site 28b. *Dodonaea viscosa* ssp. *angustissima* Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush).

BAM site	BCM	BAM Association	Condition Score	Length mapped (km)
15c	3.1	*Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hop-bush) Tall Very Open Shrubland with emergent *Callitris gracilis* (Southern Cypress Pine)	40.08	0.75
28b	4.3	*Dodonaea viscosa* ssp. *angustissima* (Narrow-leaf Hopbush) Tall Open Shrubland over *Maireana pyramidata* (Black Bluebush)	33.12	5.94

Threatened species or community	No threatened species or communities were recorded in this habitat.				
Landscape context score	Average: 1.08 Range: 1.08	Vegetation Condition Score	Average: 36.6 Range: 33.1 – 40.1	Conservation significance score	Average / Range: 1.08

Unit biodiversity Score	Average: 43.48 Range: 39.4 – 47.6	Area (ha) (Total impact for habitat type)[1]	13.38	Total biodiversity Score	538.89

[1] Based on total km of habitat type x 2 ha (upper estimate of impact area as per EIS); scores / areas / lengths rounded to 2 decimal places

Site map showing areas of proposed impact

Site maps delineating each broad habitat and delineation of BAM site association segments are provided in Appendix 1.

Photo log

Representative photos (and direction) of each BAM site are provided in the Vegetation Assessment Summary (Appendix 2 of this report) and in BAM scoresheets (that will be provided with the formal submission of the clearance application to the NVC). Photopoint locations align with site locations on Figure 3-1 of the Vegetation Assessment Summary and Eastings and Northings are provided in Appendix A2 of that report.

4.2 Threatened Species assessment

Threatened species (Commonwealth and State listed) have been considered as part of the project EIS. Refer EIS Chapter 11, Section 11.3.3 Conservation Significant Flora, Section 11.3.6 Conservation Significant Fauna, Section 11.4.7 Summary of Impacts to listed Flora and 11.4.8 Summary of impacts to listed fauna. EIS Appendices that provide additional detail to inform threatened species assessments include:

Appendix I-1: Species Likelihood Assessments

Appendix I-2: Vegetation Assessment Summary

Appendix I3-: Significant Impact Assessments

Appendix I-4: Threatened Mallee Birds Assessment

Appendix I-5: Review of Potential Impacts to Wetland Birds

It should be noted that all of the above assessments have been highly conservative. Refer Table 3 below for comparison of likelihood criteria required here and criteria used in the EIS.

In addition to the assessments undertaken for the EIS, an assessment for BAM sites within each major habitat type and location along the alignment was also undertaken to inform fauna required to be input into BAM scoresheets, ultimately informing Unit Biodiversity Score and offset requirements. As per Method (Section 3 above), for each major habitat type, a 5 km buffer was applied to all segments mapped as that habitat type. All threatened species recorded in each buffer, since 1995 and at a spatial accuracy of 1 km was considered for their potential to use the habitat. To align with the overarching EIS fauna assessment, any threatened fauna recorded > 5 km from the alignment, but within the region, were also included if considered potentially suitable for the habitat (Refer Appendix 3.1).

Table 3: Criteria for the likelihood of occurrence of species within the Study area.

Likelihood	Criteria NVC Template	Criteria EIS
Highly Likely/Known	Recorded in the last 10 years, the species does not have highly specific niche requirements, the habitat is present and falls within the known range of the species distribution or; The species was recorded as part of field surveys.	Present recorded within the transmission line corridor since 1995 during DEH Biological Surveys (to align with NVC Bushland Assessment Methodology, NVC 2020b).
Likely	Recorded within the previous 20 years, the area falls within the known distribution of the species and the area provides habitat or feeding resources for the species.	Based on the presence of suitable habitat, multiple recent database records from the transmission line corridor or immediate proximity to the transmission line corridor boundary since 1995.

Possible	Recorded within the previous 20 years, the area falls inside the known distribution of the species, but the area provide limited habitat or feeding resources for the species. Recorded within 20 -40 years, survey effort is considered adequate, habitat and feeding resources present, and species of similar habitat needs have been recorded in the area.	Suitable habitat for the species is present within the transmission line corridor or immediate proximity, but no or very limited recent (since 1995) database record(s) exist within the transmission line corridor or adjacent environments.
Unlikely	Recorded within the previous 20 years, but the area provide no habitat or feeding resources for the species, including perching, roosting or nesting opportunities, corridor for movement or shelter. Recorded within 20 -40 years; however, suitable habitat does not occur, and species of similar habitat requirements have not been recorded in the area. No records despite adequate survey effort.	There is a lack of suitable habitat within the transmission line corridor for the species (or community) and / or a lack of proximate historic (pre 1995) records which indicate previous or current occurrence.

4.3 Cumulative impact

Direct and indirect impacts related to construction and operation have been considered as part of the EIS (refer 11.4) and are summarised below.

Direct Impacts

This application considers all vegetation clearance required for all the project development and for maintenance activities for the duration of the project, including access tracks, laydown areas and other temporary facilities. Chapter 7 of the EIS outlines upper estimates for permanent and temporary clearance. Refer section 11.4.9 of the EIS for key mitigation measures for direct impacts.

ElectraNet will incorporate vegetation management requirements in the Construction Environmental Management Plan (CEMP), which will detail the requirements for pre-clearance micro-siting and post clearance audits, exclusion zones and NVC approved clearance areas. Monitoring will be undertaken during and following construction to ensure that vegetation management measures are effective and remediation will be undertaken if required.

Indirect Impacts

Indirect impacts considered as part of the EIS include habitat fragmentation (Section 11.4.2), impacts to fauna and vegetation from dust, noise, erosion and sedimentation, water management (Section 11.4.3), fauna mortality (11.4.4), pests and weeds (11.4.5), fire (11.4.6). No significant or long-term impacts to listed and common fauna are expected.

Cumulative Impacts refer to where multiple closely positioned clearances will impact the viability and functionality of larger area of vegetation. The proposed route has been chosen to avoid areas of ecological value, traverse highly modified vegetation, align with existing tracks and/or traverse the boundaries of remnants where possible, rather than bisection.

As per Chapter 7 of the EIS, all aspects of clearance for the Project have been considered to determine the upper estimates of impact including permanent and temporary infrastructure requirements for construction and operation, access tracks, laydown areas, fencing, hydrology, dust suppression and fire management. Also refer Section 11.4.1 (general clearance), and 11.4.6 (fire) for further detail about additional cumulative impact considerations.

ElectraNet's key finding is that Project construction or operational activities will not lead to significant or long-term impacts to flora and fauna. Potential impacts can be readily managed with appropriate location of infrastructure and application of mitigation measures.

4.4 Address the Mitigation Hierarchy

a) Avoidance – outline measures taken to avoid clearance of native vegetation

The vegetation communities present on the transmission line corridor are common and widespread in the region and extensively represented in areas managed for conservation. The estimated vegetation clearance represents a very small proportion of remnant vegetation in the region. The mallee vegetation present along the central part of the transmission line corridor provides valuable habitat, particularly for threatened mallee birds, however the potential impacts are mitigated as far as practicable by the route selected as well as the very small proportion of habitat that will be impacted.

A comprehensive route selection process has been undertaken to ensure that technical, engineering, environmental, social, land access, and economic factors have been appropriately considered. The Project has used the mitigation hierarchy as a driving principle throughout the route selection process to minimise impacts on flora and fauna. The resulting alignment predominantly follows existing disturbance corridors and follows the boundary of the mallee habitats and the Heritage Agreements that are part of the Riverland Biosphere Reserve, which will minimise potential impacts as a result of clearance and fragmentation.

A range of measures will be implemented during detailed design and construction to minimise vegetation clearance, including the following:

- detailed design of the alignment will aim to avoid traversing isolated patches of vegetation (e.g. at the western end of the transmission line corridor)
- pre-clearance surveys will be undertaken to 'micro-site' towers and other infrastructure to avoid occurrences of threatened plants or other significant features (e.g. active Malleefowl mounds)
- areas where native vegetation is degraded or has been previously cleared will be utilised in preference to clearing vegetation wherever practicable
- existing access tracks will be used for access along the easement as far as possible
- tracks will be designed to take the shortest route (with the potential to use short spur tracks off existing roads or access tracks) and with as little impact as possible to native vegetation, existing land uses and landholders

Minimization – if clearance cannot be avoided, outline measures taken to minimize the extent, duration and intensity of impacts of the clearance on biodiversity to the fullest possible extent (whether the impact is direct, indirect or cumulative).

There are areas along the alignment where it is possible to avoid clearance of higher value vegetation and preferentially locate infrastructure (particularly temporary facilities) in vegetation of lower quality over areas of higher quality.

A range of measures will be implemented during detailed design and construction to minimise vegetation clearance, including the following:

- areas of lesser quality vegetation will be cleared wherever practicable.
- track widths minimised, typically to 5m (to allow safe access)
- temporary worker camps will be sited in disturbed / cleared areas or in areas with limited native vegetation
- other temporary facilities (e.g. temporary laydown areas / staging sites) will be sited in disturbed areas or in areas with limited native vegetation as far as practicable
- where feasible, vegetation will be rolled or trimmed rather than being completely removed
- preparation of the stringing access corridor between tower locations will typically be undertaken using a dozer with blades raised to remove larger trees while keeping shrubs, grasses and topsoil largely intact, or rolled where possible
- larger trees in the stringing access corridors may be cut off above ground level with rootstock left intact to allow regeneration rather than being removed where practicable
- removal of larger trees (e.g. trunk diameter over 30 cm) will be avoided where possible (noting that sites such as access tracks, tower locations, helicopter staging sites and some break and winch sites will require complete removal of vegetation)

- pads for tower assembly will be restricted to the minimum size necessary for safe access
- the line will be designed to span across mature vegetation (with minimal clearance required) where feasible.
- Use of helicopters during construction will be considered during detailed design and may be used through sensitive areas with difficult access, such as Calperum Station and Taylorville Station, subject to health and safety, commercial and technical feasibility. It is expected that this method would reduce construction footprints and required vegetation clearance.
- ElectraNet will incorporate vegetation management requirements in the Construction Environmental Management Plan (CEMP), which will detail the requirements for pre-clearance micro-siting and post clearance audits, exclusion zones and NVC approved clearance areas. Monitoring will be undertaken during and following construction to ensure that vegetation management measures are effective and remediation will be undertaken if required.

b) Rehabilitation or restoration – outline measures taken to rehabilitate ecosystems that have been degraded, and to restore ecosystems that have been degraded, or destroyed by the impact of clearance that cannot be avoided or further minimized, such as allowing for the re-establishment of the vegetation.

Following the completion of construction activities, areas of temporary disturbance will be rehabilitated. Pads used for tower construction would be reduced in size, as a much smaller cleared area (typically 25% or less) is required around towers for operation. Topsoil and subsoil would be re-spread over cleared areas with cleared vegetation, and sites allowed to naturally revegetate. The areas of mallee in the middle third of the transmission line corridor are expected to regenerate well, based on the low levels of weeds present and level of regeneration observed in field surveys. Control of exotic vegetation (particularly grasses) may be required around towers in other areas.

Rehabilitation has been accounted for in SEB calculations, and will be adjusted following micro-siting and post construction verification. Refer EIS for further detail about rehabilitation.

c) Offset – any adverse impact on native vegetation that cannot be avoided or further minimized should be offset by the achievement of a significant environmental benefit that outweighs that impact.

The proposed vegetation clearance will be offset. ElectraNet are investigating potential on-ground projects with landholders and SEB credit providers, with the aim of achieving some or all of the SEB via on-ground works. An offset strategy is being developed that will include details about the combination of such on-ground activities, and where these are not feasible payment would be made to the Native Vegetation in accordance with the SEB Offset Policy (NVC 2020c). The offset strategy will be submitted and approved by the NVC / DEW Native Vegetation Management Branch as part of the formal submission of the Native Vegetation Clearance Application.

4.5 Principles of Clearance (Schedule 1, *Native Vegetation Act 1991*)

This project is being approved as a Major Development under the Development Act, hence only Principles 1b, 1c and 1d require addressing. For completeness, the remaining principles of clearance have been addressed, where information is available.

Note: As discussed in Section 5, an additional 1.3 km of BAM site 19b has been included in the SEB calculations to account for the cultural heritage avoidance alignment on Hawks Nest Station (refer Section 2.2). This has not been included in the statistics in this section, however it is considered that it would not materially affect the discussion given that it represents a very small proportion of the total alignment length, and the approach to calculating unit biodiversity scores and SEB requirement for this part of the alignment has been highly conservative.

<table>
<tr><th>Principle of clearance</th><th>Considerations</th></tr>
<tr><td>Principle 1a - it comprises a high level of diversity of plant species</td><td>
<u>Relevant information</u>
A total of 74 BAM sites were used to represent vegetation associations along the alignment. These were grouped into major habitat types comprising similar vegetation structure and floristic composition. The table below provides the range in plant biodiversity scores, and weighted average scores.
<table>
<tr><th>Habitat Type</th><th>Weighted Average[1] and Range in Species (Plant) Biodiversity Score</th><th>At Variance? (where < 10 = not at variance, 10-20 = at variance, > 20 = seriously at variance)</th></tr>
<tr><td>Austrostipa sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks</td><td>Range = 6 – 24
Weighted average = 13
9 BAM sites</td><td>On average = At Variance</td></tr>
<tr><td>Chenopod shrubland - eastern half of alignment</td><td>Range = 6 – 24
Weighted average = 11
6 BAM sites</td><td>On average = At Variance</td></tr>
<tr><td>Chenopod open shrubland -western half of alignment</td><td>Range = 4 – 30
Weighted average = 12
10 BAM sites</td><td>On average = At Variance</td></tr>
<tr><td>Low Open Woodland (Casuarina pauper, Myoporum platycarpum and/or Alectryon oleifolius) over chenopod understorey</td><td>Range = 12 - 30
Weighted average = 19.2
10 BAM sites</td><td>On average = At Variance</td></tr>
<tr><td>Old growth mallee over open sclerophyll and/or chenopod shrub understorey</td><td>Range = 10 – 26
Weighted average = 21.8
21 BAM sites</td><td>On average = Seriously at Variance
9 BAM sites = At Variance
12 BAM sites = Seriously at Variance</td></tr>
<tr><td>Mallee over Triodia dominated understorey</td><td>Range = 12 – 30
Weighted average = 22.0
13 BAM sites</td><td>On average = Seriously at Variance
5 BAM sites = At Variance
8 BAM sites = Seriously at Variance</td></tr>
<tr><td>Hopbush (Dodonaea viscosa ssp angustissima) shrubland – eastern half of alignment</td><td>Range = 10 – 22
Weighted average = 11.3
2 BAM sites</td><td>On average = At Variance</td></tr>
<tr><td>Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey</td><td>One BAM site only, score = 24</td><td>Seriously at Variance</td></tr>
</table>
[1]Average of scores weighted by clearance for that habitat type (i.e. length of the alignment mapped as that habitat by BAM site)
</td></tr>
</table>

Assessment against the principles

Seriously at Variance – 143.92 hectares

Sites	Habitat Type	Area of Clearance (ha)
101a, 1c	*Austrostipa sp*. grassland and/or sparse chenopod regrowth of previously cropped paddocks	2.48
104, 111, 29b	Low Open Woodland over chenopods	6.74
7c, 112	Chenopod open shrubland	4.1
15c	Hopbush (*Dodonaea viscosa ssp angustissima*) shrubland	1.5
17c, 22b, 29c, 20c, 109a, 22c, 115, 16c	Mallee over *Triodia* dominated understorey	65.4
117, 19b, 4b, 10c, 18c, 23c, 24b,27b, 116, 12c, 15b, 8c	Old growth mallee over open sclerophyll and/or chenopod shrub understorey	58.42
21c	Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey	5.28

At Variance – 238.16 hectares

-

Sites	Habitat Type	Area of Clearance (ha)
3c, 4c, 101c, 101d, 102b	*Austrostipa sp*. grassland and/or sparse chenopod regrowth of previously cropped paddocks	23.56
5c, 6b, 8b, 9a, 11a, 105, 114	Low Open Woodland over chenopods	43.82
6a, 6c, 11b, 12b, 13a, 13b, 14b, 102c, 107, 14c, 20a, 25b, 26b, 26b, 102c, 107	Chenopod open shrubland	74.08
28b	Hopbush (*Dodonaea viscosa* ssp *angustissima*) shrubland	11.88
9c, 16b,17b,18b,24c	Mallee over *Triodia* dominated understorey	49.82
1a, 3b, 5a, 5b, 7a, 8a, 19c, 23b,108	Old growth mallee over open sclerophyll and/or chenopod shrub understorey	35.00

Not at Variance = 25 ha

Sites	Habitat Type	Area of Clearance
1b, 2b	*Austrostipa* sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks	7.14
6a, 13c, 12b, 25b	Chenopod open shrubland	17.86

	<u>Moderating factors that may be considered by the NVC</u> As per above approximately 35% of the alignment clearance is seriously at variance with principle 1a), with the remainder at variance or not at variance. As per the EIS Section 11.4.1, where possible, the transmission line will be aligned with areas of less intact vegetation and/or existing tracks, spanning rather clearing intact vegetation with no prior clearance history. Micro-siting will be undertaken pre construction to avoid better quality vegetation where feasible and verification post construction to ensure clearance has been appropriately offset, will also be undertaken. *Note NVC guide says where <0.25 % of native vegetation within a 5 km radius will be impacted, this may reduce the impact from 'Seriously at variance' to 'At variance' or 'At variance to 'Not at Variance'* Given that proposed clearance of 2 km / ha is 0.2% of the native vegetation within 5km of the alignment, it is suggested that the 35% of the alignment that is 'seriously at variance could be reduced to '***At Variance'***.
Principle 1b - significance as a habitat for wildlife	<u>Relevant information</u> Section 11.3 of the EIS describes the significance of the proposed clearance area as habitat for wildlife, including the likelihood of occurrence of both EPBC listed and NPW listed threatened and migratory species. Section 11.4.8 of the EIS summarises potential impacts to listed fauna and Section 11.4.3 and 11.4.4 also consider impacts to threatened and general fauna. Most listed and protected species that occur in the broader ESA are concentrated in the adjacent reserves, are not located within the transmission line corridor and are highly mobile and will move away from an area during disturbance (e.g. as vehicles transport infrastructure to the areas for assembly / construction). If important breeding / nesting sites of listed fauna are located within the final footprint (e.g. active Malleefowl mounds, Black-eared Miner colony) they could potentially be avoided via micro-siting of tower locations. Avoidance buffers could also be applied to minimise disturbance impacts, if required. During the BAM vegetation assessments, the only State listed as threatened fauna species recorded was the Rare White-Winged Choughs (*Corcorax melanoramph*), recorded in mallee patches at the western end of the alignment. In addition, EPBC listed and State listed mallee bird species were detected during the Mallee Birds Survey (refer Section 11.3.6 of the EIS). It is acknowledged that Black-eared Miners are present within sections of the transmission line corridor, specifically in dense mallee areas, however it is noted that the majority of the population occurs further north, over 15 to 25 km away from the transmission line corridor, all within core habitat of the Listed Critical Habitat area that will be avoided by the Project. Within a particular Habitat Type, all BAM sites within that habitat type were considered to be suitable for the same suite of threatened fauna, hence all BAM sites within a particular habitat type scored the same for Threatened Fauna. Within a particular Habitat Type, however, the Unit Biodiversity Score varied between BAM sites. A List of threatened species that were recorded or may use the vegetation, was submitted to DEW Native Vegetation Management Branch for approval and BAM scoresheet inputs (Refer Appendix 3 this report). Whist there are some areas that are considered seriously at variance given the UBS is > 50, it is intended to minimize clearance as much as possible, via micro-siting, using existing tracks and spanning / tower placement). Areas with higher UBS scores will be avoided where possible through micro-siting and spanning. Consideration of threatened fauna scores against habitat types and variance is provided below.

Habitat Type	Threatened Fauna Score	At Variance	Unit Biodiversity Score*	Sites with UBS >50
Austrostipa sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks	0.1	Seriously at Variance	Range 8 to 53	4c, 101a
Chenopod shrubland - eastern half of alignment	0.1	Seriously at Variance	Range 28 to 74	13c, 112
Chenopod open shrubland - western half of alignment	0.06	Seriously at Variance	Range 20 to 76	6c, 7c
Low Open Woodland (*Casuarina pauper, Myoporum platycarpum* and/or *Alectryon oleifolius*) over chenopod understorey	0.1	Seriously at Variance	Range 37 to 85	5c, 29b, 104, 105, 111
Old growth mallee over open sclerophyll and/or chenopod shrub understorey – western half of alignment	0.08	Seriously at Variance	Range 44 to 75	1a, 3b, 4b, 8a
Old growth mallee over open sclerophyll and/or chenopod shrub understorey – eastern half of alignment	0.1	Seriously at Variance	Range 49 to 81	19b, 12c, 108, 15b, 24b, 23b, 10c, 23c, 18c, 27b, 4b, 116, 8c
Mallee over Triodia dominated understorey	0.1	Seriously at Variance	Range = 51 to 75	24c, 18b, 16b, 9c, 17b, 17c, 109a, 20c, 16c, 22b, 22c, 29c, 115
Hopbush (Dodonaea viscosa ssp angustissima) shrubland – eastern half of alignment	0.1	Seriously at Variance	Range = 39 to 48	Nil
Post-fire regrowth mallee over sclerophyll and chenopod shrub understorey	0.1	Seriously at Variance	One site only Score = 67	21c

*Rounded to nearest whole number

Assessment against the principles

Seriously at Variance:
Based on threatened fauna score, all sites are seriously at variance

Based on Unit Biodiversity Score, 70.01 hectares clearance for areas with UBS score 50-60; 165.12 hectares clearance for areas with UBS score >60

At Variance:
174.56 hectares of proposed clearance have UBS score <50

Moderating factors that may be considered by the NVC

Approximately 413 hectares of native vegetation will be cleared during construction (based on upper estimates of 135 ha permanent and 278 ha temporary disturbance). This represents a very small proportion of native vegetation in the region traversed by the Project, and will be offset by achieving a 'Significant Environmental Benefit' in accordance with the *Native Vegetation Act 1991*.

It is noted that this clearance estimate is likely to be higher than the final vegetation clearance required, as it uses upper estimates for all Project components, and does not take into account the

	preferential use (where feasible) of disturbed areas with no or poor quality native vegetation (e.g. existing access tracks and firebreaks and the Bundey substation site). Some components (e.g. temporary facilities) have greater flexibility in placement and are likely to be able to utilise disturbed areas to a large extent. Vegetation clearance for temporary facilities will only occur if there are no suitable existing cleared areas in proximity to the work areas and access tracks. Where UBS scores are higher, the primary influence is the plant diversity component. Threatened fauna scores have also contributed to some BAM sites. It is noted that threatened fauna inputs have been very conservative (Refer Summary in Appendix 3 this report). For example: for *Austrostipa sp*. grassland and/or sparse chenopod regrowth of previously cropped paddocks, EPBC listed species Pygmy Bluetongue (*Tiliqua adelaidensis*) and Flinders Ranges Worm Lizard (*Aprasia pseudopulchella*) were included in BAM sheets based on a very slight possibility of occurrence in small unploughed areas near the alignment, noting that these sites are on the edge or just outside the species range, there are no records within 5 km of the sites, the species were only considered to 'may occur' or 'likely' to occur in PMST output for the segments of alignment. Micro-siting of the towers will avoid unploughed areas, Some of these areas would also align with micro-siting to avoid known Peep-hill Hopbush plants. *Impact Significance* As per the EIS a number of threatened fauna are known to be present or possibly present in areas of the transmission line corridor, including species such as the Black-eared Miner, Malleefowl, Red-lored Whistler and Regent Parrot. Section 11.4.8 provides a summary of the impacts to threatened fauna. ElectraNet's key finding is that Project construction or operational activities will not lead to significant or long-term impacts to flora and fauna. Potential impacts can be readily managed with appropriate location of infrastructure and application of mitigation measures. Given significant impacts are not expected to lead to a long-term decrease in the size of a population, reduce the area of occupancy of threatened fauna species, fragment existing populations, adversely affect habitat critical to the survival of the species, result in harmful or threatened species becoming established in threatened species habitat, it is suggested that clearance for the project could be reduced to ***'At Variance'***.
Principle 1c - plants of a rare, vulnerable or endangered species	**<u>Relevant information</u>** Refer Section 11.3.3 of the EIS regarding desktop assessment of conservation significant flora. Refer Appendix I-3 of the EIS for significant impacts assessment against DotE (2013) criteria. Refer summary of impacts to listed flora (EIS Section 11.4.7). No significant or long-term impacts to listed flora are expected. One Nationally threatened flora species was identified along the January 2021 alignment, *Dodonaea subglandulifera* (Peep Hill Hopbush). An estimated 50 – 100 individuals of *Dodonaea subglandulifera* occurred over approximately 0.5 ha at site 101a. Individuals ranged from approximately 0.2 to 1 m high. Grazing pressure on the *Dodonaea* was low and the plants appeared slightly droughted, otherwise in good health. No flowers or fruits were present. A further population of three bushes has also been recorded approximately 500 m east of site 101a. The three bushes were in similar habitat – rocky slope with Mallee, near an existing transmission line pole, in an existing transmission line easement. These plants are all likely part of the known Robertstown subpopulation documented in the species recovery plan (Moritz and Bickerton 2010) and in the BDBSA. This species was associated with BAM site 101a, Threatened Flora Score(s) -= 0.2. One State rated flora species was recorded at the BAM sites, namely *Geijera parviflora* (Wilga) which is considered State Rare. This species was recorded at BAM sites 14a and 15a, which are within 1 km of each other. These sites are about 20 km north of Waikerie and 1 km north of current alignment (west of Taylorville Station). These sites have not been considered most representative of the alignment in this location and have not been included in the assessment.

Assessment against the principles

Site 101A

Proposed maximum clearance = 0.54 ha of BAM site 101a vegetation.
Clearance of *Dodonaea subglandulifera* will be avoided at this site by micro-siting of the alignment to avoid two known groups of plants that are part of a larger known subpopulation.

Given that the species will be avoided and significant impact assessment against DotE (2013) criteria considered significant impacts to the species unlikely, and the mitigation and SEB offset measures that will be implemented, it is suggested that the proposed clearance is ***'At Variance'***

Moderating factors that may be considered by the NVC

As above

***Principle 1d - the vegetation comprises the whole or part of a plant community that is Rare, Vulnerable or endangered*:**

Relevant information

No threatened ecosystems at a National or State Level were recorded in the transmission line corridor and are considered unlikely to occur. Refer 11.3.3 and 11.4.7 of EIS.
At one BAM site (16c), *Eucalyptus cyanophylla* (Blue-leaf Mallee) was observed as present in lower numbers within *Eucalyptus dumosa* (White Mallee) / *Eucalyptus socialis* (Beaked Red Mallee) Mallee over *Triodia* (Spinifex) Hummock Grassland. It was observed along an existing track on the boundary of Calperum Station, north of Cooltong CP where it is known to occur. Given the vegetation at this site was not dominated by Blue-leaf Mallee, it is unlikely to qualify as the State Rare association. *Eucalyptus cyanophylla* was not recorded at any other BAM site, or noted incidentally between sites during the surveys.

Threatened Community Score - 1

Assessment against the principles

'Not at Variance'

Moderating factors that may be considered by the NVC

Not applicable

Principle 1e - it is significant as a remnant of vegetation in an area which has been extensively cleared.

Relevant information

The transmission line traverses the following IBRA Sub-regions:

Sub-region	Remnancy (%)	TBS	% of alignment	Major Habitats	KM	TBS	At Variance?
Broughton	10 At Variance (if TBS <5) Seriously at variance if TBS 5-500	180	5.26	Austrostipa sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks	10.66	167	Seriously at variance
				Old growth mallee over open sclerophyll and/or chenopod shrub understorey	0.13	13	
Murray Mallee	21 Seriously at variance if TBS> 500	4453	24	Low Open Woodland over chenopod	14.28	1519	
				Austrostipa sp. grassland and/or sparse chenopod	10.92	636	

				regrowth of previously cropped paddocks			
				Chenopod open shrubland	17.12	1526	
				Old growth mallee	6.9	771	
Braemer	100 At Variance if TBS> 500	1428	7.36	Chenopod open shrubland	10.85		At variance
				Old growth mallee	4.23		
South Olary Plain	97 At Variance if TBS> 500	14503	60.45	Low Open Woodland over chenopod	10.77		At variance
				Chenopod open shrubland	16.7		
				Hopbush shrubland	.75		
				Mallee over Triodia	57.61		
				Old growth mallee	35.45		
				Post-fire regrowth mallee	2.64		
Murray Scroll Belt	56 At Variance if TBS> 500	647	3.74	Low Open Woodland over chenopod	0.23		At variance
				Chenopod open shrubland	1.49		
				Hopbush shrubland	5.94		

Major Habitats of the Transmission Line Corridor by IBRA Subregion and IBRA Association

Note: IBRA association statistics are not available (NatureMaps 2021). Table is presented to show which IBRA associations align with project broad habitat types.

Major Habitats	IBRA subregion	IBRA Association
Regrowth on cropped lands (highly modified habitat);	Broughton (about 20%) Murray Mallee (about 80%)	Burra Hill Sutherlands Mt Mary
Low Open Woodland – western end	Murray Mallee (100%)	Mt Mary Florieton Parcoola
Low Open Woodland – eastern end	South Olary Plain (100%)	Renmark (major) Canopus (minor)
Mallee over sclerophyll and chenopod shrubs - western end	Murray Mallee (100%)	Sutherlands (100%)
Mallee over sclerophyll and chenopod shrubs - central and end	South Olary Plain (90%) Braemer (10%)	Parcoola (major) Renmark (minor) Canopus (minor)
Mallee over Triodia	South Olary Plain (100%)	Parcoola
Mallee regrowth over sclerophyll and chenopod shrubs	South Olary Plain (100%)	Parcoola
Hopbush Shrubland	South Olary Plain (100%)	Renmark
Chenopod shrubland – western end	Murray Mallee (two thirds) Braemer (one third)	Sutherlands Mt Mary Florieton Parcoola
Chenopod shrubland - eastern end	Murray Scroll Belt (two thirds) South Olary Plain (one third)	Renmark (major) Canopus (minor)

Note: IBRA Associations not mapped therefore cannot calculate length of corridor mapped within each IBRA Association

	Refer Table 11-9 of the EIS for approximate % of clearance within each subregion (<1% for each subregion ranging from 0.04 to 0.004 %).
	Assessment against the principles *Seriously at Variance* Clearance in the Broughton and Murray Mallee IBRA subregions (5.26% and 25% of the corridor, respectively) is considered to be 'Seriously at Variance'. Clearance in Broughton will be minimized given location of Peep-hill Hopbush occurs within this section, and vegetation assessments have been very conservative, given presence of previously cropped land (Austrostipa and Chenopod regrowth). Clearance in the Murray Mallee will also be minimized where possible given Cultural Sensitivities and objectives to minimise potential impacts to mallee birds. Whilst the Murray Mallee TBS is high, it is noted that the higher TBS are associated with Low Open Woodland and Chenopod shrubland habitats, given clearance in Old Growth Mallee will be minimized where possible. *At Variance* Clearance in Braemer, Murray Scroll Belt and South Olary Plain is considered to be 'At Variance', which is ~71.5% of the proposed upper limit of clearance area.
	Moderating factors that may be considered by the NVC As per the EIS clearance in the Broughton IBRA subregion includes vegetation of poorer condition and better quality vegetation would be avoided where possible. Similarly, there are mitigation measures to avoid better quality vegetation in the Murray Mallee including extensive tracts of contiguous vegetation within the Riverland Biosphere Reserve and Black-eared Miner Critical Habitat Area (Refer Section 11.4.1 and 11.4.9 of the EIS). It is suggested that the proposed clearance could be reduced to ***'At Variance'***
Principle 1f - it is growing in, or in association with, a wetland environment.	**Relevant information** The proposed alignment was chosen deliberately to avoid wetlands as a priority. No wetlands are included in the alignment.
	Assessment against the principles **'Not at Variance'**
	Moderating factors that may be considered by the NVC Not applicable
Principle 1g - it contributes significantly to the amenity of the area in which it is growing or is situated.	**Relevant information** The vegetation proposed to be cleared is generally on minor roads, or fire/service tracks within areas with low visitor access. For much of the alignment, the vegetation is sparse native regrowth or open chenopod shrubland in regions with high native vegetation remnancy. The vegetation being cleared per se is not considered to contribute significantly to the amenity of the region. The transmission line corridor is generally distant from roads, towns and visual impact receptors. The vegetation that would be cleared for towers, access tracks and other Project-related activities is generally not highly visible and does not contribute significantly to the amenity of the area. For further detail about visual amenity refer Chapter 13 of the EIS. The Project will not impact Cultural Heritage values of the region (refer to the EIS, refer Chapter 12).
	'Not at Variance'
	Moderating factors that may be considered by the NVC N/A

Principles of Clearance (h-m) will be considered by comments provided by the local NRM Board or relevant Minister. The Data Report should contain information on these principles where relevant and where sufficient information or expertise is available.

4.6 Risk Assessment

Determine the level of risk associated with the application

Total clearance	No. of trees	NA
	Area (ha)	413 (135 permanent, 278 temporary)
	Total biodiversity Score	20017
Seriously at variance with principle 1(b), 1(c) or 1 (d)		It is suggested (b) and (c) are 'at variance'; (d) is 'not at variance'
Risk assessment outcome		Level 4

4.7 NVC Guidelines

Provide any other information that demonstrates that the clearance complies with any relevant NVC guidelines related to the activity.

Not applicable

5. Clearance summary

Estimated vegetation clearance and SEB requirements for the project are summarised in the following table.

Vegetation associations (represented by BAM site number) have been grouped by broad habitat type in the table.

The entry in the table for each vegetation association / BAM site number represents the total length of this association that has been mapped for the proposed alignment (i.e. where there are multiple segments mapped under a BAM site number, these have been aggregated into one line in the table).

Vegetation on the cultural heritage avoidance alignment on Hawk's Nest Station has been accounted for by using the vegetation mapped on the transmission line corridor to the east of the alignment (refer Figure 3 in Appendix 1). The additional 1.3 km of length in the revised section of the alignment has been accounted for by adding 1.3 km of site 19b to the table (which is the vegetation association mapped at the point where the alignment deviates to the south). This approach is conservative; the vegetation types along the cultural heritage avoidance alignment are consistent with the transmission line corridor, however there is existing disturbance present (from tracks, fence lines, the 132 kV line easement and access track and edge effects from adjacent cleared areas) and the vegetation condition scores would be lower[1] than the scores that have been assumed for the calculations.

The vegetation clearance estimates and SEB requirements outlined in the following table are expected to be higher than the final vegetation clearance and SEB required, as the table uses upper estimates of land disturbance for all project components to derive the total clearance and does not take into account the preferential use (where feasible) of disturbed areas with no or poorer quality native vegetation. In addition, the vegetation condition and biodiversity assessments do not account for existing tracks and disturbance areas, hence the quality of the vegetation, and Total Biodiversity Score proposed for impact is conservative.

As noted in Section 2.2, this report and the following table may be updated to incorporate refinements in clearance estimates at the time of submission of a formal application under the Native Vegetation Regulations (depending on the status of detailed design). As is standard for large linear infrastructure projects, it is expected that the clearance areas will remain as estimates in the application and final clearance will be confirmed following construction with in-field audits against approved clearance areas, with the SEB adjusted as necessary to reflect the final clearance.

Similarly, requirements for trimming of vegetation to maintain required clearance distances between vegetation and conductors (under the Electricity (Principles of Vegetation Clearance) Regulations) will be confirmed after construction is completed, and the SEB adjusted as necessary.

Loadings (for conservation areas / Heritage Agreement Areas) have been calculated based on the length of each BAM site segment that is in an area with a Loading Factor (e.g. if 60% of the BAM site is in a Conservation Park or Heritage Agreement (Loading Factor of 1) then a loading factor of 0.6 has been applied to the BAM site).

Reductions for ecological restoration have been applied based on the proportion of the total area of clearance that will be rehabilitated. Based on the estimates of 278 ha of the total 413 ha clearance being temporary (i.e. 67%), a reduction of 0.67 x 0.5 has been applied (where 0.5 is the reduction to be applied when restoration is initiated within 3 years of clearance occurring).

An average rainfall factor has been applied for each major habitat type, using the rainfall shown on the NatureMaps Rainfall layer at the centre of the mapped habitat type, but also differentiated by location along the alignment (e.g. western or eastern end.

The economies of scale factor has been determined using on the economies of scale area in which the majority of the BAM site segment is located, these would be adjusted following micro siting, as clearance may actually occur in the areas with lower loadings (e.g. cleared paddocks).

Clearance Area(s) Summary table

Summary Clearance Table for *patches* of vegetation assessed using the Bushland Assessment Method.

[1] As noted in the EIS (Section 11.4.8), the cultural heritage avoidance alignment does not increase the likelihood of presence of any listed species so this would not increase unit biodiversity scores. (Conversely it is likely to reduce potential impacts as it follows existing disturbance corridors).

Clearance Area(s) Summary table

Summary Clearance Table for *patches* of vegetation assessed using the Bushland Assessment Method.

BAM Site	Broad Habitat Group	Species (plant) diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	Unit biodiversity Score	Length (km)	Area (ha)	Total Biodiversity Score	Loss Factor	Loading factor for protected areas	Reduction factor	SEB points required	Mean Annual Rainfall (mm)	Economies of scale	SEB payment	Admin fee	Total Payment
104	Low Open Woodland over chenopod understorey	30	1	0	0.1	84.45	0.39	0.78	65.87	1	0	0.34	45.99	255	0.23	$7,015.38	$385.85	$7,401.22
105		20	1	0	0.1	63.37	2.08	4.16	263.62	1	0	0.34	460.87	255	0.23	$70,295.31	$3,866.24	$74,161.55
111		24	1	0	0.1	58.79	0.23	0.46	27.04	1	0	0.34	47.28	249	0.5	$15,307.77	$841.93	$16,149.70
114		20	1	0	0.1	36.68	8.02	16.04	588.35	1	0	0.34	410.81	249	0.11	$29,262.70	$1,609.45	$30,872.15
11a		16	1	0	0.1	47.96	3.57	7.14	342.43	1	0	0.34	239.10	255	0.23	$36,469.86	$2,005.84	$38,475.70
29b		24	1	0	0.1	63.62	2.75	5.5	349.91	1	1	0.34	244.32	249	0.11	$17,403.52	$957.19	$18,360.71
5c		20	1	0	0.1	60.77	2.75	5.5	334.24	1	0	0.34	233.38	255	0.23	$35,596.61	$1,957.81	$37,554.42
6b		18	1	0	0.1	49.82	3.06	6.12	304.90	1	1	0.34	212.90	255	0.35	$49,414.23	$2,717.78	$52,132.01
8b		12	1	0	0.1	45.59	1.13	2.26	103.03	1	0	0.34	71.94	255	0.35	$16,698.40	$918.41	$17,616.81
9a		14	1	0	0.1	40.51	1.3	2.6	105.33	1	0	0.34	73.54	255	0.23	$11,217.40	$616.96	$11,834.36
101a	Austrostipa sp. grassland and/or sparse chenopod regrowth of previously cropped paddocks	22	1	0.2	0.1	50.67	0.29	0.58	29.39	1	0	0.34	20.52	280	0.5	$7,471.29	$410.92	$7,882.21
101c		14	1	0	0.1	21.03	1.81	3.62	76.13	1	0	0.34	53.16	280	0.5	$19,353.72	$1,064.45	$20,418.18
101d		14	1	0	0.1	28.33	6.02	12.04	341.09	1	0	0.34	238.17	280	0.35	$60,699.88	$3,338.49	$64,038.37
102b		12	1	0	0.1	22.73	2.37	4.74	107.74	1	0	0.34	75.23	280	0.35	$19,173.11	$1,054.52	$20,227.63
1b		6	1	0	0.1	9.65	1.86	3.72	35.90	1	0	0.34	25.07	280	0.5	$9,126.14	$501.94	$9,628.07

BAM Site	Broad Habitat Group	Species (plant) diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	Unit biodiversity Score	Length (km)	Area (ha)	Total Biodiversity Score	Loss Factor	Loading factor for protected areas	Reduction factor	SEB points required	Mean Annual Rainfall (mm)	Economies of scale	SEB payment	Admin fee	Total Payment
1c		24	1	0	0.1	42.46	0.95	1.9	80.67	1	0	0.34	56.33	280	0.35	$14,356.49	$789.61	$15,146.10
2b		6	1	0	0.1	7.59	1.71	3.42	25.96	1	0	0.34	18.13	280	0.5	$6,599.10	$362.95	$6,962.05
3c		18	1	0	0.1	32.81	1.51	3.02	99.09	1	0	0.34	69.19	280	0.35	$17,633.07	$969.82	$18,602.89
4c		18	1	0	0.1	53.32	0.073	0.146	7.78	1	0	0.34	5.44	280	0.35	$1,385.34	$76.19	$1,461.54
107	Chenopod open shrubland - western half of alignment	12	1	0	0.06	44.21	2.61	5.22	230.78	1	0	0.34	161.14	255	0.23	$24,578.07	$1,351.79	$25,929.86
102c		12	1	0	0.06	48.44	1.07	2.14	103.66	1	0	0.34	72.38	255	0.35	$16,800.21	$924.01	$17,724.23
11b		12	1	0	0.06	28.99	0.25	0.5	14.50	1	0	0.34	10.12	255	0.23	$1,543.74	$84.91	$1,628.65
12b		8	1	0	0.06	28.99	4.95	9.9	287.00	1	0.277	0.34	200.40	255	0.23	$30,566.11	$1,681.14	$32,247.24
13a		10	1	0	0.06	30.9	4.52	9.04	279.34	1	0	0.34	276.29	255	0.23	$42,141.78	$2,317.80	$44,459.58
13b		10	1	0	0.06	31.89	6.1	12.2	389.06	1	0	0.34	271.66	255	0.23	$41,435.35	$2,278.94	$43,714.30
14b		14	1	0	0.06	37.21	4.75	9.5	353.50	1	0	0.34	246.83	255	0.23	$37,647.83	$2,070.63	$39,718.46
6a		4	1	0	0.06	19.54	0.91	1.82	35.56	1		0.34	24.83	255	0.35	$5,763.59	$317.00	$6,080.58
6c		18	1	0	0.06	52.36	2.81	5.62	294.26	1	0.818	0.34	458.21	255	0.23	$69,889.54	$3,843.92	$73,733.46
7c		30	1	0	0.06	75.57	1.86	3.72	281.12	1	0	0.34	196.29	255	0.23	$29,939.81	$1,646.69	$31,586.50
112	Chenopod shrubland - eastern half of alignment	24	1	0	0.1	74.11	0.19	0.38	28.16	1	1	0.34	49.23	250	0.5	$16,004.85	$880.27	$16,885.12
13c		6	1	0	0.1	58.24	0.43	0.86	50.09	1	0.606	0.34	87.56	250	0.11	$6,262.30	$344.43	$6,606.73
14c		12	1	0	0.1	36.32	8.56	17.12	621.80	1	1	0.34	1087.06	250	0.25	$176,689.56	$9,717.93	$186,407.49
20a		20	1	0	0.1	42.6	0.87	1.74	74.12	1	0.046	0.34	55.34	250	0.11	$3,957.57	$217.67	$4,175.23
25b		8	1	0	0.1	27.97	2.64	5.28	147.68	1	1	0.34	258.18	250	0.5	$83,930.09	$4,616.15	$88,546.24
26b		10	1	0	0.1	29.08	5.5	11	319.88	1	1	0.34	426.90	250	0.5	$138,774.50	$7,632.60	$146,407.10
28b	Hopbush	10	1	0	0.1	39.35	5.94	11.88	467.48	1	0.918	0.34	777.02	249	0.11	$55,347.90	$3,044.13	$58,392.04

BAM Site	Broad Habitat Group	Species (plant) diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	Unit biodiversity Score	Length (km)	Area (ha)	Total Biodiversity Score	Loss Factor	Loading factor for protected areas	Reduction factor	SEB points required	Mean Annual Rainfall (mm)	Economies of scale	SEB payment	Admin fee	Total Payment
15c	(*Dodonaea viscosa ssp angustissima*) shrubland – eastern half of alignment	22	1	0	0.1	47.61	0.75	1.5	71.42	1	1	0.34	124.85	247	0.5	$40,099.38	$2,205.47	$42,304.85
115	Mallee over Triodia dominated understorey	30	1	0	0.1	75.32	7.18	14.36	1081.60	1	0	0.34	1659.22	255	0.23	$253,075.45	$13,919.15	$266,994.60
109a		26	1	0	0.1	61.39	5.17	10.34	634.77	1	1	0.34	443.23	255	0.23	$67,604.38	$3,718.24	$71,322.63
16b		16	1	0	0.1	54.36	18.13	36.26	1971.09	1	0.627	0.34	2673.99	255	0.23	$407,854.08	$22,431.97	$430,286.05
16c		30	1	0	0.1	67.29	0.46	0.92	61.91	1	0	0.34	108.23	255	0.23	$16,507.74	$907.93	$17,415.67
17b		20	1	0	0.1	55.97	3.78	7.56	423.13	1	1	0.34	739.74	255	0.23	$112,830.47	$6,205.68	$119,036.14
17c		24	1	0	0.1	60.12	0.32	0.64	38.48	1	1	0.34	67.27	255	0.23	$10,260.02	$564.30	$10,824.32
18b		14	1	0	0.1	53.88	1.48	2.96	159.48	1	0	0.34	278.82	255	0.23	$42,527.38	$2,339.01	$44,866.38
20c		26	1	0	0.1	65.52	1.93	3.86	252.91	1	1	0.34	442.15	255	0.23	$67,438.90	$3,709.14	$71,148.04
22b		24	1	0	0.1	68.36	2.43	4.86	332.23	1	1	0.34	374.66	255	0.23	$57,144.92	$3,142.97	$60,287.89
22c		28	1	0	0.1	69.05	2.26	4.52	312.11	1	0.409	0.34	545.64	255	0.23	$83,224.54	$4,577.35	$87,801.89
24c		12	1	0	0.1	51.36	0.24	0.48	24.65	1	1	0.34	17.21	255	0.23	$2,625.57	$144.41	$2,769.97
29c		24	1	0	0.1	74.97	12.95	25.9	1941.72	1	0.989	0.34	3372.19	255	0.23	$514,348.92	$28,289.19	$542,638.11
9c		20	1	0	0.1	55.62	1.28	2.56	142.39	1	0.796	0.34	99.42	255	0.23	$15,164.48	$834.05	$15,998.53
108	Old growth mallee over open sclerophyll and / or chenopod shrub understorey	18	1	0	0.1	61.39	6.36	12.72	780.88	1	0	0.34	545.25	250	0.23	$81,534.47	$4,484.40	$86,018.87
116		26	1	0	0.1	77.31	4.15	8.3	641.67	1	0	0.34	850.28	250	0.23	$127,147.55	$6,993.12	$134,140.67
117		22	1	0	0.1	49.22	1.69	3.38	166.36	1	0.488	0.34	201.41	250	0.23	$30,117.75	$1,656.48	$31,774.22
10c		24	1	0	0.1	69.52	2.78	5.56	386.53	1	1	0.34	269.90	250	0.23	$40,359.06	$2,219.75	$42,578.81

BAM Site	Broad Habitat Group	Species (plant) diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	Unit biodiversity Score	Length (km)	Area (ha)	Total Biodiversity Score	Loss Factor	Loading factor for protected areas	Reduction factor	SEB points required	Mean Annual Rainfall (mm)	Economies of scale	SEB payment	Admin fee	Total Payment
12c		26	1	0	0.1	60.23	1.59	3.18	191.53	1	0	0.34	334.84	250	0.11	$23,947.16	$1,317.09	$25,264.25
15b		26	1	0	0.1	62.31	1.82	3.64	226.81	1	0	0.34	158.37	250	0.23	$23,681.85	$1,302.50	$24,984.35
18c		24	1	0	0.1	73.26	0.36	0.72	52.75	1	0	0.34	92.22	250	0.23	$13,789.50	$758.42	$14,547.92
19b		22	1	0	0.1	57.36	2.1	4.2	240.91	1	0	0.34	421.17	250	0.23	$62,980.71	$3,463.94	$66,444.65
19BB*		22	1	0	0.1	57.36	1.3	2.6	149.14	1	1	0.34	260.73	250	0.23	$38,988.06	$2,144.34	$41,132.40
19c		16	1	0	0.1	49.75	0.27	0.54	26.87			0.34	46.97	250	0.23	$7,023.21	$386.28	$7,409.49
1a		14	1	0	0.08	51.18	0.13	0.26	13.31	1	1	0.34	9.29	285	0.5	$3,443.32	$189.38	$3,632.70
23b		18	1	0	0.1	66.05	5.42	10.84	715.98	1	0	0.34	1251.72	250	0.23	$187,176.46	$10,294.71	$197,471.16
23c		24	1	0	0.1	71.81	4.14	8.28	594.59	1	0	0.34	428.28	250	0.23	$64,043.38	$3,522.39	$67,565.77
24b		24	1	0	0.1	65.42	3.27	6.54	427.85	1	0.385	0.34	471.70	250	0.23	$70,536.27	$3,879.49	$74,415.76
27b		24	1	0	0.1	74.32	1.5	3	222.96	1	1	0.34	155.68	250	0.11	$11,133.93	$612.37	$11,746.29
3b		10	1	0	0.08	55.54	0.68	1.36	75.53	1	0	0.34	52.74	285	0.35	$13,681.90	$752.50	$14,434.40
4b		24	0	0	0.08	74.71	1.58	3.16	236.08	1	0.021	0.34	164.85	285	0.35	$42,762.92	$2,351.96	$45,114.89
5a		14	1	0	0.08	50.6	0.07	0.14	7.08	1	1	0.34	4.95	285	0.35	$1,283.16	$70.57	$1,353.73
5b		14	1	0	0.08	44.05	2.29	4.58	201.75	1	0	0.34	140.87	285	0.35	$36,543.74	$2,009.91	$38,553.64
7a		14	1	0	0.08	45.32	0.3	0.6	27.19	1	0	0.34	18.99	285	0.35	$4,925.41	$270.90	$5,196.31
8a		20	1	0	0.08	56.59	1.98	3.96	224.10	1	0.597	0.34	156.48	285	0.35	$40,591.63	$2,232.54	$42,824.17
8c		26	1	0	0.1	81.11	4.23	8.46	686.19	1	0	0.34	479.13	250	0.23	$71,647.54	$3,940.61	$75,588.16
21c	Post-fire regrowth mallee	24	1	0	0.1	66.7	2.64	5.28	352.18	1	0.758	0.34	526.20	257	0.23	$80,889.59	$4,448.93	$85,338.52

BAM Site	Broad Habitat Group	Species (plant) diversity score	Threatened Ecological community Score	Threatened plant score	Threatened fauna score	Unit biodiversity Score	Length (km)	Area (ha)	Total Biodiversity Score	Loss Factor	Loading factor for protected areas	Reduction factor	SEB points required	Mean Annual Rainfall (mm)	Economies of scale	SEB payment	Admin fee	Total Payment
	over sclerophyll and chenopod shrub understorey																	
						Total	**205**	**410**	**21363**				**25249**			**$3,994,686.9**	**$219,707.8**	**$4,214,394.7**

* Site 19b has been used to estimate the SEB requirement for the additional length of alignment (1.3 km) on the cultural heritage avoidance alignment on Hawk's Nest Station (line 19BB). See Section 5 for discussion.

Totals summary table

	Total Biodiversity score	Total SEB points required	SEB Payment	Admin Fee	Total Payment
Application	21363	25249	$3,994,686.90	$219,707.78	$4,214,394.68

Economies of Scale Factor	Varies across the alignment 0.11, 0.23, 0.35, 0.5 Refer *Clearance Area Summary Table*
Rainfall (mm)	247-285 across the alignment refer *Clearance Area Summary Table*

6. Significant Environmental Benefit

A Significant Environmental Benefit (SEB) is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The NVC must be satisfied that as a result of the loss of vegetation from the clearance that an SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

ACHIEVING AN SEB

Indicate how the SEB will be achieved by ticking the appropriate box and providing the associated information:

☐ Establish a new SEB Area on land owned by the proponent. Provide information below.

☐ Use SEB Credit that the proponent has established. Provide the SEB Credit Ref. No. _____

☒ Apply to have SEB Credit assigned from another person or body. The application form needs to be submitted with this Data Report.

☒ Apply to have an SEB to be delivered by a Third Party. The application form needs to be submitted with this Data Report.

☒ Pay into the Native Vegetation Fund. Provide details below

PAYMENT SEB

If a proponent proposes to achieve the SEB by paying into the Native Vegetation Fund, summary information must be provided on the amount required to be paid and the manner of payment:

As noted in Section 4.4, ElectraNet are investigating potential on-ground projects with landholders and SEB credit providers, with the aim of achieving some or all of the SEB via on-ground works. An offset strategy is being developed that will include details about the combination of such on-ground activities, and where these are not feasible payment would be made to the Native Vegetation in accordance with the SEB Offset Policy (NVC 2020c). The offset strategy will be submitted and approved by the NVC / DEW Native Vegetation Management Branch as part of the formal submission of the Native Vegetation Clearance Application.

References

Department for Environment and Water (2020). Biological Databases of South Australia – Data Request Procedure. Webpage accessed: http://www.environment.sa.gov.au/Science/Information_data/Biological_databases_of_South_Australia. Accessed 22/2/2021 Recordset number DEWNRBDBSA201201-1, November 2020

Native Vegetation Council (2020a) Guide for applications to clear native vegetation under the Native Vegetation Act 1991 and Native Vegetation Regulations 2017. Published by Natural Resources for Native Vegetation Council, Government of South Australia.

Native Vegetation Council (2020b) Native Vegetation Council (NVC) Bushland Assessment Manual. Published by Natural Resources for the Native Vegetation Council, Government of South Australia.

Native Vegetation Council (2020c) Policy for a Significant Environmental Benefit under the Native Vegetation Act 1991 and the Native Vegetation Regulations 2017 (SEB Policy). Native Vegetation Council. Natural Resources.

Native Vegetation Council (2020d) Guide for calculating a Significant Environmental Benefit under the Native Vegetation Act 1991 and Native Vegetation Regulations 2017. Natural Resources for the NVC, Government of South Australia.

For additional references refer EIS and associated Appendices.

Proposed alignment

Existing ElectraNet transmission line

Proposed Bundey substation

Figure 1
Proposed alignment and vegetation associations

0 5

Kilometres

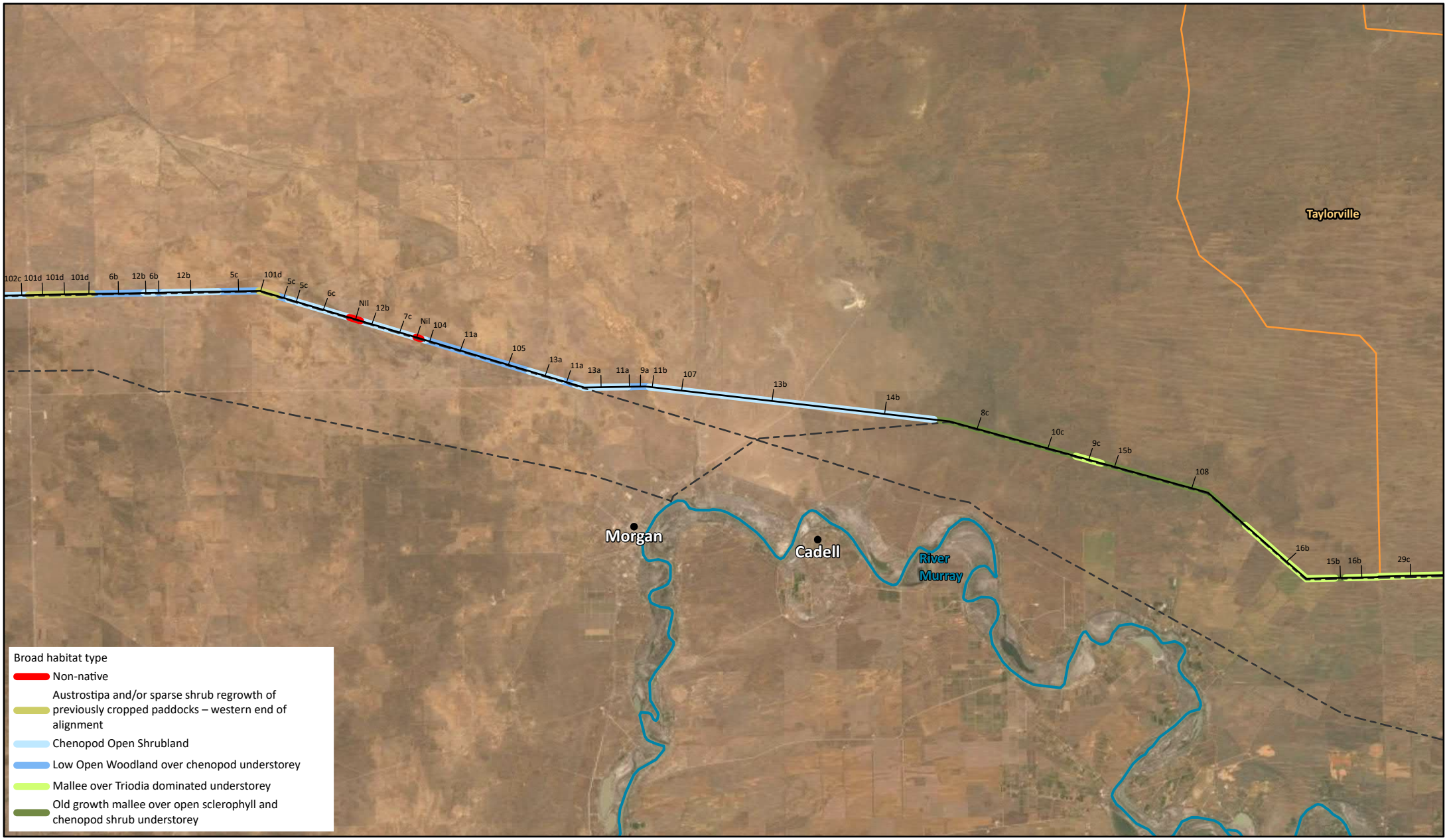
N

ElectraNet

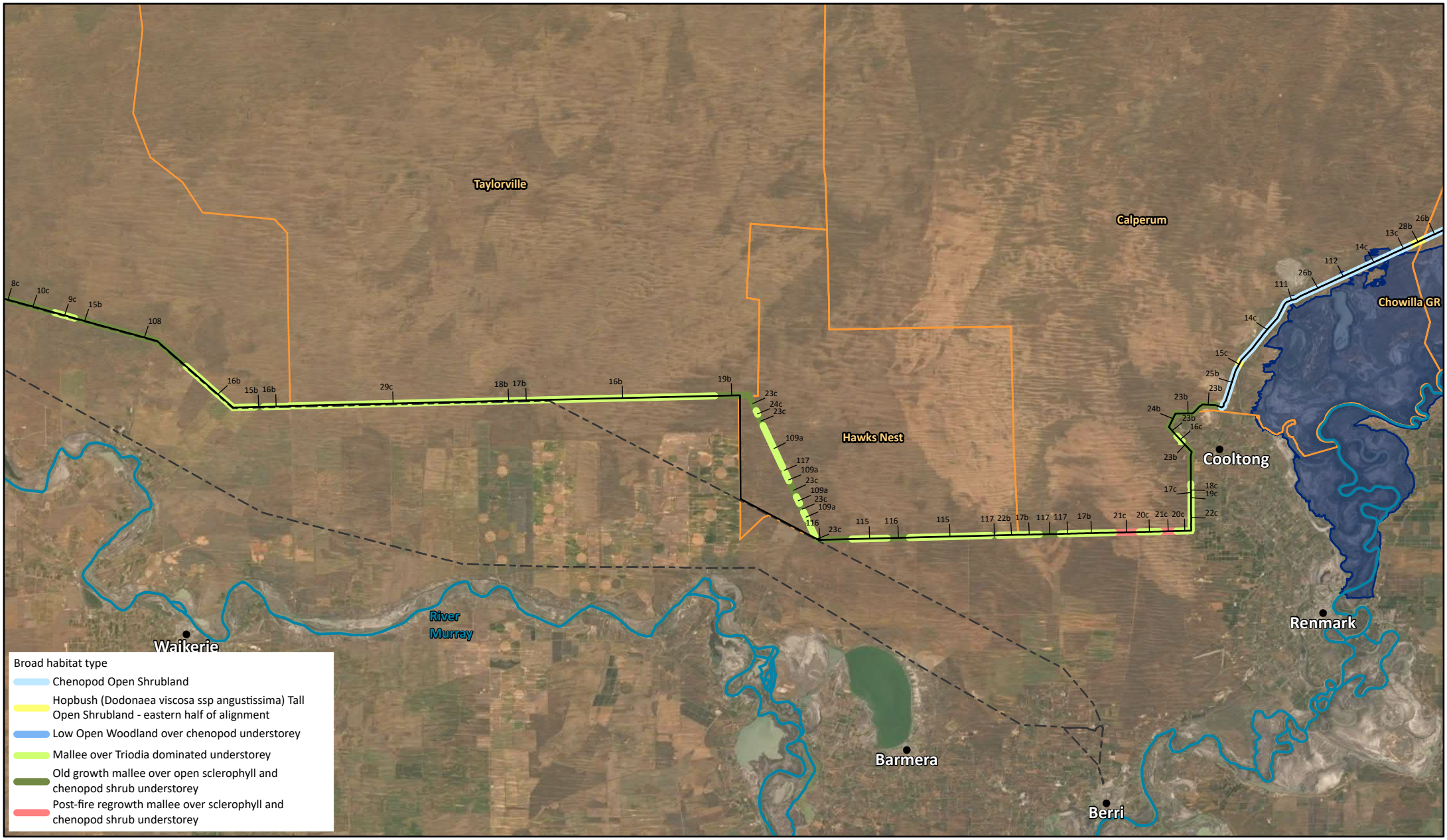
energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment

Riverland Ramsar wetland

Pastoral lease

Existing ElectraNet transmission line

River Murray

Figure 3
Proposed alignment and vegetation associations

0 5

Kilometres

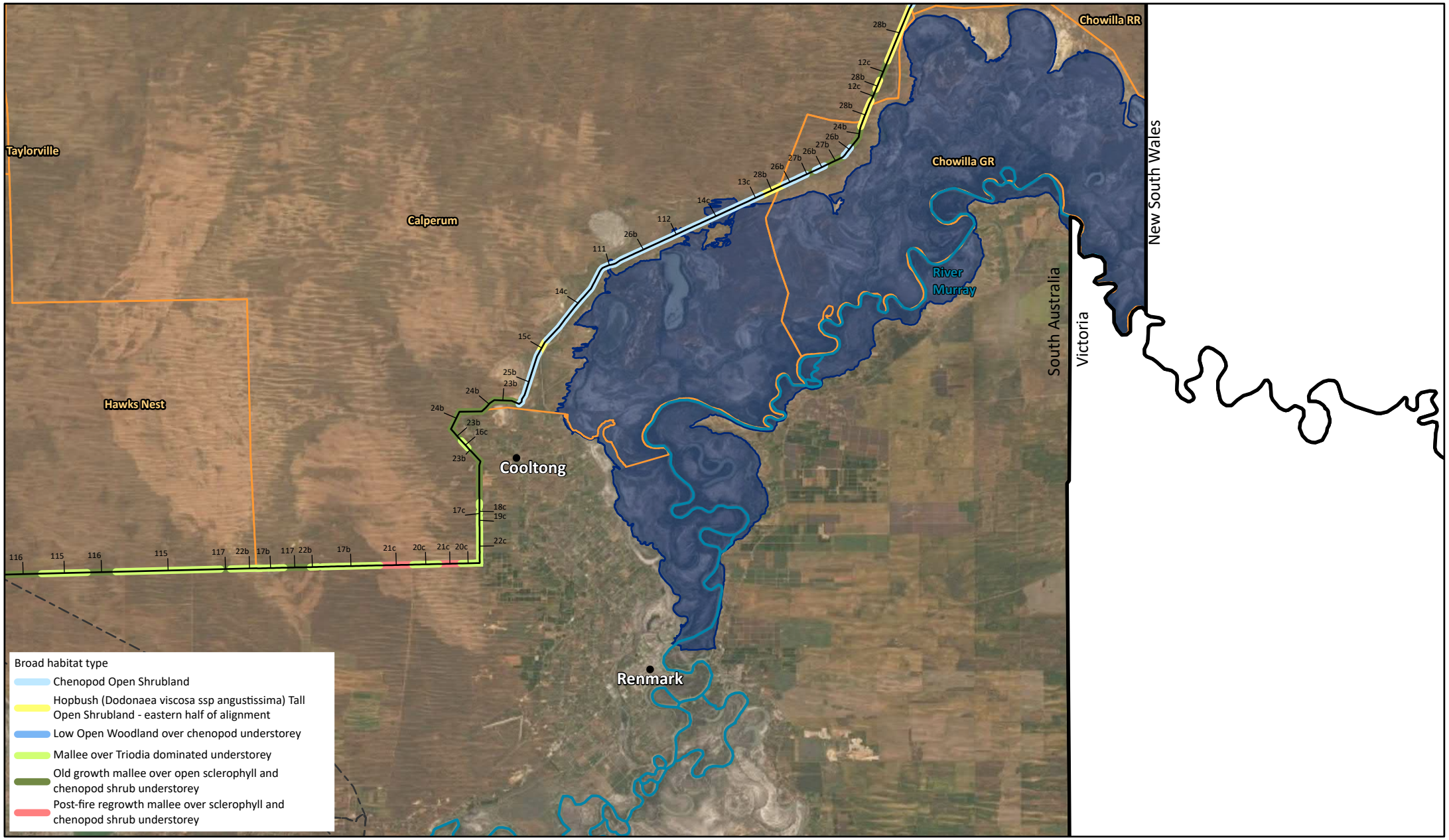
N

ElectraNet

energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment

Riverland Ramsar wetland

Pastoral lease

Existing ElectraNet transmission line

River Murray

Figure 4
Proposed alignment and vegetation associations

0 5
Kilometres

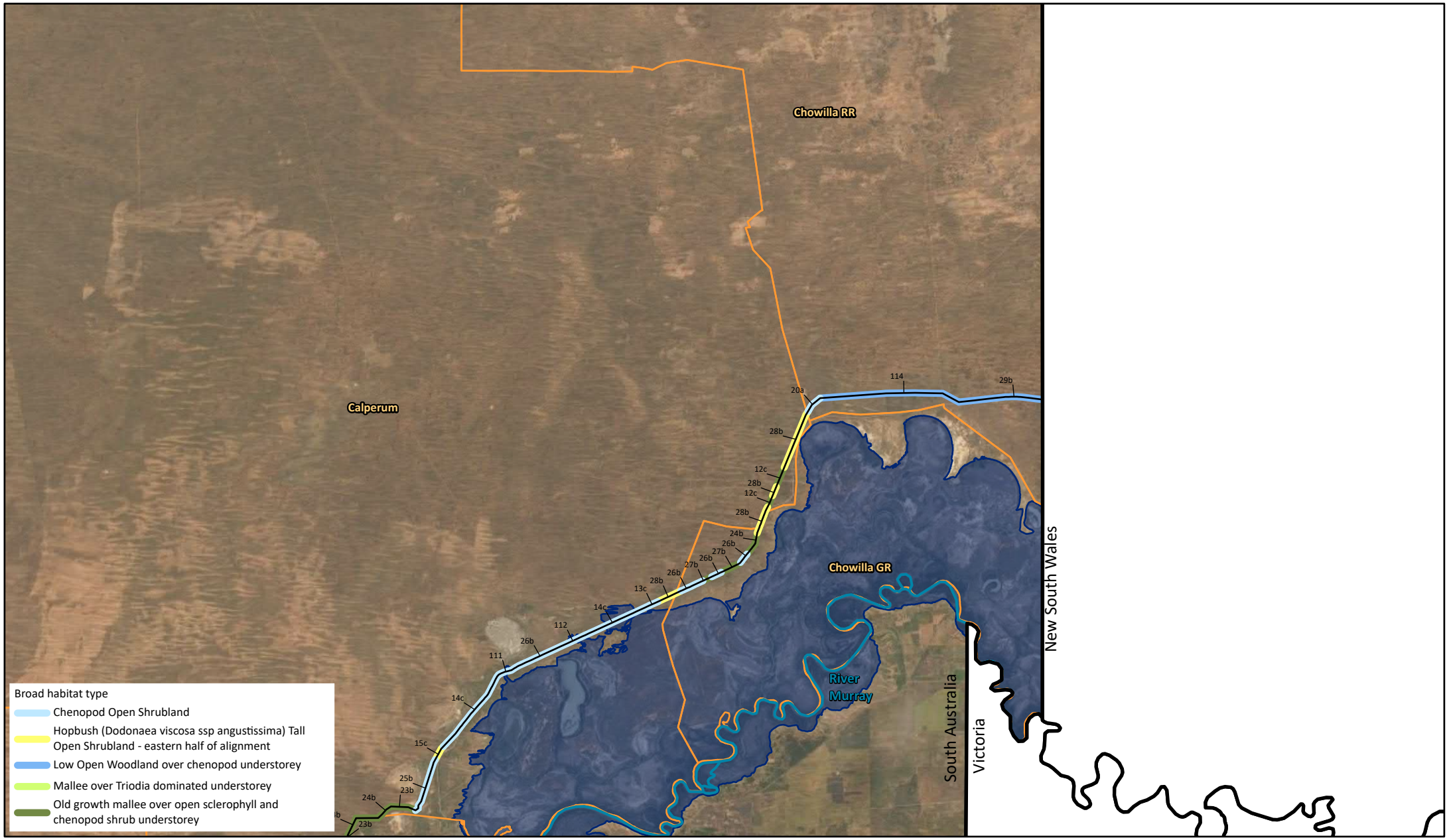
N

ElectraNet

energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment
Riverland Ramsar wetland
Pastoral lease
River Murray

Figure 5
Proposed alignment and vegetation associations

0 5
Kilometres

N

ElectraNet
energy connect
JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)

7. Appendices

Appendix 7.1: Detailed mapping of vegetation associations and proposed alignment

Proposed alignment

Existing ElectraNet transmission line

Proposed Bundey substation

Figure 1
Proposed alignment and vegetation associations

0 5

Kilometres

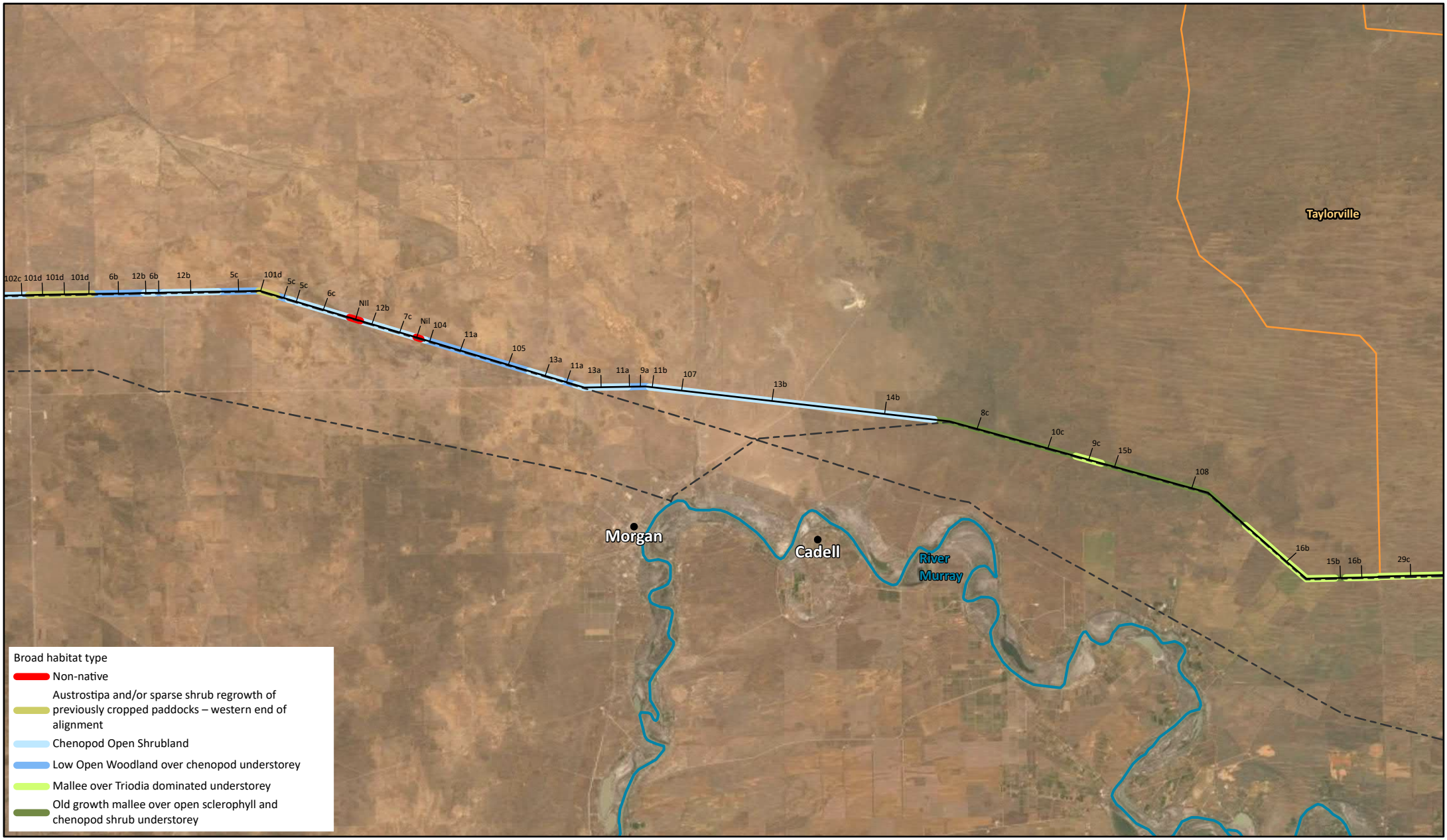
N

ElectraNet

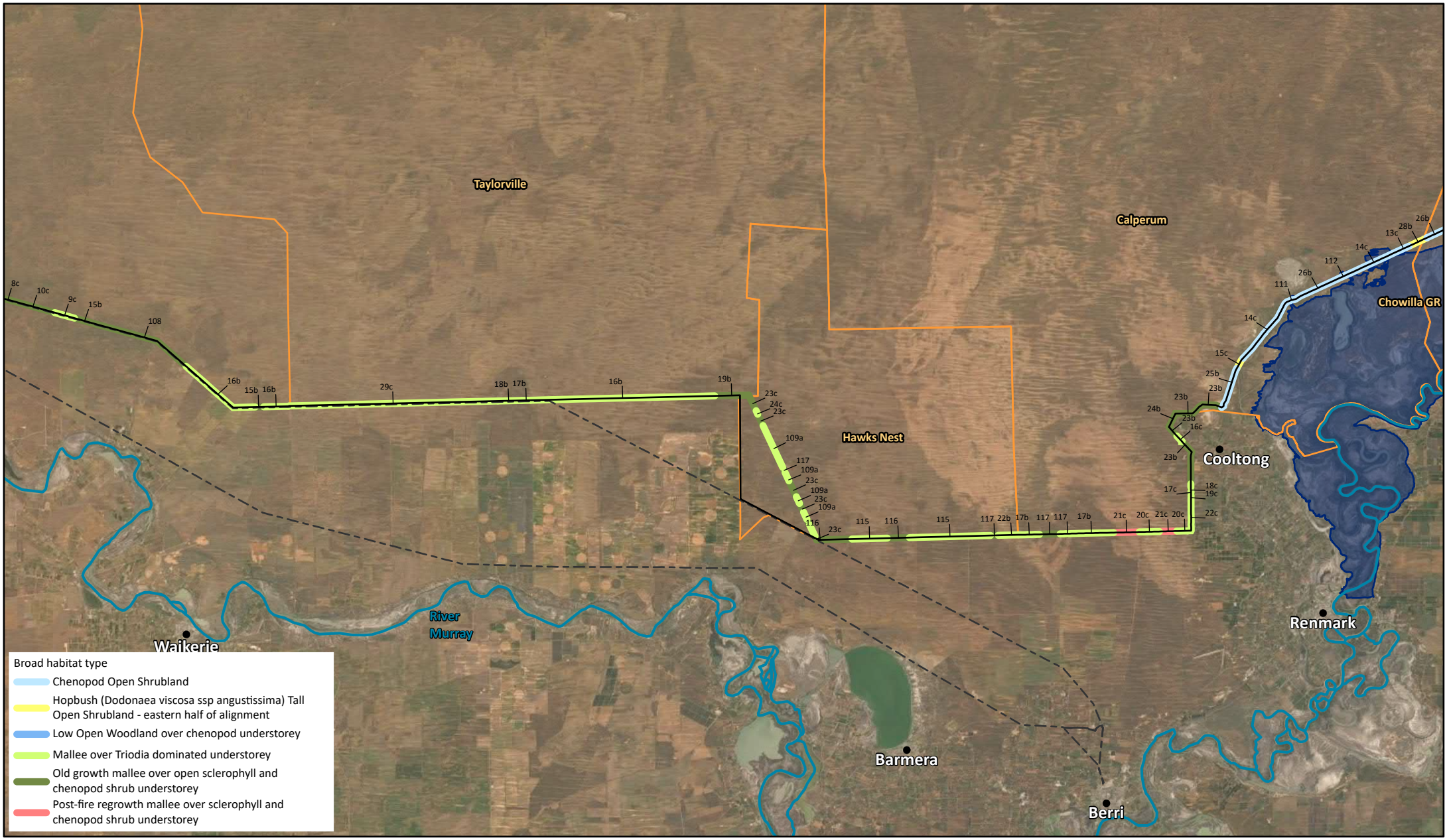
energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment

Riverland Ramsar wetland

Pastoral lease

Existing ElectraNet transmission line

River Murray

Figure 3
Proposed alignment and vegetation associations

0 5

Kilometres

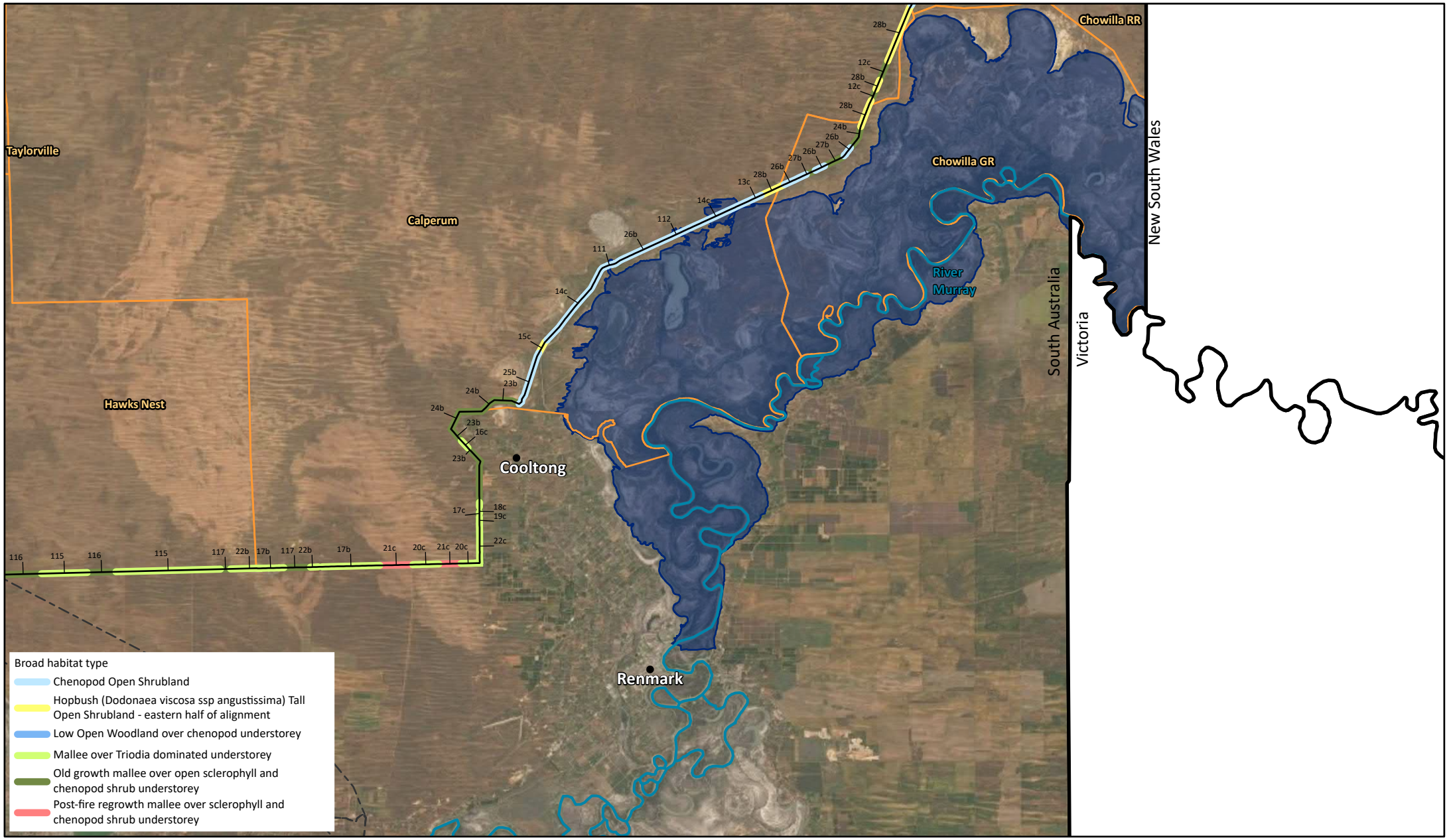
N

ElectraNet

energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment

Riverland Ramsar wetland

Pastoral lease

Existing ElectraNet transmission line

River Murray

Figure 4
Proposed alignment and vegetation associations

0 5
Kilometres

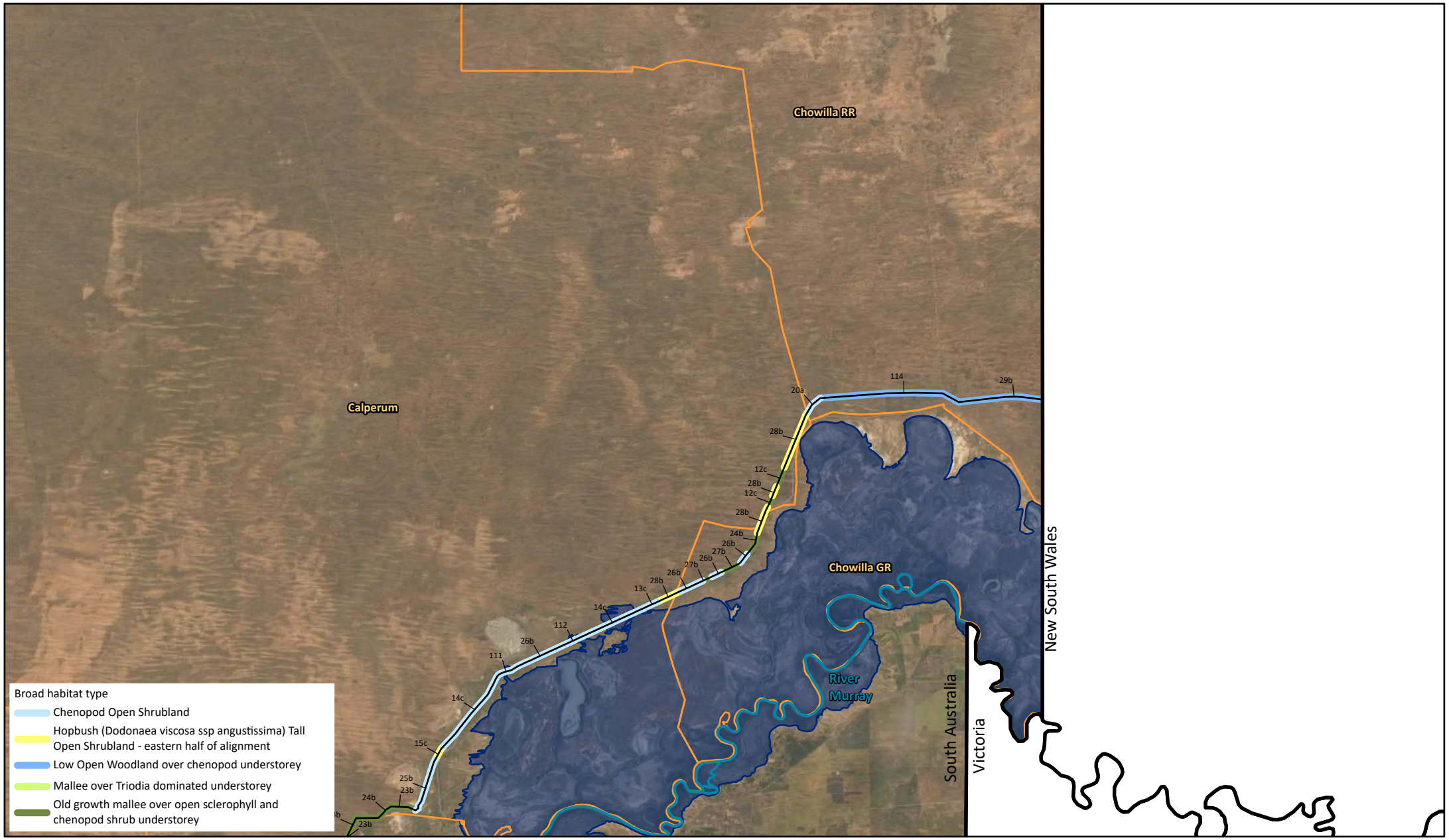
N

ElectraNet

energy connect

JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)



Proposed alignment
Riverland Ramsar wetland
Pastoral lease
River Murray

Figure 5
Proposed alignment and vegetation associations

0 5
Kilometres

N

ElectraNet
energy connect
JBS&G

Labels (e.g. 101a) represents vegetation association (identified by BAM site number)

Appendix 7.2: Vegetation Assessment Summary

The Vegetation Assessment Summary is included as Appendix I-2 of the Project EnergyConnect EIS.

Appendix 7.3: Fauna Species List (where applicable)

- For additional fauna information refer EIS Chapter 11.3.6, 11.3.6 and Appendices as follows: EIS Appendix I1: Species Likelihood Assessments
- EIS Appendix I-3: Significant Impact Assessments
- EIS Appendix I-4: Threatened Mallee Birds Assessment
- EIS Appendix I-5: Review of Potential Impacts to Wetland Birds

Appendix 7.3.1: EPBC and NPW Fauna considered for BAM inputs

	Common Name	EPBC Act Status	NPW Act Status	Source	Species known habitat	Austrostipa + chenopod regrowth of cropping land likelihood of use for habitat - comments	Chenopod shrubland (western end) likelihood of use / last record	Chenopod shrubland (eastern end) likelihood of use / last record	Low Open Woodland over chenopod (western end). Likelihood of use / last record	Low Open Woodland over chenopod (eastern end). Likelihood of use / Last record	Older mallee over sclerophyll/ chenopods (central/east) likelihood of use / last record	Mallee over sclerophyll/chenopods (western end) likelihood of use / last	Post-fire mallee over sclerophyll/ chenopods likelihood / last record	Mallee over Triodia likelihood / last record	Hopbush likelihood / last record
Botaurus poiciloptilus	Australasian Bittern	E	V	5	Favours permanent freshwater wetlands with tall, dense vegetation, particularly rushes and reeds	Unlikely. NSH. No records > 1995	Unlikely. NSH. Possible flyover only No records > 1995	Unlikely. NSH. Possible flyover records only. No records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995
Ardeotis australis	Australian Bustard		V	6	Possible. Limited recent records. Scattered, declining distribution. Occurs in open country, dry grasslands, sand plains with spinifex, pasture stubble	Possible habitat, range, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Anhinga novaehollandiae novaehollandiae	Australasian Darter		R	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH record 2004	Unlikely. NSH. Record 2013	record 2004, but Unlikely NSH	Unlikely. NSH, record 2013	Unlikely. NSH, record 2013	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2006	Unlikely. NSH, record 2013
Spatula rhynchotis	Australasian Shoveler		R	1	Well vegetated permanent wetlands	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2010	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2009	Unlikely. NSH, record 2010	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2002	Unlikely. NSH, record 2010
Cladorhynchus leucocephalus	Banded Stilt		V	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH record 2010	Unlikely. NSH. Record 2002	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2002	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2002
Manorina flavigula melanotis	Black-eared Miner	EN	E	1,5	Preferred habitat is old growth mallee (over Spinifex, Saltbush or Bluebush) that has not been burnt for at least 45 years, and not degraded by grazing	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 1996	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2003	Possible, record 2003	Unlikely, beyond known distribution, no records	Possible, foraging habitat, record 2001	Likely, record 2005	Unlikely. NSH. No records > 1995
Falco subniger	Black Falcon		R	6	Possible in transmission line corridor, wide-ranging. Records from Murraylands and Riverland and Northern and Yorke.	Unlikely, no records and sub-optimal habtat	Unlikely, no records and sub-optimal habtat	Unlikely, no records and sub-optimal habtat. No records > 1995	Possible, no records > 1995	Possible, no records > 1995	Unlikely, no records and sub-optimal habtat, no records > 1995	Unlikely, no records and sub-optimal habtat, no records > 1995	Unlikely, no records and sub-optimal habtat, no records > 1995	Possible, no records > 1995	Unlikely, no records and sub-optimal habtat, no records > 1995
Oxyura australis	Blue-billed Duck		R	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2008	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2008	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2008
Entomyzon cyanotis cyanotis	Blue-faced Honeyeater		R	1	Open Forests Woodlands, mainly near water	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2003	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2003	Unlikely. NSH, record 2003	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2001	Unlikely. NSH. Record 2003
Neophema chrysostoma	Blue-winged Parrot		V	1	Nests in coastal and subcoastal eucalypt forest and woodland, forages on grassland, saltmarsh, rough pasture. Post-breeding dispersal into semi-arid inland areas.	Possible habitat, range, no records > 1995	Possible, record 2000	Possible, near known records. No records > 1995	Possible, record 2000	Possible, no records > 1995	Unlikely. NSH, record 2018	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995
Coturnix ypsilophora australis	Brown Quail		V	1	Occurs in tall vegetation or grass, ferns, in damp swampy areas around wetlands	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2013 (only 1)	Unlikely. NSH. No records > 1995	Unlikely. NSH, (1 individual) record in 2013	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Burhinus grallarius	Bush Stonecurlew		R	1	Occurs in pairs or singly, preferred habitat is open grasssland and grassy woodlands, with a cover of leaf litter, fallen branches and tussock grasses (including grasslands pasture of farmland). Within project area there are numerous records concentrated in wetland areas adjacent transmission line corridor within Chowilla Game Reserve, and HA 1544. Most records from Eucalyptus largiflorens Woodland on floodplain.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, if sufficient grass and litter. Record 2017	Unlikely. NSH. No records > 1995	Possible, if sufficient grass and litter, record 2006	Unlikely. NSH, record 2017	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2007	Unlikely. NSH, record 2017
Morelia spilota	Carpet Python		R	1	Within project area mainly recorded from E largiflorens and/or E camaldulensis woodlands on floodplain and occasionally, adjoining habitats	Unlikely. NSH. Record 2007	Unlikely. NSH record 2007	Possible, record 2006	Unlikely, record	Possible, record 2006	Unlikely. NSH, record 2003	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2007	Possible, record 2000

Cinclosoma castanotum	Chestnut Quailthrush (Chestnut-backed Quailthrush)		R	1	Mallee, low shrubs, dry woodland and heath in arid or semi-arid regions, usually on sandy substrates. Forage on the ground, often among spinifex	Unlikely. NSH. Record 2012	Possible, record 2012	Possible, record 2006	Possible, record 2012	Possible, record 2006	Likely, record 2018	Possible, record 2012	Possible, record 2005	Likely, record 2013	Unlikely. NSH, record 2006
Trichosurus vulpecula	Common Brushtail Possum		R	1	Witin the project region, open forest and woodlands, particularly on the River Murray Floodplain. Uses hollows in live and dead eucalypt trees (e.g. E. brachycalyx, E. calmaldulensis, E. gracilis),	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Tringa nebularia	Common Greenshank	M		5	Migratory. Within SA habitats included coastal and inland in estuaries and mudflats, mangrove swamps and lagoons, as well as billabongs, swamps, sewage farms and flooded crops. Potential flyover within transmission line	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995
Neophema elegans elegans	Elegant Parrot		R	1	Open habitats, including grasslands, shrublands, open woodlands, rough pasture	Possible, near known records	Possible, record 2008	Possible, near known records. No records > 1995	Possible record 2004	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995
Petroica phoenicea	Flame Robin		V	6	Possible. 1 Birdlife record 22 km from the TLC. Core range is southeastern SA an eastern NSW most of Victoria. Proposed alignment occurs is irregular range. Habitat is present that would be used by the species, open forest woodland, farmland grasslands, burnt areas.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Aprasia pseudopulchella	Flinders Ranges Worm-Lizard	VU		6	Considered possible in EIS, but only for far western end, nearest recorrd was 10 km from the transission line corridor. occurs in open woodland, native tussock grassland, riparian habitats and rocky isolates. Species prefers stony soils or clay soils with a stony surface and has been found sheltering in soil beneath stones and rotting stumps. Same likelihood habitat / range as Pygmy Blue-tongue very wetstern end only	Posssible, in rocky slopes (minor area)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Stictonetta naevosa	Freckled Duck		V	1	Wetlands	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2013	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2013	Unlikely. NSH, record 2006	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2006
2018	Gilbert's Whistler		R	1	Occurs in a wide range of habitats, dry scrub and woodland and open Callitris woodland Acacia thicket. Generally with a **dense shrub understorey** inc. Acacia, Senna, Hop-bush.	Unlikely. NSH. No records > 1995	Unlikely. NSH record 2010	Unlikely. NSH. Record 2006.	Unlikely. NSH. Record 2010	Unlikely. NSH, record 2018	Possible, 2018	Unlikely. NSH. No records > 1995	Possible, record 2002	Possible, record 2013	Unlikely. NSH, record 2018
Plegadis falcinellus	Glossy Ibis	M	R	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2006.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2006	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Podiceps cristatus australis	Great Crested Grebe		R	1	Wetland habitats.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2008	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2008	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2008
Melanodryas cucullata cucullata	Hooded Robin (YP, MN, AP, MLR, MM, SE)		R	1	Inhabits open mallee (esp. E oleosa, E socialis, E gracilis), Casuarina pauper, Myoporum, Callitris woodlands , often in or near clearings or open areas; (2) Often structurally diverse habitats including patches of young Eucalypts or shrubs for nest-sites and (3) the presence of suitable perches for foraging.	Unlikely. NSH. Record 2012	Unlikely. NSH record 2012	Unlikely. NSH. Record 2003	Possible, record 2012	Unlikely. NSH, record 2006	Possible, record 2013	Possible, record 2012	Unlikely. NSH, record 1995	Unlikely. NSH, record 2013	Unlikely. NSH, record 2005
Varanus varius	Lace Monitor		R	1, 6	In the project region, largely confined to flood plain (within which, prefers woodland with larger eucalypt trees with hollows. Range is primarily east coast of Australia from QLD to Victoria, occurs in a variety of habitats (Cogger 2014). Multiple records in riverine habitats along the River Murray corridor, and within HA 1544), Loch Luna (GR) and Riverlands.	Unlikely. NSH. Record 2012	Unlikely. NSH. No records > 1995	Possible, near floodplain. Record 2012	Unlikely. NSH. No records > 1995	Possible, near floodplain, record 2003	Unlikely. NSH, record 2012	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2012
Hieraaetus morphnoides	Little Eagle		V	1	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2005	Possible, no records > 1995	Possible, record 2005	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Egretta garzetta nigripes	Little Egret		R	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2008	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2008	Unlikely. NSH, record 2011	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2002

Philemon citreogularis citreogularis	Little Friarbird		R	1	In the project area, confined to riverine habitats	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2013	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2013	Unlikely. NSH, record 2011	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2000	Unlikely. NSH, record 2011
Chalinolobus picatus	Little Pied Bat		E	6	Possible in Riverland Biosphere Reserve habitats. Although few records in the ESA, records in SA are primarily from Riverland Biosphere Reserve (northern Calperum Station) in the Chowilla (RR), which is at the southwestern extent of the range. Roosts in trees, caves, abandoned mines and buildings. Roosting trees include Casuarina pauper, Mulga, Bloodwoods and large eucalypts. Prefer hollows in large mature trees with dead limbs, or dead fallen trees with hollowed stump. Can roost in small or large colonies and have been known to travel 35 km round trip to foraging sites (Churchill 2008). Possible in E. gracilis to E. oleosa low (open) woodland (SKM 2002).	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Possible in unburnt sites* , no records > 1995	Unlikely. NSH. No records > 1995
Lophochroa leadbeateri	Major Mitchell's Cockatoo		R	1	Tall Open Mallee (E gracilis, E oleosa, E socialis), Blackoak, Callitris and Myoporum woodlands. They require old trees which support hollows that are large enough to be suitable for nesting in. Also need to be near water	Unlikely. NSH. Record 2008	Unlikely. NSH, record 2008	Unlikely. NSH. Record 2002	Possible, no records > 1995	Possible, record 2001	Possible, 2011	Unlikely. No records, no records > 1995	Unlikely. NSH (mallees too small, no hollows), no records > 1995	Unlikely. NSH (mallees too small, lack of large hollows), record 2002	Possible, record 2011
Leipoa ocellata	Malleefowl	VU	V	1,5	Preferred habitat is semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. Sandy soils and abundance leaf litter are required for breeding	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2018	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2006	Likely, record 2018	Unlikely, no records, no records > 1995	Possible, record 2018	Possible, record 2018	Unlikely, NSH, record 2011
Tringa stagnatilis	Marsh Sandpiper			5	Migratory. Within SA preferred habiat includes coast and inland fresh or saltwater wetlands. Potential flyover within transmission line	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995
Biziura lobata menziesi	Musk Duck		R	1	Water habitats (within the project area, confined to River Murray and adjoining wetlands)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2010	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2003	Unlikely. NSH, record 2010	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2010
Pluvialis fulva	Pacific Golden Plover	M	R	5	Migratory shorebird. Potential flyover records	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Turnix varius varius	Painted Buttonquail		R	1	Dry open forests and woodlands (especially Eucalypts) with dense leaf litter and sparse to moderate understorey of grass, small shrubs and fallen timber.	Unlikely. NSH. Record 2015	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Posssible, record 2012	Unlikely, NSH and no records, no records > 1995	Unlikely (lack of dense litter layer), no records > 1995	Possible, no records 2012	Unlikely. NSH. No records > 1995
Falco peregrinus macropus	Peregrine Falcon		R	1	Inhabits most environments, prefers cliff face for nesting. Suitable prey in wetland habitats south of transmission line corridor.	Unlikely. NSH. No records > 1995	Possible, record 2008	Possible, record 2006	Possible, record 2008	Possible, record 2006	Unlikely, NSH, record 2006	Unlikely. No recent reords, no records > 1995	Unlikely. No recent reords, no records > 1995	Unlikely. NSH, record 2002	Unlikely. NSH, record 2006
Lichenostomus cratitius occidentalis	Purple-gaped Honeyeater (mainland SA)		R	1	Mallee Heath	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Possible, no records > 1995	Possible, no records > 1995	Possible, 2002	Unlikely. NSH. No records > 1995
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	EN	E	5	Preferred habitat is unploughed grassland, commonly Lomandra grassland (with spider holes).	Posssible, in unploughed areas (minor)	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Pachycephala rufogularis	Red-lored Whistler	VU	R	1,5	Mallee and mallee heath, limited by presence of Triodia scariosa, often nesting in Spinifex grasslands. Occur at low densities within large home ranges. Occupies vegetation with a post fire age of 4-40 years, but is most abundant in areas with a post fire age of 21-40 years	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, record 2002	Unlikely. NSH. No records > 1995	Possible, record 2001	Likely, preferred habitat, record 2006	Unlikely. NSH. No records > 1995

Calidris ruficollis	Red-necked Stint	MW		5	Occurs on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They can also occur in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. Potential flyover records in transmission line	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995
Polytelis anthopeplus monarchoides	Regent Parrot	VU	V	1	Breeds in Red Gums along River Murray and feeds in adjacent areas of mallee, Black Box and Black Oak. Post-breeding movements extend about 20 km from River	Unlikely. NSH. No records > 1995	Unlikely. NSH record 2004	Unlikely. NSH. Record 2013	Possible, record 2004	Possible, record 2003	Likely, record 2013	Unlikely, no recent records and sub-optimal habitat, no records > 1995	Unlikely, no recent records and sub-optimal habitat, record 2012	Possible, record, 2013	Unlikely. NSH, record 2012
Myiagra inquieta	Restless Flycatcher		R	1	Widespread in open eucalypt woodland, treed farmland and mallee (e.g. *E. gracilis, E. oleosa, E. socialis, E. brachycalyx*).	Unlikely. NSH (trees absent or sparse. Record 2012	Unlikely. NSH record 2012	Unlikely. NSH. Record 2013	Unlikely. NSH. Record 2012	Unlikely. NSH, record 2013	Possible, record 2018	Possible, 2012	Possible, record 2004	Unlikely. NSH, record 2018	Unlikely. NSH, record 2006
Myiagra cyanoleuca	Satin Flycatcher	M	E	5	Migratory. Very occasional visitor to SA with few records	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, no records > 2003	Unlikely. NSH. No records > 1995
Neophema splendida	Scarlet-chested Parrot		R	1	Arid mallee, usually with a diverse, low shrub understorey, often in recently burnt areas	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2001	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, record 2011	Unlikely. NSH. No records > 1995	Possible, record 2002	Possible, record 2012	Unlikely. NSH, record 2011
Petroica boodang boodang	Scarlet Robin (SE, MLR, FR, EP)		R	6	Possible very western end of TLC. Records in SA are concentrated in the MLR / Fleurieu region, KI and scattered across the SE. Records in the ESA are concentrated west of the transmission line corridor in the Tothill Ranges within HA 1082, 1093, 1448 and 655. Occurs in open sclerophyll forest and woodland. TLC is iwithin irregular occurence range.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible at very western end of alignment, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Calidris acuminata	Sharp-tailed Sandpiper	M		5	Migratory wader / shorebird	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Possible flyover records only	Unlikely. NSH. No records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Possible flyover records only, no records > 1995
Hylacola cauta cauta	Shy Heathwren (EP, YP, FR, MM, upper SE)		R	1	Mallee with dense understory	Unlikely. NSH. No records > 1995	Unlikely. NSH record 2010	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2008	Unlikely. NSH, record 2006	Possible, record 2013	Unlikely. No recent reords, no records > 1995	Likely, record 2002	Likely, record 2006	Unlikely, NSH, record 2002
Acanthiza iredalei iredalei	Slender-billed Thornbill		R	1	Chenopod and Samphire habitat	Unlikely. NSH. No records > 1995	Possible. Last record was in Maireana sedifolia, 2010	Unlikely. Out of known range. No records > 1995	No records, but possible. Suitable habitat. No records > 1995	Unlikely. Out of known range, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Lophoictinia isura	Square-tailed Kite		E	6	Possible. Limited records, but is wide ranging and suitable habitat would occur. Alignment is in irregular occurrence range, not core range. Summer spring visitor to SA, glides over mallee, open forest, woodland, heath, preys on birds, nestlings	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, no records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Possible, no records > 1995
Litoria raniformis	Southern Bell Frog	VU	V	5	Wetland Habitats. the frogs are concentrated in refugia prior to flooding, then disperse across the landscape during flooding / breeding events. Species is highly mobile and can move at least one km in 24 hrs. Possible in habitats north of wetland area?	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, disperal during non-breeding. Localised habitat. Record 2010	Unlikely. NSH. No records > 1995	Possible, disperal during non-breeding. Localised habitat. Record 2003	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, disperal during non-breeding. Localised habitat. Record 2010
Nyctophilus corbeni	South-eastern Long-eared Bat	VU	V	6	Considered poss in EIS, may be present in dense mallee habitats.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, records to north in mallee, no records in site > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, records to north in mallee, no records > 1995	Unlikely. NSH. No records > 1995
Amytornis striatus striatus	Striated Grasswren		R	1	Prefers mature spinifex (Triodia irritans), usually in association with mallee eucalypts and sandy soils but known to re-occupy burnt vegetation 6 to 8 years following fire. Within application area, most recent records are from Cooltong-Calperum region where Triodia is extensive.Formerly widespread in the centre part of the transmission line	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH, record 2002	Unlikely. NSH. No records > 1995	Unlikely. NSH. Record 2002	Possible. NSH, record 2018	Unlikely. NSH. No records > 1995	Possible, record 2004	Likely. Preferred habitat, record 2012	Unlikely. NSH, record 2018

Plectorhyncha lanceolata	Striped Honeyeater		R	1	Tall Open woodland, including Red Gum and Black Box woodlands along River and in adjoining mallee, plus Black Oak, Myoprum, Native Pine	Unlikely. NSH. Record 1999	Unlikely. NSH record 2004	Unlikely. NSH, record 2013	Possible, no records > 1995	Likely, record 2013	Likely, record 2018	Possible, no records > 1995	Possible, record 2002	Unlikely. NSH, record 2003	Unlikely. NSH, record 2002
Climacteris affinis superciliosa	White-browed Treecreeper		R	6	Possible in transmission line corridor. Records in northern part of ESA and beyond, primarily in Moorook area. Prefers semi-arid woodlands, tall shrublands, Mulga, Native Pine and Sheoak, uncommon in eucalypt woodlands. Known to occur in the Blackoak Woodlands of Chowilla Station near the NSW border not recorded in SNI surveys (SKM 2002 or mallee bird report (Nature Advisory 2021).	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Haliaeetus leucogaster	White-bellied Sea Eagle		E	1	Records in ESA are primarily from riverine environments, or flying over adjacent habitats within the Chowilla (GR) and Murray River (NP). Considered as possible to occur foraging in riverine environments and habitats adjacent the transmission line corridor.	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Possible, record 2005	Unlikely. NSH. No records > 1995	Possible, record 2005	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995
Corcorax melanorhamphos	White-winged Chough		R	1	Occurs in open forest, woodland, and taller mallee where understorey is sparse and leaf litter is productive	Unlikely. NSH. Record 2015	Unlikely. NSH record 2012	Unlikely. NSH, record 2006	Unlikely. NSH. Record 2012	Unlikely. NSH, record 2006	Likely, record 2011	Likely, record 2012	Possible, record 2002	Unlikely, NSH, record 2005	Unlikely,NSH, record 2011
Tringa glareola	Wood Sandpiper	M	R	5	Migratory. Inland freshwater wetlands with emergent sedges and taller fringing vegetation. Potential flyover within transmission line	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. No records > 1995. Potential flyover only	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. No records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995	Unlikely. NSH. Potential flyover only, no records > 1995

Source; 1- BDBSA, 2 - AoLA, 3 – NatueMaps 4 – Observed/recorded in the field, 5 - Protected matters search tool, 6 – others EIS, Menkhorst et al 2017

NP&W Act; E= Endangered, V = Vulnerable, R= Rare

EPBC Act; Ex = Extinct, CR = Critically endangered, EN = Endangered; VU = Vulnerable

NSH = No Suitable Habitat

Appendix 7.3.2: PMST species considered for BAM inputs from PMST outputs of 4 broad habitat segments

Species suggested as 'known' in PMST outputs for 4 segments across the alignment		**Segment 1**	**Segment 2**	**Segment 3**	**Segment 4**
Myiagra cyanoleuca	Satin Flycatcher	x	x		
Botaurus poiciloptilus	Australasian Bittern		x		
Leiopoa ocellata	Malleefowl		x	x	x
Manorina melanotis	Black-eared Miner		x	x	x
Calidris acuminata	Sharp-tailed Sandpiper		x	x	x
Calidris ruficollis	Red-necked Stint				x
Pluvialis fulva	Pacific Golden Plover				x
Tringa glareola	Wood Sandpiper				x
Tringa nebularia	Common Greenshank				x
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank				x
Litoria raniformis	Southern Bell Frog				x
BAM sites		1a, 1b, 2a, 2b, 3a, 3b, 4b, 5a, 6a, 1c, 2c, 3c, 4c, 5b, 7a, 8a, 101a, 101c, 101d, 102b	9a, 6b, 7b, 5c, 8b, 6c, 10a, 9b, 7c, 11a, 13a, 10b, 12a, 11b, 12b, 13b, 14b, 10c, 102c, 107, 104, 105	8c, 9c, 15b, 14a, 16b, 17am 29c, 17b, 18b, 19b, 20b, 23c, 24c, 25c, 26c, 27c, 28c, 21b, 22b, 20c, 21c, 22c, 17c, 18c, 19c, 16c, 23b, 108, 115, 116	25b, 15c, 14c, 26b, 13c, 27b, 12c, 11c, 20a, 29b, 111,112,114
Broad Habitat		Old growth mallee on calcareous loams, cropped areas (western end)	Chenopod Shrubland, BlackOak, Myoporum (western / centre)	Mallee (centre / eastern)	Black Bluebush, BlackOak, Dodonaea shrublands, Open mallee (eastern end)
Not included = Murray Hardyhead 'known' (Segment 4)					
Not included = Murray Cod 'known' (Segment 2, 4)					
Not included = Listed Marine Species Known					
Not included = Southern Bell Frog, *Litoria raniformis* 'known' (Segment 2,3)					

Appendix 7.3.3: BAM sheet fauna inputs (possible and likely species)

BAM sheets mapped	1b, 1c, 2b, 3c, 4c,101a, 101c, 101d, 102b	6a, 6c, 7c, 11b, 12b,13a, 13b,14b,102c,107	13c,14c,20a,25b,26b,112	5c,6b,8b,9a,11a,104,105	29b,111,114	8c,10c,12c,15b,18c,19b,19c,23b,23c,24b,27b,108,116,117	1a,3b,4b,5a,5b,7a,8a	21c	9c,16b,16c,17b,17c,18b,20c,22b,22c,24c,29c,109a,115	15c,28b
BAM sheets not mapped	2c, 3a, 4a	7b,10b,12a	9b,10a			14a, 15a,18a,19a,26c	2a		16a,17a,20b,21b,25c,27c,28c	11c

Vegetation Habitat Groups	Austrostipa + chenopod crop regrowth		Chenopod shrubland (western end)		Chenopod shrubland (eastern end)		Low Open Woodland over chenopod (western end)		Low Open Woodland over chenopod (eastern end)		Mallee over sclerophyll/chenopods - central/ east		Mallee over sclerophyll/chenopods -western end		Post-fire mallee over sclerophyll/ chenopods		Mallee over Triodia		Hopbush shrubland	
	Neophema chrysostoma	Blue-winged Parrot	*Cinclosoma castanotum*	Chestnut Quailthrush (Chestnut-backed Quailthrush)	*Cinclosoma castanotum*	Chestnut Quailthrush	*Acanthiza iredalei iredalei*	Slender-billed Thornbill	*Plectorhyncha lanceolata*	Striped Honeyeater	*Chalinolobus picatus*	Little Pied Bat	*Cinclosoma castanotum*	Chestnut Quailthrush	*Amytornis striatus striatus*	Striated Grasswren	*Amytornis striatus striatus*	Striated Grasswren	*Morelia spilota*	Carpet Python
	Neophema elegans elegans	Elegant Parrot	*Falco peregrinus*	Peregrine Falcon	*Falco peregrinus*	Peregrine Falcon	*Cinclosoma castanotum*	Chestnut Quailthrush (Chestnut-backed Quailthrush)	*Cinclosoma castanotum*	Chestnut Quailthrush	*Cinclosoma castanotum*	Chestnut Quailthrush	*Corcorax melanorhamphos*	White-winged Chough	*Cinclosoma castanotum*	Chestnut Quailthrush	*Chalinolobus picatus*	Little Pied Bat	*Neophema chrysostoma*	Blue-winged Parrot
	Tiliqua adelaidensis	Pygmy Bluetongue	*Neophema chrysostoma*	Blue-winged Parrot	*Haliaeetus leucogaster*	White-bellied Sea Eagle	*Falco peregrinus*	Peregrine Falcon	*Falco peregrinus*	Peregrine Falcon	*Corcorax melanorhamphos*	White-winged Chough	*Lichenostomus cratitius occidentalis*	Purple-gaped Honeyeater (mainland SA)	*Corcorax melanorhamphos*	White-winged Chough	*Cinclosoma castanotum*	Chestnut Quailthrush (Chestnut-backed Quailthrush)	*Neophema elegans elegans*	Elegant Parrot
	Ardeotis australis	Australian Bustard	*Neophema elegans elegans*	Elegant Parrot	*Morelia spilota*	Carpet Python	*Morelia spilota*	Carpet Python	*Morelia spilota*	Carpet Python	*Hieraaetus morphnoides*	Little Eagle	*Lophoictinia isura*	Square-tailed Kite	*Hieraaetus morphnoides*	Little Eagle	*Falco subniger*	Black Falcon	*Lophochroa leadbeateri*	Major Mitchell
	Aprasia pseudopulchella	Flinders Ranges Worm-Lizard	*Acanthiza iredalei iredalei*	Slender-billed Thornbill	*Burhinus grallarius*	Bush Stonecurlew	*Hieraaetus morphnoides*	Little Eagle	*Hieraaetus morphnoides*	Little Eagle	*Hylacola cauta cauta*	Shy Heathwren (EP, YP, FR, MM, upper	*Melanodryas cucullata cucullata*	Hooded Robin (YP, MN, AP, MLR, MM, SE)	*Hylacola cauta cauta*	Shy Heathwren (EP, YP, FR, MM, upper SE)	*Hylacola cauta cauta*	Shy Heathwren (EP, YP, FR, MM, upper SE)	*Falco peregrinus*	Peregrine Falcon
					Varanus varius	Lace Monitor	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	*Leipoa ocellata*	Malleefowl	*Myiagra inquieta*	Restless Flycatcher	*Leipoa ocellata*	Malleefowl	*Leipoa ocellata*	Malleefowl	*Lophoictinia isura*	Square-tailed Kite
					Neophema chrysostoma	Blue-winged Parrot	*Melanodryas cucullata cucullata*	Hooded Robin (YP, MN, AP, MLR, MM, SE)	*Polytelis anthopeplus monarchoides*	Regent Parrot	*Lichenostomus cratitius occidentalis*	Purple-gaped Honeyeater (mainland SA)	*Plectorhyncha lanceolata*	Striped Honeyeater	*Lichenostomus cratitius occidentalis*	Purple-gaped Honeyeater (mainland SA)	*Lichenostomus cratitius occidentalis*	Purple-gaped Honeyeater (mainland SA)	*Falco subniger*	Black Falcon
					Neophema elegans elegans	Elegant Parrot	*Plectorhyncha lanceolata*	Striped Honeyeater	*Trichosurus vulpecula*	Common Brushtail Possum	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	*Petroica boodang boodang*	Scarlet Robin (SE, MLR, FR, EP)	*Manorina flavigula melanotis*	Black-eared Miner	*Lophoictinia isura*	Square-tailed Kite	*Litoria raniformis*	Southern Bell Frog
					Litoria raniformis	Southern Bell Frog	*Neophema chrysostoma*	Blue-winged Parrot	*Haliaeetus leucogaster*	White-bellied Sea Eagle	*Manorina flavigula melanotis*	Black-eared Miner			*Myiagra inquieta*	Restless Flycatcher	*Manorina flavigula melanotis*	Black-eared Miner		
							Neophema elegans elegans	Elegant Parrot	*Neophema chrysostoma*	Blue-winged Parrot	*Melanodryas cucullata cucullata*	Hooded Robin (YP, MN, AP, MLR, MM, SE)			*Neophema splendida*	Scarlet-chested Parrot	*Neophema splendida*	Scarlet-chested Parrot		
							Polytelis anthopeplus monarchoides	Regent Parrot	*Neophema elegans elegans*	Elegant Parrot	*Myiagra inquieta*	Restless Flycatcher			*Pachycephala inornata*	Gilbert's Whistler	*Nyctophilus corbeni*	South-eastern Long-eared Bat		
							Falco subniger	Black Falcon	Burhinus grallarius	Bush Stonecurlew	*Neophema splendida*	Scarlet-chested Parrot			*Pachycephala rufogularis*	Red-lored Whistler	*Pachycephala inornata*	Gilbert's Whistler		
							Petroica phoenicea	Flame Robin	Varanus varius	Lace Monitor	*Nyctophilus corbeni*	South-eastern Long-eared Bat			*Petroica phoenicea*	Flame Robin?	*Pachycephala rufogularis*	Red-lored Whistler		
									Falco subniger	Black Falcon	*Pachycephala inornata*	Gilbert's Whistler			*Plectorhyncha lanceolata*	Striped Honeyeater	*Polytelis anthopeplus monarchoides*	Regent Parrot		
									Litoria raniformis	Southern Bell Frog	*Pachycephala rufogularis*	Red-lored Whistler			*Polytelis anthopeplus monarchoides*	Regent Parrot	*Turnix varius varius*	Painted Buttonquail		
									Climacteris affinis superciliosa	White-browed Treecreeper	*Plectorhyncha lanceolata*	Striped Honeyeater								
											Polytelis anthopeplus monarchoides	Regent Parrot								
											Trichosurus vulpecula	Common Brushtail Possum								
											Turnix varius varius	Painted Buttonquail								

Appendix 7.3.4 BAM sheet fauna exclusions

Species Name	Common Name	Austrostipa + chenopod regrowth of cropping land	Chenopod shrubland (western end)	Chenopod shrubland (eastern end)	Low Open Woodland over chenopod (western end)	Low Open Woodland over chenopod (eastern end)	Older mallee over sclerophyll/chenopods - central/ east	Mallee over sclerophyll/chenopods (western end)	Post-fire mallee over sclerophyll/ chenopods	Mallee over Triodia	Hopbush shrubland
Botaurus poiciloptilus	Australasian Bittern	x	x	x	x	x	x	x	x	x	x
Ardeotis australis	Australian Bustard		x	x	x	x	x	x	x	x	x
Anhinga novaehollandiae novaehollandiae	Australasian Darter	x	x	x	x	x	x	x	x	x	x
Spatula rhynchotis	Australasian Shoveler	x	x	x	x	x	x	x	x	x	x
Cladorhynchus leucocephalus	Banded Stilt	x	x	x	x	x	x	x	x	x	x
Manorina flavigula melanotis	Black-eared Miner	x	x	x	x	x		x			x
Falco subniger	Black Falcon	x	x	x			x	x	x		x
Oxyura australis	Blue-billed Duck	x	x	x	x	x	x	x	x	x	x
Entomyzon cyanotis cyanotis	Blue-faced Honeyeater	x	x	x	x	x	x	x	x	x	x
Neophema chrysostoma	Blue-winged Parrot						x	x	x	x	
Coturnix ypsilophora australis	Brown Quail	x	x	x	x	x	x	x	x	x	x
Burhinus grallarius	Bush Stonecurlew	x	x		x		x	x	x	x	x
Morelia spilota	Carpet Python	x	x		x		x	x	x	x	
Cinclosoma castanotum	Chestnut Quailthrush	x									x
Trichosurus vulpecula	Common Brushtail Possum	x	x	x	x			x	x	x	x
Tringa nebularia	Common Greenshank	x	x	x	x	x	x	x	x	x	x
Neophema elegans elegans	Elegant Parrot						x	x	x	x	
Petroica phoenicea	Flame Robin	x	x	x		x	x	x		x	x
Aprasia pseudopulchella	Flinders Ranges Worm-Lizard		x	x	x	x	x	x	x	x	x
Stictonetta naevosa	Freckled Duck	x	x	x	x	x	x	x	x	x	x
Pachycephala inornata	Gilbert's Whistler	x	x	x	x	x		x			x
Plegadis falcinellus	Glossy Ibis	x	x	x	x	x	x	x	x	x	x
Podiceps cristatus australis	Great Crested Grebe	x	x	x	x	x	x	x	x	x	x
Melanodryas cucullata cucullata	Hooded Robin (MM)	x	x	x		x			x	x	x
Varanus varius	Lace Monitor	x	x		x		x	x	x	x	x
Hieraaetus morphnoides	Little Eagle	x	x	x				x		x	x
Egretta garzetta nigripes	Little Egret	x	x	x	x	x	x	x	x	x	x
Philemon citreogularis citreogularis	Little Friarbird	x	x	x	x	x	x	x	x	x	x
Chalinolobus picatus	Little Pied Bat	x	x	x	x			x			x
Lophochroa leadbeateri	Major Mitchell's Cockatoo	x	x	x				x	x	x	
Leipoa ocellata	Malleefowl	x	x	x	x	x		x			x
Tringa stagnatilis	Marsh Sandpiper	x	x	x	x	x	x	x	x	x	x
Biziura lobata menziesi	Musk Duck	x	x	x	x	x	x	x		x	x
Pluvialis fulva	Pacific Golden Plover	x	x	x	x	x	x	x	x	x	x
Turnix varius varius	Painted Buttonquail	x	x	x	x	x		x	x		x
Falco peregrinus macropus	Peregrine Falcon	x					x	x	x	x	x
Lichenostomus cratitius occidentalis	Purple-gaped Honeyeater,mainland	x	x	x	x	x					x
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard		x	x	x	x	x	x	x	x	x
Pachycephala rufogularis	Red-lored Whistler	x	x	x	x	x		x			x
Calidris ruficollis	Red-necked Stint	x	x	x	x	x	x	x	x	x	x
Polytelis anthopeplus monarchoides	Regent Parrot	x	x	x				x	x		x
Myiagra inquieta	Restless Flycatcher	x	x	x	x	x				x	x
Myiagra cyanoleuca	Satin Flycatcher	x	x	x	x	x	x	x	x	x	x
Neophema splendida	Scarlet-chested Parrot	x	x	x	x	x		x			x
Petroica boodang boodang	Scarlet Robin (SE, MLR, FR, EP)	x	x	x	x	x	x		x	x	x
Calidris acuminata	Sharp-tailed Sandpiper	x	x	x	x	x	x	x	x	x	x
Hylacola cauta cauta	Shy Heathwren (FR, MM)	x	x	x	x	x		x			x

Acanthiza iredalei iredalei	Slender-billed Thornbill	x			x		x	x	x	x	x	x
Lophoictinia isura	Square-tailed Kite	x	x	x	x	x	x			x		
Litoria raniformis	Southern Bell Frog	x	x		x		x		x	x	x	
Nyctophilus corbeni	South-eastern Long-eared Bat	x	x	x	x	x			x	x		x
Amytornis striatus striatus	Striated Grasswren	x	x	x	x	x	x		x			x
Plectorhyncha lanceolata	Striped Honeyeater	x	x	x							x	x
Climacteris affinis superciliosa	White-browed Treecreeper	x	x		x	x	x		x	x	x	x
Haliaeetus leucogaster	White-bellied Sea Eagle	x	x		x		x		x	x	x	x
Corcorax melanorhamphos	White-winged Chough	x	x	x	x	x					x	x
Tringa glareola	Wood Sandpiper	x	x	x	x	x	x		x	x	x	x

Appendix 7.4. Score Sheets

Bushland Assessment Scoresheets associated with the proposed clearance and SEB Area (to be submitted in Excel format) as part of formal submission to NVC

BAM Site locations / Photopoint Locations

BAM Site	Easting	Northing
1a	326912	6241289
2a	326346	6243131
3a	327444	6243894
4a	328332	6244173
5a	331393	6244270
6a	331405	6244311
7a	338077	6244405
8a	342323	6244493
9a	346146	6244541
10a	362948	6243674
11a	368680	6242036
12a	372504	6245494
13a	373231	6240712
14a	404140	6236150
15a	404256	6237216
16a	404821	6239765
17a	417173	6231199
18a	474243	6242614
19a	469729	6249710
20a	488983	6250431
1c	335546	6244992
2c	335638	6244883
3c	335914	6244541
4c	335480	6244469
5c	358422	6244788
6c	361627	6244063
7c	366026	6242758
8c	393756	6238108
9c	398599	6236782
10c	396259	6237409
11c	488350	6248485
12c	487807	6247222
13c	481632	6240897
14c	473515	6236303

15c	471539	6234044
16c	467806	6229090
17c	468375	6225832
18c	468304	6225993
19c	468361	6225520
20c	465196	6223380
21c	466543	6223395
22c	468377	6223447
23c	446654	6229898
24c	446916	6229978
25c	447230	6229902
26c	448474	6229841
27c	448617	6229771
28c	448383	6229876
29c	421552	6231323
1b	326523	6242708
2b	326460	6243549
3b	329771	6244488
4b	333182	6244427
5b	338305	6244423
6b	352355	6244757
7b	355898	6244955
8b	358615	6245421
9b	366296	6244560
10b	371154	6243102
11b	377868	6240339
12b	378885	6240770
13b	383097	6239751
14b	388568	6238936
15b	399893	6236417
16b	410363	6231087
17b	426320	6231528
18b	426353	6231480
19b	441608	6231793
20b	445729	6231861
22b	458734	6228331
21b	457366	6228304
23b	466426	6229766
24b	468806	6231037
25b	470792	6232321

26b	477457	6239001
27b	485341	6242661
29b	499305	6250798
28b	492299	6249947
101a	327812	6244016
101c	328710	6244316
102b	331559	6244345
101d	345324	6244565
102c	347590	6244617
104	367285	6242379
105	3711445	6241155
107	379005	6240092
108	405343	6234430
109a	442440	6228408
117	443199	6227379
116	447230	6222783
115	451391	6221568
111	474564	6237682
112	477773	6239172
114	494322	6251009

Appendix 7.5. Flora Species List

Table 1. Native species recorded at BAM sites for EnergyConnect Project (94 BAM sites in total, 72 of these are within the January 2021 alignment). Species lists per site are within each BAM scoresheet.

Common Name	*Species Name*	Number of Records
Annual Groundsel	*Senecio glossanthus*	1
Australian Boxthorn	*Lycium australe*	10
Baldoo	*Atriplex lindleyi ssp.*	2
Ball Bindyi	*Dissocarpus paradoxus*	12
Beaked Red Mallee	*Eucalyptus socialis ssp.*	6
Bindyi	*Sclerolaena sp.*	1
Bitter Saltbush	*Atriplex stipitata*	30
Black Bluebush	*Maireana pyramidata*	32
Black Oak	*Casuarina pauper*	15
Black-anther Flax Lily	*Dianella revoluta var.*	3
Black-anther Flax-lily	*Dianella revoluta var. revoluta*	1
Bladder Saltbush	*Atriplex vesicaria*	12
Bluebush	*Maireana sedifolia*	35
Bluebush Daisy	*Cratystylis conocephala*	1
Blue-leaf Mallee	*Eucalyptus cyanophylla*	1
Bonefruit	*Osteocarpum acropterum var.*	1
Bottle-washers/Nineawn	*Enneapogon sp.*	2
Box Mistletoe	*Amyema miquelii*	3
Broad-leaf Desert Senna	*Senna artemisioides ssp. X coriacea*	15
Broom Emubush	*Eremophila scoparia*	12
Broombush Templetonia	*Templetonia egena*	12
Brown-head Samphire	*Tecticornia indica ssp.*	1
Buckbush	*Salsola australis*	8
Bulbine-lily	*Bulbine bulbosa*	3
Bullock Bush	*Alectryon oleifolius ssp. canescens*	23
Burr-daisy	*Calotis sp.*	1
Bush Bean	*Rhyncharrhena linearis*	1
Casuarina Mistletoe	*Amyema linophylla ssp. orientalis*	2
Climbing Saltbush	*Einadia nutans ssp.*	4
Climbing Twinleaf	*Roepera eremaea*	2
Comb Grevillea	*Grevillea huegelii*	17
Common Eutaxia	*Eutaxia microphylla*	1
Cotton-bush	*Maireana aphylla*	4
Cottony Goosefoot	*Chenopodium curvispicatum*	9
Cypress Daisy-bush	*Olearia teretifolia*	1
Dark Turpentine Bush	*Beyeria opaca*	18
Desert Bog-rush	*Schoenus subaphyllus*	2
Desert Goosefoot	*Chenopodium desertorum ssp.*	2
Desert Hop-bush	*Dodonaea stenozyga*	1
Desert Poplar	*Codonocarpus cotinifolius*	8
Desert Senna	*Senna artemisioides ssp. artemisioides x ssp. coriacea*	1
Desert Senna	*Senna artemisioides ssp.*	7

Dodder-laurel	*Cassytha sp.*	2
Dryland Tea-tree	*Melaleuca lanceolata*	2
Dune Grevillea	*Grevillea pterosperma*	1
Dune Tea-tree	*Leptospermum coriaceum*	2
Dwarf Nealie	*Acacia wilhelmiana*	9
Dwarf Twinleaf	*Roepera ovata*	5
Emubush/Turkey-bush	*Eremophila sp.*	1
Erect Mallee Bluebush	*Maireana pentatropis*	39
Eucalyptus sp.		3
False Sandalwood	*Myoporum platycarpum ssp.*	32
Feather Daisy-bush	*Olearia passerinoides ssp.*	2
Feather Spear-grass	*Austrostipa elegantissima*	1
Fine-leaf Desert Senna	*Senna artemisioides ssp. filifolia*	18
Fleshy Saltbush	*Rhagodia crassifolia*	1
Fuzzy New Holland Daisy	*Vittadinia cuneata var.*	1
Gilja	*Eucalyptus brachycalyx*	5
Grass Family	*Gramineae sp.*	1
Grassy Bindweed	*Convolvulus remotus*	2
Green Bindyi	*Sclerolaena decurrens*	1
Grey Bindyi	*Sclerolaena diacantha*	19
Grey Germander	*Teucrium racemosum*	1
Hairy Angianthus	*Angianthus tomentosus*	1
Hairy Burr-daisy	*Calotis hispidula*	1
Hairy-fruit Bluebush	*Maireana trichoptera*	6
Hall's Wattle	*Acacia halliana*	1
Harlequin Mistletoe	*Lysiana exocarpi ssp. exocarpi*	10
Inland Pigface	*Carpobrotus modestus*	1
Intricate Saltbush	*Rhagodia ulicina*	23
Kerosene Grass	*Aristida contorta*	1
Leafless Cherry	*Exocarpos aphyllus*	12
Little Plantain	*Plantago sp. B*	1
Mallee Box	*Eucalyptus porosa*	5
Mallee Fringe-lily	*Thysanotus baueri*	1
Mealy Saltbush	*Rhagodia parabolica*	3
Mueller's Daisy-bush	*Olearia muelleri*	10
Narrow-leaf Bindweed	*Convolvulus angustissimus*	3
Narrow-leaf Hop-bush	*Dodonaea viscosa ssp. angustissima*	20
Narrow-leaf Red Mallee	*Eucalyptus leptophylla*	11
Native Apricot	*Pittosporum angustifolium*	3
Native Camomile	*Gnephosis sp.*	1
Native Carrot	*Daucus glochidiatus*	1
Native Daisy	*Brachyscome sp.*	1
Nealie	*Acacia rigens*	4
New Holland Daisy	*Vittadinia sp.*	2
New Zealand Spinach	*Tetragonia tetragonoides*	1
Nitre-bush	*Nitraria billardierei*	4

Oblique-spined Bindyi	*Sclerolaena obliquicuspis*	20
One-flower Apple-berry	*Billardiera uniflora*	1
Pale-fruit Bluebush	*Maireana appressa*	1
Panic/Millet	*Panicum sp.*	1
Peep Hill Hopbush	*Dodonaea subglandulifera*	1
Pimelea Daisy-bush	*Olearia pimeleoides*	9
Pleated Copper-wire Daisy	*Podolepis rugata var.*	1
Pointed Twinleaf	*Roepera apiculata*	19
Potato Weed	*Heliotropium europaeum*	1
Purple Emubush	*Eremophila weldii*	1
Pussytails	*Ptilotus spathulatus*	1
Quandong	*Santalum acuminatum*	1
Radiate Bluebush	*Maireana radiata*	8
Red Mallee	*Eucalyptus oleosa ssp.*	36
Ridge-fruited Mallee	*Eucalyptus incrassata*	8
River Box	*Eucalyptus largiflorens*	1
Rosy Bluebush	*Maireana erioclada*	3
Rough Blue-flower	*Halgania cyanea*	1
Ruby Saltbush	*Enchylaena tomentosa var. tomentosa*	42
Rusty Spear-grass	*Austrostipa eremophila*	2
Salt Sand-spurrey	*Spergularia marina*	1
Saltbush	*Atriplex sp.*	2
Satiny Bluebush	*Maireana georgei*	14
Saw-sedge	*Gahnia sp.*	1
Scarlet Mintbush	*Prostanthera aspalathoides*	2
Scented Mat-rush	*Lomandra effusa*	5
Scrub Cypress Pine	*Callitris verrucosa*	5
Senna	*Senna artemisioides ssp. petiolaris*	21
Sheep Bush	*Geijera linearifolia*	3
Short-leaf Bluebush	*Maireana brevifolia*	21
Short-wing Bindyi	*Sclerolaena brachyptera*	1
Shrubby Riceflower	*Pimelea microcephala ssp.*	4
Shrubby Twinleaf	*Roepera aurantiaca ssp. aurantiaca*	18
Shrubby Twinleaf	*Roepera aurantiacum ssp. /eremaeum*	5
Sida	*Sida sp.*	3
Silky Cryptandra	*Cryptandra propinqua*	1
Silver Senna	*Senna artemisioides ssp. X artemisioides*	1
Slender Dodder-laurel	*Cassytha glabella f. dispar*	1
Small Hop-bush	*Dodonaea bursariifolia*	4
Small-flower Bindyi	*Sclerolaena parviflora*	3
Small-flower Goodenia	*Goodenia pusilliflora*	2
Small-flower Tobacco	*Nicotiana goodspeedii*	1
Small-flower Wallaby-grass	*Rytidosperma setaceum*	2
Southern Cypress Pine	*Callitris gracilis*	2
Spear-fruit Bindyi	*Sclerolaena patenticuspis*	20
Spear-grass	*Austrostipa sp.*	30

Spine Bush	*Acacia nyssophylla*	25
Spinifex	*Triodia sp.*	23
Spiny Fanflower	*Scaevola spinescens*	4
Spiny Saltbush	*Rhagodia spinescens*	17
Spiny Wattle	*Acacia spinescens*	2
Spreading Saltbush	*Atriplex limbata*	1
Spurge	*Euphorbia drummondii group*	1
Spurge	*Euphorbia sp.*	1
Star-flower	*Grammosolen dixonii*	5
Sticky Sword-sedge	*Lepidosperma viscidum*	2
Stiff Westringia	*Westringia rigida*	6
Sword-sedge/Rapier-sedge	*Lepidosperma sp.*	1
Tar Bush	*Eremophila glabra ssp.*	10
Thick-leaf Emubush	*Eremophila crassifolia*	8
Thorny Lawrencia	*Lawrencia squamata*	5
Thread-petal	*Stenopetalum sp.*	2
Three-spine Bindyi	*Sclerolaena tricuspis*	2
Three-wing Bluebush	*Maireana triptera*	1
Tobacco	*Nicotiana sp.*	1
Top-fruit Bluebush	*Maireana turbinata*	6
Turkey-Bush	*Eremophila deserti*	2
Turpentine Bush	*Eremophila sturtii*	4
Twiggy Guinea-flower	*Hibbertia virgata*	1
Twinleaf	*Roepera sp.*	1
Two-horn Saltbush	*Dissocarpus biflorus var.*	1
Umbrella Bush	*Acacia ligulata*	8
Umbrella Wattle	*Acacia oswaldii*	7
Variable Daisy	*Brachyscome ciliaris var.*	2
Veined Wait-a-while	*Acacia colletioides*	3
Wallaby-grass	*Rytidosperma sp.*	5
Wallowa	*Acacia calamifolia*	3
Wattle	*Acacia sp.*	1
Western Bindyi	*Sclerolaena parallelicuspis*	2
White Everlasting	*Rhodanthe floribunda*	1
White Mallee	*Eucalyptus dumosa*	20
Wilga	*Geijera parviflora*	2
Wire-leaf Mistletoe	*Amyema preissii*	1
Wiry Podolepis	*Podolepis capillaris*	8
Woolly Mat-rush	*Lomandra leucocephala ssp. robusta*	12
Woolly New Holland Daisy	*Vittadinia gracilis*	1
Woolly-fruit Bluebush	*Eriochiton sclerolaenoides*	12
Yellow-tails	*Ptilotus nobilis*	1
Yorrell	*Eucalyptus gracilis*	18

Table 2. Exotic Species recorded at BAM sites for EnergyConnect Project (94 BAM sites in total, 72 of these are within the January 2021 alignment). Species lists per site are within each BAM scoresheet

Common Name	Species	Number of Records	BAM Sites
African Boxthorn	*Lycium ferocissimum*	3	101a, 1b, 2a
Barley	*Hordeum vulgare*	4	3a, 4a
Barley-grass	*Hordeum sp.*	1	101a, 1b, 2a
Brome Grass	*Bromus sp.*	1	1c
Cut-leaf Heron's-bill	*Erodium cicutarium*	1	1b
Heron's-bill	*Erodium spp.*	4	20b, 25b, 26b, 28b
Horehound	*Marrubium vulgare*	2	2a, 4a
Iceplant	*Mesembryanthemum crystallinum*	1	5c
Maltese thistle	*Centaurea melitensis*	1	117
Match-head Plant	*Psilocaulon granulicaule*	2	111, 27b
Medic	*Medicago sp.*	13	11c, 12b, 13c, 14b, 1c, 25b, 26b, 28b, 2c, 3b, 3c, 6c, 7c
Onion Weed	*Asphodelus fistulosus*	6	101c, 15b, 1b, 4a, 6a, 8c
Potato Weed	*Heliotropium europaeum*[1]	2	117, 7c
Saffron Thistle	*Carthamus lanatus*	4	101a, 1b, 1c, 3c
Sea Barley-grass	*Hordeum marinum*	1	101c
Sea-lavender	*Limonium sp.*	4	112, 114, 25b, 26b
Small Burr-medic	*Medicago minima*	1	114
Smooth Cat's Ear	*Hypochaeris glabra*	1	1b
Stemless Thistle	*Onopordum acaulon*	3	104, 101a, 1c
Thread Iris	*Moraea setifolia*	3	11b, 15b, 1b
Tiny Bristle-grass	*Rostraria pumila*	5	104, 111, 112, 114, 101a
Tree Tobacco	*Nicotiana glauca*	2	2c, 3c
Ward's Weed	*Carrichtera annua*	17	104, 105, 111, 112, 114, 101a, 11b, 14b, 14c, 15b, 25b, 26b, 27b, 4b, 6c, 8b, 8c
Wild Mustard	*Sisymbrium sp.*	4	104, 111, 114, 117
Wild Oat	*Avena fatua*	2	101a, 3a
Wild Sage	*Salvia verbenaca var.*	9	111, 114, 117, 14c, 15c, 17c, 20a, 21c, 22c
Wild Turnip	*Brassica sp.*	1	

[1] A naturalized exotic