



**EP Transmission Line
Threatened Species Management Plan
(Construction)**

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9 October 2020

Version 3.0

Prepared by EBS Ecology for ElectraNet

Document Control					
Revision No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
1	13/03/2020	J. Carpenter	Dr M. Louter	13/03/2020	Draft
1	08/04/2020	J. Carpenter	Alecia Wright	07/04/2020	Draft
1.1	08/04/2020	J. Carpenter	ElectraNet	04/06/2020	Draft
2.0	15/06/2020	J. Carpenter	ElectraNet	-	Final
3.0	09/10/2020	J. Carpenter			Final

Distribution of Copies			
Revision No.	Date issued	Media	Issued to
1	31/03/2020	Electronic	A. Wright, ElectraNet
1	08/04/2020	Electronic	J. Carpenter
1.1	08/04/2020	Electronic	A. Wright, ElectraNet
2.0	16/06/2020	Electronic	A. Wright, ElectraNet
3.0	09/10/2020	Electronic	A. Wright, ElectraNet

EBS Ecology Project Number: E90106B

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CITATION: EBS Ecology (2020) EP Transmission Line Threatened Species Management Plan. Report to ElectraNet. EBS Ecology, Adelaide.

Cover photograph: *Santalum spicatum* (Sandalwood), listed as Endangered in South Australia.

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ACKNOWLEDGMENTS

EBS Ecology acknowledges the assistance and contributions of the following people:

- Peter Day for providing some of the photographs used in the species sections of this report.
- John Read and Katherine Moseby (Ecological Horizons) for document review and input into the management actions sections.

GLOSSARY AND ABBREVIATION OF TERMS

cm	Centimetre(s)
DAWE	Australian Government Department of Agriculture, Water and the Environment (previously DoTEE)
EBS Ecology	Environmental and Biodiversity Services Pty Ltd – trading as EBS Ecology
EEC	Endangered Ecological Community(ies)
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	Hectare(s).
km	Kilometre(s).
kV	Kilovolt(s).
m	Metre(s).
mm	Millimetre(s)
NPW Act	South Australian <i>National Parks and Wildlife Act 1972</i>
NV Act	South Australian <i>Native Vegetation Act 1991</i>
Project	ElectraNet Eyre Peninsula Transmission Line Project
Project Area	Impact footprint of the Project
SEB	Significant Environmental Benefit
sp.	Species
spp.	Species plural
ssp.	Subspecies
TEC	Threatened Ecological Community(ies)
TSMF	Threatened Species Management Plan
var.	Variant

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1 INTRODUCTION

EBS Ecology was engaged by ElectraNet to prepare a Threatened Species Management Plan (TSMP) for the proposed Eyre Peninsula Transmission Line (the 'Project') to outline the measures to be implemented for management of impacts to threatened ecological communities and species listed as Matters of National Environmental Significance (MNES) during construction of the Project.

EBS Ecology has completed various flora and fauna studies within the proposed transmission line corridor, including targeted threatened species surveys and vegetation association mapping. In addition, targeted surveys for Malleefowl and Sandhill Dunnart have been undertaken by Ecological Horizons Pty Ltd. Results of these studies have also informed the relevant sections of the TSMP.

The TSMP provides species descriptions and distribution information for threatened species either recorded or highly likely to occur in the Project impact footprint. It identifies potential threats possibly exacerbated by construction activities and describes the management actions that will be required to be undertaken by ElectraNet and its contractors to minimise the potential impacts to significant species.

1.1 Objectives

This TSMP is to be used by ElectraNet during construction of the Project to minimise and mitigate impacts to significant species that may occur as a result of the activity and cannot be avoided.

For the purposes of this plan 'significant species' are those species or communities considered to be Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The document is intended to minimise potential impacts during the construction phase only. It does not fulfill any long-term monitoring or offset obligations ElectraNet may incur as a result of impacts during the operation of the Eyre Peninsula transmission line.

Broadly this TSMP describes:

- Significant species known or potentially present within the Project Area
- Specific requirements for managing potential impacts to significant species during the construction phases of the Project; and
- Monitoring and reporting requirements.

1.2 Project Area

The Project will replace the existing, soon-to-be obsolete, infrastructure between Port Lincoln and Cultana, currently a 132 kilovolt (kV) transmission line and is planned to broadly follow a similar alignment to the existing line. The transmission line will be approximately 290 kilometres (km) long. Detailed project design is dependent on route constraints and has not yet been finalised, however a construction impact footprint of 454.35 hectares (ha) is expected. This impact footprint is referred to as the Project Area from here on. It contains up to 192.02 ha of native vegetation, with the remainder made up of cropping areas, pasture and planted vegetation.

The Project Area (Figure 1) is located within the Eyre Peninsula and South Australian Arid Lands Natural Resource Management regions and the following local government areas:

- Lower Eyre Peninsula
- Tumby Bay
- Cleve
- Franklin Harbour
- Whyalla.

For the purposes of this TSMP, the Project Area has been divided into two sections: the southern and northern sections, with the Southern Project Area being that section south of Yadnarie.



Figure 1. The location of the Project Area.

1.3 Legislative framework

1.3.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage matters of national environmental significance, including threatened species and threatened ecological communities (TEC).

As the Project potentially impacts several species and communities, referral of the Project under the EPBC Act has occurred. This TSMP is an integral component of that referral and consequent assessment by the Australian Department of Agriculture, Water and the Environment (DAWE).

ElectraNet will offset any impact to EPBC listed species that occurs as a result of the Project in agreement with DAWE. The intent of this TSMP is to document management actions to be implemented to avoid and minimise impacts that occur during the construction phase of the Project. It should not be regarded as an offset programme and does not include any long-term management or monitoring that may be required throughout the operational phase of the Project.

1.3.2 South Australian National Parks and Wildlife Act 1972

Vascular plants and vertebrate animals are protected in South Australia (SA) under the threatened species schedules of the *National Parks and Wildlife Act 1972* (NPW Act). Threatened species under the NPW Act are listed in the following schedules:

Schedule 7 – Endangered Species

Schedule 8 – Vulnerable Species

Schedule 9 – Rare Species.

1.3.3 South Australian Native Vegetation Act 1991

Impact to native vegetation caused by the Project has been assessed under the *Native Vegetation Act 1991* (NV Act). Under this assessment, impact to species listed on Schedule 7, 8 or 9 of the NPW Act has been accounted for within the calculation of the Significant Environmental Benefit (SEB) offset for the Project.

This TSMP does not discuss the SEB obligations associated with the Project. This has been completed previously by EBS Ecology in *Eyre Peninsula Transmission Line Vegetation Assessment* (EBS Ecology, 2019a).

1.4 Previous threatened species surveys

The following studies have been used to inform this TSMP:

- *Eyre Peninsula Transmission Line Native Vegetation Assessment* (EBS Ecology, 2019a). This study included a vegetation survey carried out according to Bushland and Rangeland Assessment Methodologies, in order to assess the SEB required to offset the Project. Targeted searches for threatened flora species were undertaken and opportunistic records of fauna collected.

- *Eyre Peninsula Transmission Line EPBC Assessment* (EBS Ecology, 2019b). Desktop study of the potential occurrence of EPBC Act listed threatened species and communities in the Project Area. The study provides a list of EPBC Act listed species and communities potentially impacted and referral requirements under the EPBC Act.
- *Eyre Peninsula Transmission Line – Biodiversity Assessment Report* (EBS Ecology, 2014a). Targeted surveys for threatened flora and some threatened fauna historically recorded within the Project Area were carried out from August to November in 2013. Vegetation surveys were also conducted to determine the suitability of habitat for species where no targeted survey was carried out.
- *Sandhill Dunnart Habitat Assessment Proposed ElectraNet Transmission Line Corridor Eastern Eyre Peninsula – March 2014* (Moseby, 2014). Targeted surveys and habitat modelling were carried out by Ecological Horizons Pty Ltd in the Project Area in 2014.

The above studies included desktop research and field surveys undertaken in 2012, 2013 and 2019. Field surveys undertaken in 2012 and 2013 included targeted surveys for threatened flora and bird species. Surveys undertaken in 2019 completed vegetation mapping in order to calculate the SEB obligations of the Project.

1.5 ElectraNet's Environmental Management

ElectraNet is committed to conducting its operations and activities to minimise disturbance to the environment in which it operates by using environmental standards consistent with development in technology, industry codes of practice and relevant statutory requirements. ElectraNet has a Health, Safety and Environment Management System (HSEMS) that establishes a framework under which environmental management of ElectraNet's activities takes place. It also ensures the identification of environmental impacts and that measures are in place to mitigate, measure and review impacts as well as environmental performance.

This TSMP forms part of the environmental management procedures established within the HSEMS. ElectraNet will incorporate the relevant management actions into procedures and plans for contractors to comply with its contents.

ElectraNet's Construction Environmental Management Plan (CEMP) (in preparation) is the document that describes the actions ElectraNet will take to minimise impacts during construction. This includes the following sub-plans:

- Biodiversity Management Plan (in preparation)
- Rehabilitation Management Plan (in preparation)
- Weed, Pest and Disease Management Plan (in preparation)
- Sedimentation, Erosion and Drainage Management Plan (in preparation)
- Unexploded Ordinance (UXO) Management Plan (in preparation)
- Landholder Liaison Plan (in preparation)

EP Transmission Line Threatened Species Management Plan

- Cultural Heritage Management Plan (in preparation)
- Bushfire Management Plan, including Lightning Management Plan (in preparation)
- Waste Management Plan (in preparation).

2 ROLES AND RESPONSIBILITIES

ElectraNet is responsible for management of construction activities in the Project Area. All ElectraNet employees and contractors are responsible for conforming to applicable Australian and South Australian laws and regulations and conducting work in accordance with permit and approval conditions, ElectraNet's HSEMS, CEMP (and sub-plans) and this TSMP.

An overview of the roles and responsibilities of ElectraNet personnel and the Principal Contractors are summarised in Table 1. Detailed descriptions of roles and responsibilities are provided in the Principal Contractor's Construction Environmental Management Plan and sub-plans.

Table 1. Roles and responsibilities during the Project construction phase.

Role	Responsibilities
ElectraNet	<ul style="list-style-type: none"> • Obtain statutory approvals in accordance with the EP Link Contract. • Comply with conditions of statutory approvals. • Maintain documentation and a compliance system to ensure compliance with approval conditions, the EP Link Contract, and the CEMP. • Ensure all contractors operate in accordance with the EP Link Contract. • Complete environmental audits. • Ensure all personnel are competent to perform their assigned duties. • Ensure all personnel have received appropriate training and inductions.
Principal Contractor	<ul style="list-style-type: none"> • Overall responsibility for environmental compliance, including monitoring, data collection and reporting. • Preparation and implementation of the Construction Environmental Management Plan (CEMP) and sub-plans. • Inclusion of the management measures outlined in this TSMP into the CEMP and sub-plans. • Ensure resources are available to manage environmental obligations and implement management actions. • Identify and address risks associated with Contractor's activities prior to commencing works. • Ensure all contractor personnel are competent to perform their assigned duties. • Ensure all contractor personnel have received appropriate training and inductions. • Ensure that personnel are adequately supervised. • Ensure that all activities are carried out in accordance with the CEMP and sub-plans. • Implement the management actions identified in the CEMP and sub-plans. • Immediately notify the ElectraNet Environmental Manager of any incidents and non-compliances with the CEMP or statutory approvals conditions. • Undertake project auditing and monitoring.

3 THREATENED SPECIES OF RELEVANCE

3.1 *Threatened ecological communities*

Previous studies indicate that one TEC is potentially impacted by the Project, as shown in Table 2. While vegetation associations were not assessed against the EPBC Act criteria for listing as the TEC, it has been assessed as highly likely that some areas within the Project Area are the listed community *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum) Woodland.

Table 2. Threatened ecological communities potentially impacted by the Project.

Threatened Ecological Community	Conservation status		Likelihood of occurrence within project area
	Aus	SA	
<i>Eucalyptus petiolaris</i> (Eyre Peninsula Blue Gum) Woodland	EN		Highly Likely

Aus: Australia (Environment Protection and Biodiversity Conservation Act 1999). SA: South Australia (National Parks and Wildlife Act 1972). Conservation codes: CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare.

3.2 *Threatened species*

Previous studies have identified 25 flora and eight fauna species listed as threatened under the EPBC Act and/or the NPW Act are potentially impacted by the Project. This includes the following:

- Six EPBC listed flora
- Four EPBC listed fauna
- Twenty-one NPW Act listed flora
- Ten NPW Act listed fauna.

Note that some species are listed under both Commonwealth and State legislation. Threatened species and their listed status are shown in Table 3. The locations of threatened species observed throughout these studies are shown in Figure 2 to Figure 5.

Many species share similar habitats across the Project Area, have similar ecology, with similar threatening processes affecting their status throughout their distribution. Similar species therefore require the implementation of comparable management actions to avoid and/or minimise impact. This TSMP addresses the management of similar species within common sections in the document. Table 3 indicates which Section of the Management Plan refers to each species.

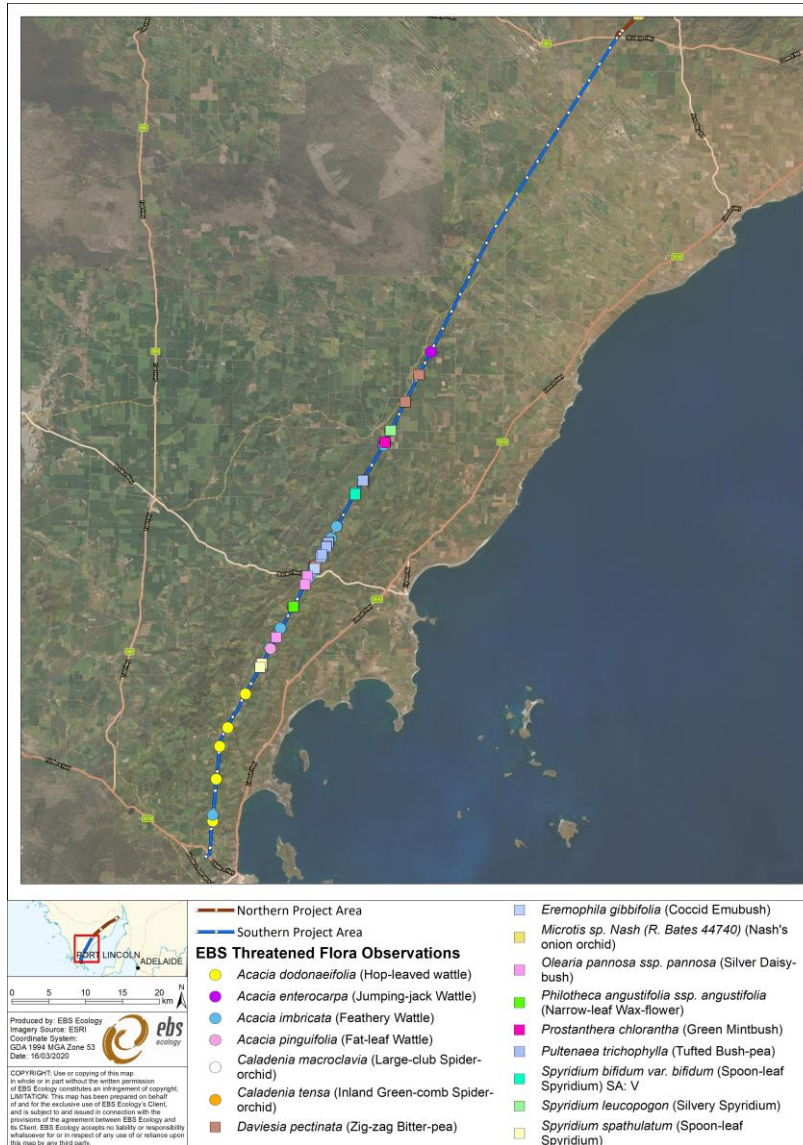


Figure 2. Threatened flora species recorded by EBS Ecology, Southern Project Area.

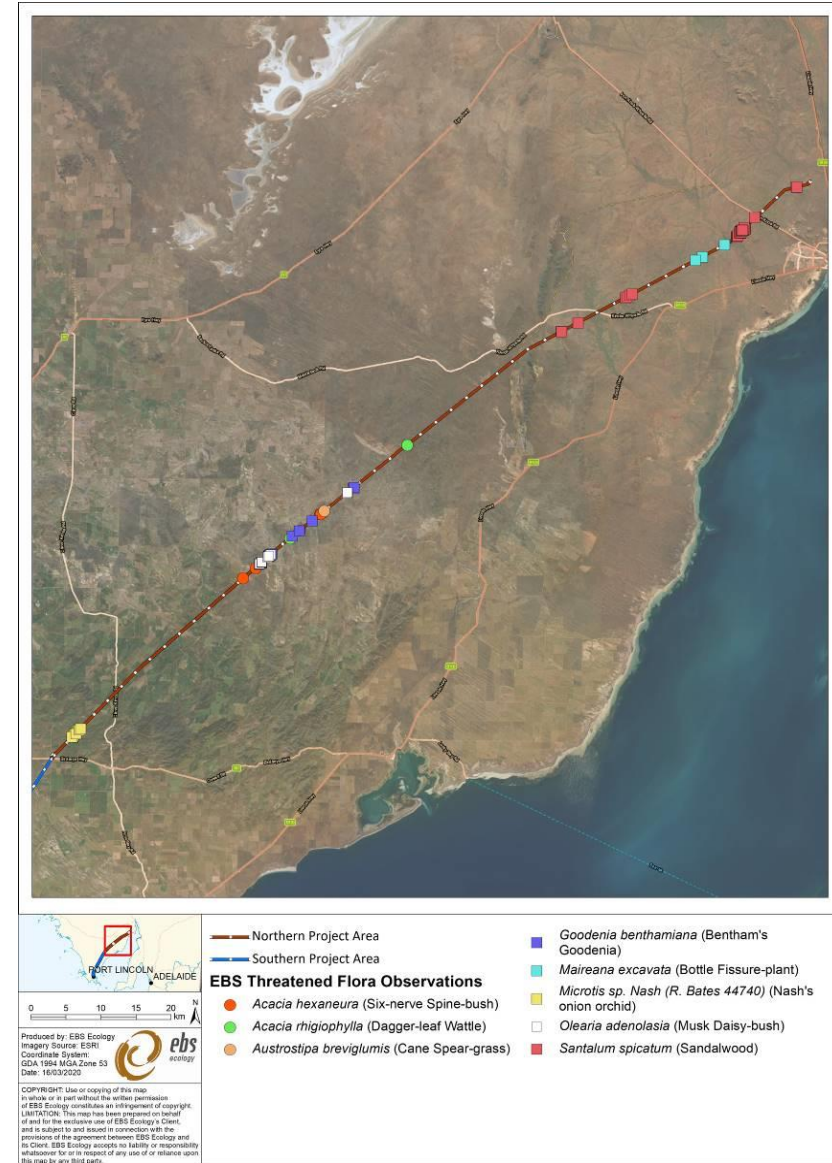


Figure 3. Threatened flora species recorded by EBS Ecology, Northern Project Area.



Figure 4. Threatened fauna species recorded by EBS Ecology, Southern Project Area.

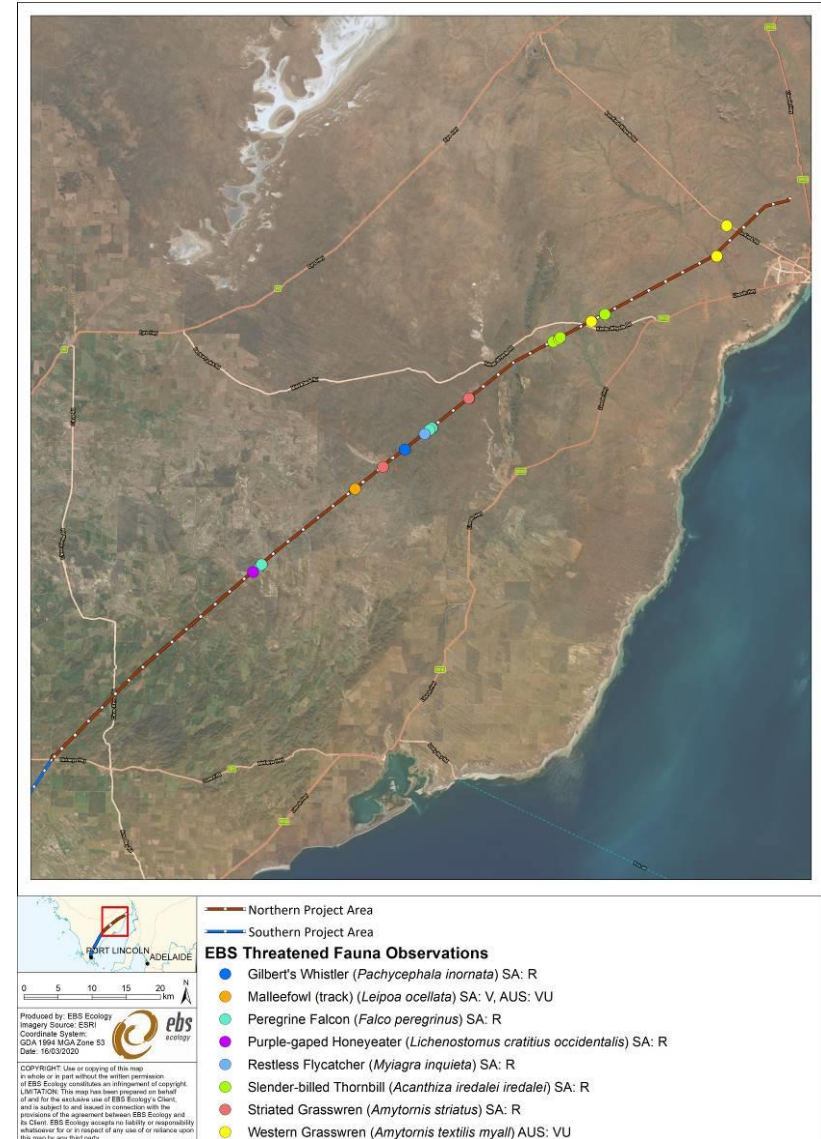


Figure 5. Threatened fauna species recorded by EBS Ecology, Northern Project Area.

Table 3. Threatened species recorded or likely occurring within the Project Area and potentially impacted by the Project.

Management Plan Section	Scientific Name	Common Name	Conservation Status		Presence in Project Area
			Aus	SA	
Flora of National Environmental Significance					
Section 6.2	<i>Acacia enterocarpa</i>	Jumping-jack Wattle	EN	E	Recorded 2013
Section 6.5	<i>Acacia pinguifolia</i>	Fat-leaf Wattle	EN	E	Recorded 2013
Section 5.1	<i>Caladenia macroclavia</i>	Large-club Spider-orchid	EN	E	Recorded 2013
Section 5.2	<i>Caladenia tensa</i>	Inland Green-comb Spider-orchid	EN		Recorded 2013
Section 7.6	<i>Olearia pannosa</i> ssp. <i>pannosa</i>	Silver Daisy-bush	VU	V	Recorded 2013
Section 7.7	<i>Pultenaea trichophylla</i>	Tufted Bush-pea	EN	R	Recorded 2013
Fauna of National Environmental Significance					
Section 13.2	<i>Amytornis textilis myall</i>	Western Grasswren	VU	V	Recorded 2012
Section 12.6	<i>Leipoa ocellata</i>	Malleefowl	VU	E	Recorded 2012, 2013, 2019
Section 11.1	<i>Sminthopsis psammophila</i>	Sandhill Dunnart	EN	E	Recorded 2009 - 2013
Section 12.10	<i>Stipiturus malachurus parimeda</i>	Southern Emu-wren (Eyre Peninsula)	VU	E	Highly likely to occur
Flora of State Environmental Significance					
Section 6.1	<i>Acacia dodonaefolia</i>	Hop-bush Wattle		R	Recorded 2013, 2019
Section 6.3	<i>Acacia hexaneura</i>	Six-nerve Wattle		R	Recorded 2013, 2019
Section 6.4	<i>Acacia imbricata</i>	Feathery Wattle		R	Recorded 2013, 2019
Section 6.6	<i>Acacia rhigiophylla</i>	Dagger-leaf Wattle		R	Recorded 2013
Section 10.1	<i>Austrostipa breviglumis</i>	Bamboo Spear-grass		R	Recorded 2013
Section 10.2	<i>Austrostipa tenuifolia</i>			R	Recorded 2013
Section 7.1	<i>Daviesia benthamii</i> ssp. <i>humilis</i>	Mallee Bitter-pea		R	Recorded 2013
Section 7.2	<i>Daviesia pectinata</i>	Zig-zag Bitter-pea		R	Recorded 2013, 2019
Section 7.3	<i>Eremophila gibbifolia</i>	Coccid Emubush		R	Recorded 2013, 2019
Section 9.1	<i>Eucalyptus cretata</i>	Darke Peak Mallee		R	Recorded 2013
Section 7.4	<i>Goodenia benthamiana</i>	Bentham's Goodenia		R	Recorded 2013, 2019
Section 8.2	<i>Maireana excavata</i>	Bottle Fissure-plant		V	Recorded 2019
Section 8.3	<i>Maireana suaedifolia</i>	Lax Bluebush		R	Recorded 2013
Section 5.3	<i>Microtis</i> sp. <i>Nash (R. Bates 44740)</i>	Nash's Onion-orchid		R	Recorded 2013
Section 7.5	<i>Olearia adenolasia</i>	Musk Daisy-bush		R	Recorded 2013, 2019

Section 7.8	<i>Philothea angustifolia</i> ssp. <i>angustifolia</i>	Narrow-leaf Wax-flower		R	Recorded 2013
Section 7.9	<i>Prostanthera chlorantha</i>	Green Mintbush		R	Recorded 2013
Section 8.1	<i>Santalum spicatum</i>	Sandalwood		V	Recorded 2013, 2019
Section 7.10	<i>Spyridium bifidum</i> var. <i>bifidum</i>	Forked Spyridium		V	Recorded 2013
Section 7.11	<i>Spyridium leucopogon</i>	Silvery Spyridium		R	Recorded 2013
Section 7.12	<i>Spyridium spathulatum</i>	Spoon-leaf Spyridium		R	Recorded 2013
Fauna of State Environmental Significance					
Section 13.1	<i>Acanthiza iredalei iredalei</i>	Slender-billed Thornbill (Western)		R	Recorded 2012, 2013, 2019
Section 12.1	<i>Amytornis striatus</i>	Striated Grasswren		R	Recorded 2012
Section 12.2	<i>Calamanthus cauta</i>	Shy Heathwren		R	Recorded 2012
Section 12.3	<i>Corcorax melanorhamphos</i>	White-winged Chough		R	Recorded 2012, 2019
Section 14.1	<i>Falco peregrinus</i>	Peregrine Falcon		R	Recorded 2012
Section 12.4	<i>Gerygone fusca</i>	Western Gerygone		R	Recorded 2019
Section 12.5	<i>Lichenostomus cratititus</i>	Purple-gaped Honeyeater		R	Recorded 2012
Section 12.7	<i>Myiagra inquieta</i>	Restless Flycatcher		R	Recorded 2012
Section 12.9	<i>Stagonopleura guttata</i>	Diamond Firetail		R	Recorded 2019
Section 12.8	<i>Pachycephala inornata</i>	Gilbert's Whistler		R	Recorded 2012

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). **SA:** South Australia (*National Parks and Wildlife Act 1972*). **Conservation codes:** **CE:** Critically Endangered. **EN/E:** Endangered. **VU/V:** Vulnerable. **R:** Rare.

4 THREATENED ECOLOGICAL COMMUNITIES

4.1 *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum) Woodland

4.1.1 Conservation Status

Eucalyptus petiolaris (Eyre Peninsula Blue Gum) Woodland is listed as an Endangered Ecological Community (EEC) under the EPBC Act.

4.1.2 Description

Eucalyptus petiolaris (Eyre Peninsula Blue Gum) Woodland EEC is typically a woodland community with a canopy dominated by *Eucalyptus petiolaris*. It often occurs in sheltered valleys, along watercourses and on lower slopes. The structure of the community varies from a mid to dense shrub layer with a low, open ground layer dominated by grasses and sedges, the key diagnostic features of the community being as follows (Threatened Species Scientific Committee):

- Distribution within the Eyre York Block bioregion (Eyre Hills subregion) with outliers possibly in the Talia subregion of the Eyre Peninsula.
- Woodland or open forest structure.
- Upper layer dominated or co-dominated by *Eucalyptus petiolaris*, with a tree cover of 10% or more.
- The mid layer varies from open to dense in response to soil moisture and disturbance and/or management history and consists of native sclerophyllous shrubs and small trees.
- The ground layer is variable in development and composition, ranging from sparse to a thick layer of native grasses and other herbs.
- The ecological community is mainly restricted to well-drained, moderate to high fertility soils and is typically associated with sheltered valleys, lower hill slopes and watercourses in the higher rainfall districts of the Eyre Peninsula.

4.1.3 Occurrence in the Project Area

Although not assessed against EPBC criteria for listing as the EEC, one vegetation association mapped in the Project Area may possibly meet the listing:

- *Eucalyptus petiolaris* +/- *Eucalyptus odorata* +/- *Allocasuarina verticillata* Open Grassy Woodland (Figure 6).

The location of this vegetation association is mapped in Appendix 1.



Figure 6. *Eucalyptus petiolaris* +/- *Eucalyptus odorata* +/- *Allocasuarina verticillata* Open Grassy Woodland.

4.2 ***Management of Threats to Eucalyptus petiolaris (Eyre Peninsula Blue Gum) Woodland***

Key threats to the EEC are listed in the *Approved Conservation Advice for the Eyre Peninsula Blue Gum (Eucalyptus petiolaris) Woodland* (Threatened Species Scientific Committee). They include:

- Vegetation clearance, fragmentation and edge effects,
- Invasive species, including weeds,
- Grazing,
- Salinization,
- Dieback,
- Inappropriate fire regimes.

Hollows that often form in the larger *Eucalyptus petiolaris* are an important structural element of habitat for many of the fauna species characteristic of the EEC (Government of South Australia). This includes some species listed as threatened under the NPW Act such as the Endangered Gould's Wattled Bat (*Chalinolobus gouldii*) and Rare Common Brushtail Possum (*Trichosurus vulpecula*). The loss of hollow-bearing trees is likely to impact fauna characteristic of the community, as described in Table 4.

Table 4. Threats and management of impacts to *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum) Woodland (Threatened Species Scientific Committee).

Threat	Discussion	Exacerbated by the Project during construction	Management Actions
Vegetation clearance, fragmentation and edge effects	<ul style="list-style-type: none"> Historical land clearing was extensive in the past. Ongoing clearing continues to degrade remaining patches, increasing the risk of local extinction. 	<p>Yes.</p> <ul style="list-style-type: none"> Although steps have been taken to avoid vegetation clearing where possible, some clearance is required for the Project. 	<p>4.1 4.2 4.3 4.7 4.8 4.9 4.10 4.11 4.12</p>
Loss of hollow-bearing trees	<ul style="list-style-type: none"> Removal of hollow-bearing trees may have long-term impact on fauna characteristic of the EEC by removing a critical habitat component that takes many years to replace. Short-term impact to individual fauna by death, injury or displacement may occur if utilising hollows are being cleared. 	<p>Yes.</p> <ul style="list-style-type: none"> Larger, potentially hollow-bearing, trees may be required to be removed during construction. 	<p>4.4 4.5 4.6</p>
Invasive species (e.g. weeds)	<ul style="list-style-type: none"> Weed species such as <i>Ehrharta longiflora</i> and <i>Asparagus asparagoides</i> are replacing native species, changing vegetation structure and/or altering fire regimes. 	<p>Yes.</p> <ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11</p>
Grazing	<ul style="list-style-type: none"> Animals such as cattle and sheep browse and damage native vegetation 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	

Threat	Discussion	Exacerbated by the Project during construction	Management Actions
Salinization	<ul style="list-style-type: none"> Native vegetation clearance and stream flow reduction can form salt deposition on the soil surface on the naturally saline Eyre Peninsula, leading to vegetation decline and death. 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any actions that are likely to contribute to soil salinization, such as alteration of water courses or water extraction. 	Not exacerbated by the Project.
Dieback	<ul style="list-style-type: none"> Decline and condition of trees due to insect attack, water stress and salinity. 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any actions that are likely to contribute to dieback of <i>Eucalyptus</i> spp. or canopy trees. 	Not exacerbated by the Project.
Inappropriate fire regimes	<ul style="list-style-type: none"> Fires can impact the perennial flora within the ecological community causing changes in species composition and/or interfering with regeneration capacity. 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. Clearing of vegetation and access tracks for construction make some areas more accessible to the public, increasing risk of ignition. 	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7</p>

5 THREATENED ORCHIDS

Three species of threatened orchids have previously been recorded in the Project Area or are highly likely to occur. This includes the following species:

- *Caladenia macroclavia* (Large-club Spider-orchid),
- *Caladenia tensa* (Greencomb Spider-orchid),
- *Microtis* sp. Nash (Nash's Onion-orchid).

All three are terrestrial species found in woodland or mallee habitats, and they die back to an underground tuber during a summer dormancy period. They are commonly threatened by habitat loss, weed invasion and changing fire regimes.

5.1 *Caladenia macroclavia* (Large-club Spider-orchid)

5.1.1 Conservation Status

Caladenia macroclavia (Figure 7) is listed as Endangered under the EPBC Act and NPW Act.

5.1.2 Ecology

Biology and description

Caladenia macroclavia is a terrestrial orchid. It has a wiry flowering stem up to 28 centimetres (cm) in height. It produces oblong-lanceolate basal leaves that are dull green, hairy and 8 - 10 cm long by 1 – 1.3 cm wide. The solitary flowers are green to yellow-green with a prominent dark red central band down each segment. The sepals terminate in a prominent thickened, brown, bayonet-shaped osmophore (Quarmby, 2010).

The species usually produces a leaf in July or August, with flowering occurring in late August to mid-September. However, a leaf and flower may not be produced every year, with plants possibly remaining dormant for one or more years. The underground tubers are replaced annually during winter and spring, with the plants being dormant over the dry summer (Quarmby, 2010).

Habitat

Caladenia macroclavia populations occur in sandy loam soils over limestone often in low-lying areas. It has been recorded in *Eucalyptus gracilis* / *Eucalyptus socialis* / *Eucalyptus incrassata* Mallee over *Melaleuca uncinata*, *Alyxia buxifolia*, *Acrotriche patula*, *Lepidosperma congestum*, *Gahnia deusta* and *Lomandra effusa* (Quarmby, 2010).

5.1.3 Occurrence in the Project Area

The species is endemic to South Australia and occurs on the York and Eyre Peninsulas, with most populations located on the eastern York Peninsula.

One occurrence of *Caladenia macroclavia* has been recorded in the Southern Project Area. Three plants were found by EBS Ecology in targeted surveys during 2013 at the location listed in Table 5. The plants

were found in Vegetation Association *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata* (Figure 8). This location is mapped in Figure 2.

Table 5. Location of *Caladenia macroclavia* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation association
53 H 581367E 6185823N	3	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>



Figure 7. *Caladenia macroclavia* (Large-club Spider-orchid). Photographed in the Project Area during targeted surveys by EBS Ecology in 2013.



Figure 8. Typical habitat of *Caladenia macroclavia* in the Project Area. Photographed by EBS Ecology during vegetation surveys in 2019.

5.2 *Caladenia tensa* (Green-comb Spider-orchid)

5.2.1 Conservation Status

Caladenia tensa (Figure 9) is listed as Endangered under the EPBC Act. The species is listed as Endangered due to its small population size, limited distribution and continuing decline due to threatening processes such as habitat loss (Department of Agriculture, Water and the Environment, 2020a).

The species is not listed as threatened under the NPW Act.

5.2.2 Ecology

Description and biology

Caladenia tensa is an herbaceous terrestrial orchid that dies back annually to a small underground tuber during summer dormancy. When not dormant, it develops a single long, narrow leaf with an erect hairy flower stem appearing in winter to spring (recorded from August to November), following winter rainfall. The species is most likely pollinated by the wasp species Slender Black Thynnid (*Thynnoides* sp. aff. *gracilis*) (Department of Agriculture, Water and the Environment, 2020a).

Habitat

Generally occurring on red-brown sandy loams, *Caladenia tensa* is known from open woodland vegetation associations including those dominated by *Eucalyptus leucoxylon* (South Australian Blue Gum) and *Callitris* spp. It is also known to occur in mallee-heath associations and *Melaleuca uncinata* (Broombush) mallee often with rock outcrops (Department of Agriculture, Water and the Environment, 2020a).

5.2.3 Occurrence in the Project Area

The species is distributed western Victoria and south-eastern South Australia to the Eyre Peninsula. In western Victoria and eastern South Australia, *Caladenia tensa* can be locally common in suitable habitat, with some populations containing hundreds of plants.

Caladenia tensa was recorded in the Project Area by EBS Ecology in 2013. The location of this record is shown in Table 6. The species was recorded in a single Vegetation Association, *Melaleuca uncinata* Tall Shrubland (Figure 10).

The location of the record is mapped in Figure 2.

Table 6. Location of *Caladenia tensa* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53 H 598984E 6217929N	25	<i>Melaleuca uncinata</i> Shrubland



Figure 9. *Caladenia tensa* in the Project Area, photographed by EBS Ecology in 2013



Figure 10. *Melaleuca uncinata* Shrubland in the Project Area, where *Caladenia tensa* was recorded.

5.3 *Microtis* sp. Nash (Nash’ s Onion-orchid)

5.3.1 Conservation Status

Microtis sp. Nash (Figure 11) is listed as Rare under the NPW Act.

5.3.2 Ecology

Description and biology

This species was formerly classified within the *Microtis unifolia* (Common Onion-orchid) species complex and is difficult to distinguish from that species (South Australian Seed Conservation Centre, 2020).

Microtis sp. Nash is a terrestrial herb 5 – 60 cm tall with erect, fleshy green-yellow stems. The 6 -100 densely packed flowers are spirally arranged on the single stem in racemes 2 – 20 cm long. They are yellow-green, slightly scented on pedicels 1 -1.5 mm long (Bates, 1984).

The plant flowers from August to January and forms small to extensive colonies.

Habitat

It occurs in a wide variety of habitats, including saline soils, and can be found germinating in disturbed areas (Bates, 1984).

5.3.3 Occurrence in the Project Area

Microtis sp. Nash has been recorded by EBS Ecology at nine locations in both the Southern and Northern Project Area, with the number of plants at each location ranging from three to more than 60 (Table 7). It was recorded in two Vegetation Associations:

- *Eucalyptus porosa* Open Woodland +/- *Acacia notabilis* (Figure 12),
- *Melaleuca uncinata* Tall Shrubland.

The locations are mapped in Figure 2 and Figure 3.

Table 7. Location of *Microtis* sp. Nash in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 633550E 6275311N	3	<i>Eucalyptus porosa</i> Open Woodland +/- <i>Acacia notabilis</i>
53H 633130E 6274836N	>60	<i>Eucalyptus porosa</i> Open Woodland +/- <i>Acacia notabilis</i>
53H 633095E 6274783N	10	<i>Eucalyptus porosa</i> Open Woodland +/- <i>Acacia notabilis</i>
53H 632863E 6274524N	2	<i>Melaleuca uncinata</i> Tall Shrubland
53H 632729E 6274399N	20	<i>Melaleuca uncinata</i> Tall Shrubland
53H 632687E 6274393N	30	<i>Melaleuca uncinata</i> Tall Shrubland
53H 633238E 6274843N	10	<i>Eucalyptus porosa</i> Open Woodland +/- <i>Acacia notabilis</i>
53H 633714E 6275378N	15	<i>Melaleuca uncinata</i> Tall Shrubland
53H 633930E 6275554N	5	<i>Melaleuca uncinata</i> Tall Shrubland



Figure 11. *Microtis* sp. Nash, photographed by EBS Ecology in 2013.



Figure 12. *Eucalyptus porosa* Open Woodland, in the Project Area. The largest population of *Microtis* sp. Nash was recorded in this Vegetation Association (Photo from EBS Ecology 2019).

5.4 Management of Threats to Orchids

Known threats to the three orchid species listed above have been identified in the following documents:

- *Recovery Plan for Twelve Threatened Orchids in the Lofty Block Region of South Australia 2010* (Quarmby, 2010),
- *Recovery Plan for twelve threatened Spider-orchid Caladenia taxa (Orchidaceae: Caladeniinae) of Victoria and South Australia 2000 – 2004* (Todd, 2000).

These documents identify seven threats and threatening processes as impacting on orchids throughout their distributions, including *Caladenia macroclavia* and *Caladenia tensa*. They are listed and discussed in Table 8. Five have relevance to the Project, which are also discussed in the table.

While threats to *Microtis* sp. Nash are not documented and no recovery plan for the species exists, it has been assumed that the species is impacted by similar threats as other orchid species in the Project Area. This has been assumed based on the species' similar woodland and shrubland habitats, its occurrence in similar regions within the Project Area and its broadly similar ecology, that is a terrestrial orchid species that dies back to an underground tuber when dormant. However, due to the size of some populations recorded by EBS Ecology in 2013, lack of pollination, lack of recruitment and loss of genetic diversity are not likely to be impacting on this species.

This document identifies management actions that will be implemented by ElectraNet and its contractors to minimise their impact on threatened orchid species. These actions are discussed in detail in Section 15. Management Actions relevant to orchids are listed in Table 8.

Table 8. Threats and management actions to minimise impact on threatened orchids.

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Weed invasion^{1, 2}	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Invasion of weeds such as <i>Asparagus asparagoides</i> (Bridal Creeper), <i>Oxalis pes-caprae</i> (Soursob), <i>Avena</i> spp. (Wild Oats) and other introduced grasses is a threat to all known populations of <i>Caladenia macroclavia</i>.¹ <i>Caladenia tensa</i> is also threatened by introduced grasses such as <i>Ehrharta calycina</i> (Perennial Veldt Grass).² It has been assumed that threats from weed invasion, particularly invasive grasses, would also impact on <i>Microtis</i> sp. Nash, since these grasses are widespread throughout the Project Area. 	<p>Yes.</p> <ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.1</p> <p>1.2</p> <p>1.3</p> <p>1.4</p> <p>1.5</p> <p>1.6</p> <p>1.7</p> <p>1.8</p> <p>1.9</p> <p>1.10</p> <p>1.11</p>
	<i>Caladenia tensa</i>			
	<i>Microtis</i> sp. Nash			
Grazing and herbivory^{1, 2}	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Grazing by domestic stock directly impacts species by impact to plants. It also causes indirect impacts resulting from habitat degradation caused by grazing activities¹. Herbivory of flowers by kangaroos and rabbits in known to occur within populations of both <i>Caladenia</i> species.^{1, 2} 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. <p>Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing.</p>	
	<i>Caladenia tensa</i>			
	<i>Microtis</i> sp. Nash			
Inappropriate fire regimes^{1, 2}	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Fire prevention and fuel reduction activities during the active growing period, such as slashing of fire breaks and prescribed burns, during the active growing period is likely to damage or kill orchids.¹ Hot, intense wildfire may damage underground tubers.¹ 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition. 	<p>2.1</p> <p>2.2</p> <p>2.3</p> <p>2.4</p> <p>2.5</p> <p>2.6</p> <p>2.7</p> <p>2.8</p>
	<i>Caladenia tensa</i>			
	<i>Microtis</i> sp. Nash			
Site disturbance²	<i>Caladenia tensa</i>	<ul style="list-style-type: none"> Sites are known to be disturbed by vehicles and other recreational activities in some cases.² 	<p>Yes.</p> <ul style="list-style-type: none"> While project design can avoid known populations of all three orchid species, excessive or unintended vegetation/site disturbance may occur as a result of construction within the vicinity of populations. Sites may be disturbed indirectly by other threats exacerbated by the Project (e.g. weed invasion). 	<p>3.1</p> <p>3.2</p> <p>3.5</p> <p>3.6</p> <p>3.8</p>
	<i>Microtis</i> sp. Nash			

			<ul style="list-style-type: none"> Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, creating more opportunity for disturbance. 	
Lack of pollination¹	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Within studied populations of <i>Caladenia macroclavia</i>, only low levels of natural pollination have been observed. Often with only one flowering plant within each fragmented population, cross-pollination is unlikely.¹ 	<p>Yes.</p> <ul style="list-style-type: none"> Vegetation clearing and fragmentation is expected as a result of this Project. This process may exacerbate the effects of lack of pollination. 	8.1
Lack of recruitment¹	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Low rates of natural pollination have resulted in very poor recruitment rates for <i>Caladenia macroclavia</i>. Poor recruitment has been exacerbated by other threats, such as grazing.¹ 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any actions that would impact on the rate of recruitment. 	Not exacerbated by the Project.
Loss of genetic diversity¹	<i>Caladenia macroclavia</i>	<ul style="list-style-type: none"> Almost all known populations of <i>Caladenia macroclavia</i> consist of less than 10 plants, with limited or no chance of cross-pollination between populations due to habitat fragmentation. 	<p>No.</p> <ul style="list-style-type: none"> Vegetation clearing and fragmentation is expected as a result of this Project. This process may exacerbate the effects of lack of pollination, leading to a loss of genetic diversity. 	Not exacerbated by the Project.

1: *Recovery Plan for Twelve Threatened Orchids in the Lofty Block Region of South Australia 2010* (Quarmby, 2010).

2: *Recovery Plan for twelve threatened Spider-orchid Caladenia taxa (Orchidaceae: Caladeniinae) of Victoria and South Australia 2000 – 2004* (Todd, 2000).

6 THREATENED *ACACIA* SPECIES

Six threatened *Acacia* species have previously been recorded in the Project Area or are highly likely to occur, as listed below:

- *Acacia dodonaefolia* (Hop-bush Wattle),
- *Acacia enterocarpa* (Jumping-jack Wattle),
- *Acacia hexaneura* (Six-nerve Wattle),
- *Acacia imbricata* (Feathery Wattle)
- *Acacia pinguifolia* (Fat-leaved Wattle),
- *Acacia rhigiophylla* (Dagger-leaf Wattle)

All six species occur in woodland, shrubland or mallee Vegetation Associations, with species occurring in both the Southern and Northern Project Area.

6.1 *Acacia dodonaefolia* (Hop-bush Wattle)

6.1.1 Conservation status

Acacia dodonaefolia is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

6.1.2 Ecology

Biology and description

Acacia dodonaefolia (Figure 13) is a small shrub to small tree 2 – 6 metres (m) tall. Phyllodes are linear to lanceolate, being 4 – 10 cm long and 4 – 10 millimetres (mm) broad. Flowering from July to November, flowers are bright yellow and occur in globular heads, usually in groups of two (Berkinshaw, 2010).

Within its distribution, *Acacia dodonaefolia* occurs in areas of higher rainfall (500 – 700 mm annually) (Berkinshaw, 2010).

Habitat

Occurring in woodland or open forest Vegetation Associations, *Acacia dodonaefolia* prefers acidic yellow duplex or shallow red sandy loams (Government of South Australia, 2020a).

6.1.3 Occurrence in the Project Area

Endemic to South Australia, the species is distributed mainly in the southern Eyre Peninsula and southern Mount Lofty Ranges. However, scattered occurrences elsewhere are known (e.g. Kangaroo Island) (Government of South Australia, 2020a).

Acacia dodonaefolia (Figure 13) was recorded by EBS Ecology in the south of the Project Area during surveys in both 2013 and 2019. The locations of these records are listed in Table 9. The species was recorded in 5 Vegetation Associations (Figure 14):

- *Allocasuarina verticillata* Low Woodland
- *Eucalyptus cladocalyx* Woodland / Open Woodland
- *Juncus* spp. Sedgeland
- *Acacia dodonaeifolia* Tall Shrubland
- *Acacia paradoxa* Shrubland +/- *Eucalyptus* spp.

Within *Acacia dodonaeifolia* Tall Shrubland (Figure 14), the species is the dominant overstorey species. In all other Vegetation Associations, it occurs as an infrequent understorey shrub.

The locations of *Acacia dodonaeifolia* records in the Project Area are mapped in Figure 2.

Table 9. Locations of *Acacia dodonaeifolia* in the Project Area. Location information from EBS Ecology 2014a and EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of Plants	Vegetation Association
53H 579390E 6182180N	>10	<i>Allocasuarina verticillata</i> Low Woodland
53H 575867E 6175049N	>10	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 576969E 6177606N	1	<i>Juncus</i> spp. Sedgeland
53H 574928E 6164906N	5	<i>Juncus</i> spp. Sedgeland
53H 574927E 6165749N	Dominant species	<i>Acacia dodonaeifolia</i> Tall Shrubland
53H 575418E 6170592N	>10	<i>Acacia paradoxa</i> Shrubland +/- <i>Eucalyptus</i> spp.



Figure 13. *Acacia dodonaeifolia*, photographed by EBS Ecology while undertaking vegetation surveys of the Project Area in 2019.



Figure 14. *Acacia dodonaeifolia* Tall Shrubland in the Project Area (EBS Ecology, 2019).

6.2 *Acacia enterocarpa* (Jumping-jack Wattle)

6.2.1 Conservation status

Acacia enterocarpa (Figure 15) is listed as Endangered under the EPBC Act, due to its area of occupancy remaining less than 500 square km (km²) (Moritz & Bickerton, 2011). It is also listed as Endangered under the NPW Act.

6.2.2 Ecology

Biology

Acacia enterocarpa (Figure 15) is a perennial shrub growing to 1.5 m in height. It is typically dense and prickly, with straight to slightly curved phyllodes 2-4.5 cm long and 1 mm wide. Phyllodes usually have a rigid, sharp reddish-brown tip (Pobke, 2007).

Flowering has been documented from May to October, with inflorescences growing from the joint between phyllode and stem, generally in pairs. The plant is likely to be wind or insect pollinated, although this is unknown. The seed pod is distinct, growing in a shape resembling a jumping-jack firecracker (Pobke, 2007).

Habitat

On the Eyre Peninsula, *Acacia enterocarpa* has been recorded on mottled-yellow duplex soils in the south and on red calcareous red duplex soils and dense brown loams in the north. Sub-populations occur within several mallee associations, including *Eucalyptus calycogona* (Square-fruited Mallee), *Eucalyptus Dumosa* (White Mallee), *Eucalyptus gracilis* (White Mallee), *Eucalyptus incrassata* (Ridge-fruited Mallee), *Eucalyptus peninsularis* (Cummins Mallee) and *Eucalyptus socialis* (Red Mallee). Sites generally have an understorey of *Melaleuca uncinata* (Broombush) and/or *Melaleuca lanceolata* (Dryland Teatree) (Moritz & Bickerton, 2011).

6.2.3 Occurrence in the Project Area

Acacia enterocarpa was recorded in the Project Area by EBS Ecology (2014), but not in subsequent surveys in 2019 (EBS Ecology, 2019a). The species was recorded at three locations in roadside reserves east of Ungarra and south-east of Mount Hill in the following Vegetation Associations:

- *Eucalyptus odorata* +/- *Eucalyptus pileata* Mallee over *Acacia imbricata* and *Melaleuca uncinata* (Figure 16).
- *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee over *Gahnia deusta* and herbaceous annual species.

Locations of records are mapped in Figure 2 and shown in Table 10.

Table 10. Location of known populations of *Acacia enterocarpa* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 598033E 6215960N	8	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> and <i>Melaleuca uncinata</i> .
53H 598303E 6216312N	18	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> and <i>Melaleuca uncinata</i> .
53H 604529E 6228597N	2	<i>Eucalyptus peninsularis</i> +/- <i>Eucalyptus dumosa</i> Mallee over <i>Gahnia deusta</i> and herbaceous annual species.



Figure 15. *Acacia enterocarpa* flowers, photographed during targeted surveys undertaken by EBS Ecology in 2013.



Figure 16. *Eucalyptus odorata* +/- *Eucalyptus pileata* Mallee over *Acacia imbricata* and *Melaleuca uncinata*, in which the majority of *Acacia enterocarpa* were recorded.

6.3 *Acacia hexaneura* (Six-nerve Wattle)

6.3.1 Conservation status

Acacia hexaneura (Figure 17) is listed under the NPW Act as Rare. It is confined to the north-eastern Eyre Peninsula and is endemic to South Australia (Government of South Australia, 2020b).

Acacia hexaneura is not listed as threatened under the EPBC Act.

6.3.2 Ecology

Biology and description

A rigid, prickly shrub no more than 1 m high and spreading to 2 m. The phyllodes are rigid, prickly and occur with the stems. They are distinctly six-veined, 5 – 17 mm long by 1 – 2 mm wide. The plant flowers in winter to spring, the globular, golden-yellow flower heads appearing from July to September (Government of South Australia, 2020b).

Habitat

Occurring on well drained sands and gravelly loams over limestone and ironstone, *Acacia hexaneura* is associated with mallee Vegetation Associations, often dominated by *Eucalyptus dumosa* and *Eucalyptus gracilis* with a shrubby understorey including *Melaleuca uncinata* (Government of South Australia, 2020b).

6.3.3 Occurrence in the Project Area

Acacia hexaneura was recorded in the Project Area in 2013 and 2019 at the locations listed in Table 11. It was found in two mallee Vegetation Associations in the central part of the Project Area:

- *Eucalyptus socialis* / *E. oleosa* / *E. brachycalyx* +/- *E. leptophylla* Mallee (Figure 18)
- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Melaleuca uncinata* and *Calytrix tetragona*

The locations of *Acacia hexaneura* records are mapped in Figure 3.

Table 11. Location of known populations of *Acacia hexaneura* in the Project Area. Location information from EBS Ecology (2014 and 2019). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of Plants	Vegetation Association
53H 657055E 6297000N	2	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee
53H 658859E 6298455N	>50	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee
53H 665088E 6303783N	40	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Melaleuca uncinata</i> and <i>Calytrix tetragona</i>
53H 668050E 6306150N	15	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Melaleuca uncinata</i> and <i>Calytrix tetragona</i>
53H 668118E 6306134N	1	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee
53H 665098E 6303785N	1	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee



Figure 17. *Acacia hexaneura*, photographed in the Project Area by EBS Ecology in 2013.



Figure 18. Typical habitat of *Acacia hexaneura* in the Project Area (EBS Ecology, 2019a).

6.4 *Acacia imbricata* (Feathery Wattle)

6.4.1 Conservation status

Acacia imbricata (Figure 19) is listed as Rare under the NPW Act. The plant is endemic to South Australia, its distribution limited to the southern Eyre Peninsula (Berkinshaw, 2010).

Acacia imbricata is not listed as threatened under the EPBC Act.

6.4.2 Ecology

Biology and description

A low shrub, dense and spreading, *Acacia imbricata* grows to 1 -2 m in height. Phyllodes are small, 10 - 15 mm long and 2 mm wide, flat with a single vein. Globular yellow flower heads appear in pairs during July to September. Seed pods are papery, light brown and usually straight (Berkinshaw, 2010).

Habitat

This species grows in forest, woodland and mallee in areas receiving 400 – 500 mm of rainfall annually. It mainly occurs in hard acidic to neutral soils.

6.4.3 Occurrence in the Project Area

Acacia imbricata was recorded at 16 locations in the Project Area in both 2013 and 2019 by EBS Ecology (Table 12). It occurs in the southern part of the Project Area in woodland and mallee Vegetation Associations, including those listed below:

- *Eucalyptus cladocalyx* Woodland / Open Woodland
- *Eucalyptus cladocalyx* Very Open Woodland over scattered native shrubs and exotics (Figure 20)
- *Eucalyptus incrassata* var. *angulosa* Mallee over *Melaleuca uncinata*
- *Eucalyptus odorata* +/- *Eucalyptus pileata* Mallee over *Acacia imbricata*, *Melaleuca uncinata* (Figure 21)

It occurs as an understorey shrub to a *Eucalyptus* spp. overstorey and is co-dominant in the shrub layer with *Melaleuca uncinata* in one Vegetation Association.

The locations of EBS Ecology records are mapped in Figure 2.

Table 12. Occurrences of *Acacia imbricata* in the Project Area. Location information from EBS Ecology 2014 and 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of Plants	Vegetation Association
53H 582616E 6188443N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 582625E 6188429N	>20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 582695E 6188416N	5	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 582748E 6188376N	15	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588547E 6198980N	>500	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590382E 6202271N	Throughout	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>
53H 589806E 6201267N	Throughout	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590982E 6203304N	Throughout	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588006E 6197882N	1	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 591772E 6204909N	Throughout	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>
53H 598133E 6215936N	Dominant shrub	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> , <i>Melaleuca uncinata</i>
53H 595350E 6211212N	Throughout	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>
53H 598303E 6216312N	Dominant shrub	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> , <i>Melaleuca uncinata</i>
53H 585854E 6193960N	Throughout	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 584130E 6191082N	>5	<i>Eucalyptus cladocalyx</i> Very Open Woodland over scattered native shrubs and exotics
53H 574927E 6165749N	>20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland



Figure 19. *Acacia imbricata* photographed in the Project Area by EBS Ecology in 2013.



Figure 20. Most locations of *Acacia imbricata* records are within *Eucalyptus cladocalyx* Woodland, as shown above.



Figure 21. *Acacia imbricata* is a co-dominant shrub in areas of *Eucalyptus odorata* +/- *Eucalyptus pileata* Mallee over *Acacia imbricata*, *Melaleuca uncinata*.

6.5 *Acacia pinguifolia* (Fat-leaf Wattle)

6.5.1 Conservation status

Acacia pinguifolia (Figure 22) is listed as Endangered under the EPBC Act and NPW Act.

Population are scattered on the Eyre Peninsula and include sites near Cummins, Wanilla, the Koppio Hills and Ungarra (Pound, Obst, How, & Bickerton, 2009).

6.5.2 Ecology

Biology and description

Acacia pinguifolia is a dense spreading shrub that grows to 1-2 m tall, spreading to 2-3 m wide. Numerous arching branches ascent from near ground level, with smooth reddish-brown branchlets and pale grey bark at the base of stems. Phyllodes are 1-3.5 mm long and 2-3 mm wide, light green, rigid, thick and fleshy. Inflorescences are solitary or in pairs, growing from the leaf axils. Flower-heads are deep yellow in colour.

Flowering has been observed from July to October, with pods ripening between November and January (Pound, Obst, How, & Bickerton, 2009).

Acacia pinguifolia appears to respond to fire with mass germination events, with mass recruitment observed after a fire in 2005 on Eyre Peninsula (Pound, Obst, How, & Bickerton, 2009).

Habitat

Acacia pinguifolia occurs on sandy or hard alkaline yellow duplex soils. Populations on the Eyre Peninsula are situated in undulating terrain with a westerly aspect. It occurs in various woodland, open woodland and shrubland Vegetation Associations, including (but not limited to) the following (Pound, Obst, How, & Bickerton, 2009):

- *Eucalyptus cladocalyx* mid-woodland
- *Eucalyptus behriana* +/- *Eucalyptus odorata* low open woodland
- *Eucalyptus calycogona* +/- *Eucalyptus dumosa* mid-mallee woodland
- *Melaleuca uncinata* tall open shrubland.

6.5.3 Occurrence in the Project Area

Populations of *Acacia pinguifolia* are scattered on the Eyre Peninsula and include sites near Cummins, Wanilla, the Koppio Hills and Ungarra (Pound, Obst, How, & Bickerton, 2009).

Acacia pinguifolia was recorded at one location in the Project Area, where 5 plants were present in roadside vegetation, as indicated in Table 13 and mapped in Figure 2.

It was recorded in roadside vegetation east of Koppio in Vegetation Association *Eucalyptus cladocalyx* Woodland / Open Woodland (Figure 23). At this site, the species occurs in association with *Acacia imbricata*, listed as Rare under the NPW Act.

Table 13. Location of known populations of *Acacia pinguifolia* in the Project Area. Location information from EBS Ecology (2014). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 582770E 6188334N	5	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland



Figure 22. *Acacia pinguifolia* photographed in the Project Area during targeted surveys undertaken by EBS Ecology in 2013.



Figure 23. *Eucalyptus cladocalyx* Woodland / Open Woodland in the Project Area, where *Acacia pinguifolia* was recorded.

6.6 *Acacia rhigiophylla* (Dagger-leaf Wattle)

6.6.1 Conservation status

Acacia rhigiophylla is listed as Rare under the NPW Act, occurring as two small, disjunct populations on the Eyre Peninsula and Murray regions.

The species is not listed as threatened under the EPBC Act.

6.6.2 Ecology

Biology and description

A stiff, prickly shrub growing to 2 m tall, *Acacia rhigiophylla* has stiff, shiny green phyllodes that are flattened with three raised veins on each face. Flowers are arranged in spherical heads of 3 – 10 flowers on short peduncles in the leaf axils. It flowers in spring and summer (Costermans, 1994).

Habitat

This species is found growing in areas of between 300 mm and 400 mm annual rainfall on alkaline red duplex or grey-brown calcareous loams. It occurs in open shrublands and mallee and is often associated with *Eucalyptus socialis* and *Eucalyptus gracilis* (Government of South Australia, 2020c).

6.6.3 Occurrence in the Project Area

Acacia rhigiophylla has been recorded at three locations in the Project Area (Table 14). It was recorded in Mallee and Tall Shrubland Vegetation Associations in the north of the Project Area, as listed below:

- *Eucalyptus socialis* / *E. oleosa* / *E. brachycalyx* +/- *E. leptophylla* Mallee (Figure 25),
- *Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *E. incrassata* +/- *E. brachycalyx*

Locations listed in Table 14 are mapped in Figure 3.

Table 14. Location of known populations of *Acacia rhigiophylla* in the Project Area. Location information from EBS Ecology 2014a and 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 659565E 6299131N	15	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee
53H 663770E 6302679N	30	<i>Eucalyptus socialis</i> / <i>E. oleosa</i> / <i>E. brachycalyx</i> +/- <i>E. leptophylla</i> Mallee
53H 680452E 6315984N	1	<i>Acacia wilhelmiana</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Eucalyptus gracilis</i> +/- <i>Melaleuca uncinata</i> Tall Shrubland over <i>Triodia</i> spp. +/- <i>E. incrassata</i> +/- <i>E. brachycalyx</i>



Figure 24. *Acacia rhigiophylla*, photographed by EBS Ecology in 2013.



Figure 25. Most occurrences of *Acacia rhigiophylla* in the Project Area are in *Eucalyptus socialis* / *E. oleosa* / *E. brachycalyx* +/- *E. leptophylla* Mallee.

6.7 Management of Threats to Acacia Species

Known threats to the *Acacia* species discussed above have been identified in the following documents:

- *Recovery Plan for the Endangered Jumping-Jack Wattle Acacia enterocarpa (2011)* (Moritz & Bickerton, 2011)
- *Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia 2007-2012* (Pobke, 2007)
- *Draft Recovery Plan for *Acacia pinguifolia* (Fat-leaved Wattle)* (Pound, Obst, How, & Bickerton, 2009)

These documents cover extensively the threats impacting on the two EPBC listed threatened species *Acacia enterocarpa* and *Acacia pinguifolia*. These are listed in Table 15. These threats include threatening processes that are understood to be widely impacting on threatened plants in fragmented landscapes, but also includes more species-specific threats such as mining.

While there is no formal documentation of threats to the remaining NPW Act listed species, it is assumed that they are impacted by similar widespread threatening processes but are probably not impacted by more specific threats. This is based on the following:

- All species described above are shrubs found in woodland, open woodland and mallee habitats.
- All occur within a highly cleared and fragmented landscape, except *Acacia rhigiophylla*. This species occurs in the north of the Project Area, where native vegetation is more widespread.
- Due to current and past land use in the Project Area, threatening processes such as weed invasion, changed fire regimes, grazing and habitat loss and fragmentation are widespread.

Table 15 identifies 11 threats as impacting on threatened *Acacia* species. Of these, the following six have the potential to be exacerbated by the Project:

- Disease,
- Weed invasion,
- Inappropriate disturbance and fire regimes,
- Grazing,
- Vegetation clearing and habitat fragmentation,
- Spray drift.

How these threats are potentially impacted by the Project is discussed in Table 15.

The management of threats that are exacerbated by the construction phase of the Project will be managed by implementing management actions also listed in Table 15. While ElectraNet has endeavoured to avoid impact wherever possible, these management actions aim to minimise impact where it cannot be avoided.

Management Actions are described in detail in Section 15.

Table 15. Threats to *Acacia* species exacerbated by the Project and management actions to minimise the impact of construction.

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Poor recruitment ^{1, 2}	<i>Acacia enterocarpa</i>	<ul style="list-style-type: none"> Anecdotal information suggests that although Eyre Peninsula populations of <i>Acacia enterocarpa</i> contain healthy plants, there is poor seed set and very few juvenile plants present¹. 	<p>No.</p> <ul style="list-style-type: none"> It is unlikely that any action undertaken as part of the Proposal would influence recruitment in <i>Acacia enterocarpa</i>. 	Not exacerbated by the Project.
Small population size ^{1, 2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> <i>Acacia enterocarpa</i> and <i>Acacia pinguifolia</i> are found only in small, isolated sub-populations, although were likely more widespread before land clearing.^{1, 3} Small, isolated populations are increasingly vulnerable to extinction by single events such as wildfire.¹ Other threatened <i>Acacia</i> species in the Project Area are also likely to exist in small, disjunct populations due to historical land clearing. 	<p>No.</p> <ul style="list-style-type: none"> The Proposal does not include any actions that would decrease the size of any population. 	Not exacerbated by the Project.
Disease ^{1, 2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> The Project Area falls within the known and/or potential range of <i>Phytophthora</i> species. <i>Phytophthora</i> spp. are known to infect <i>Acacia</i> spp., eventually killing infected plants.^{1, 2} All threatened <i>Acacia</i> species have the potential to be impacted by <i>Phytophthora</i>. 	<p>Yes.</p> <ul style="list-style-type: none"> Vehicles, machinery and personnel may act as a vector of spread for <i>Phytophthora</i> if carrying contaminated soil. Contaminated construction materials brought into the Project Area (e.g. contaminated gravel/fill/sand) is a potential vector of spread. 	<p>1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11</p>
Road and rail management activities ^{1, 2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> Some populations of threatened <i>Acacia</i> occur within road and rail corridors. Ongoing maintenance of road and rail infrastructure, including vegetation management, potentially remove plants and magnify the impacts of other threats such as weed invasion and spray drift.¹ 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include the maintenance of any road and/or rail corridors. 	Not exacerbated by the Project.
Weed invasion ^{1, 2, 3}	<i>Acacia dodonaeifolia</i>	<ul style="list-style-type: none"> Competition with weed species, including <i>Asparagus asparagoides</i> (Bridal Creeper), 	Yes.	<p>1.1 1.2</p>

Threat	Species	Discussion	Exacerbated by the Project	Management Action
	<i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<i>Oxalis pes-caprae</i> (Soursob), <i>Asparagus declinatum</i> (Bridal Veil), <i>Scabiosa atropurpurea</i> (Scabious) and <i>Ehrharta calycina</i> (Perennial Veldt Grass), is a major threat to small, isolated <i>Acacia</i> sp. populations. ^{1,2} <ul style="list-style-type: none"> This competition potentially reduces the ability of the shrubs to establish from seed and potentially increases the frequency and intensity of wildfires due to increased fuel loads.² 	<ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.3</p> <p>1.4</p> <p>1.5</p> <p>1.6</p> <p>1.7</p> <p>1.8</p> <p>1.9</p> <p>1.10</p> <p>1.11</p>
Grazing ^{1, 2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> It is assumed that grazing by stock, rabbits and kangaroos impacts <i>Acacia</i> sp. by reducing recruitment and facilitating the spread of invasive weeds.^{1,3} Sheep grazing of adult <i>Acacia pinguifolia</i> has been observed within some populations.² 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	
Inappropriate site disturbance and fire regimes ^{1, 2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> Disturbance requirements for the relevant species are not well known, however <i>Acacia</i> species are generally early colonisers that require a disturbance event to plant reproduction and recruitment.¹ Long periods between disturbances are expected to result in successional decline in the populations of some species.² Disturbance too soon following a germination event could result in population failure and local extinction.² 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition. 	<p>2.1</p> <p>2.2</p> <p>2.3</p> <p>2.4</p> <p>2.5</p> <p>2.6</p> <p>2.7</p> <p>2.8</p> <p>3.1</p> <p>3.2</p> <p>3.5</p> <p>3.6</p> <p>3.8</p>
Mining ¹	<i>Acacia enterocarpa</i>	<ul style="list-style-type: none"> Some areas where <i>Acacia enterocarpa</i> occurs have been subjected to historical mining and extraction activities.¹ 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any mining or extraction activity. 	Not exacerbated by the Project.

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Vegetation clearing and habitat fragmentation ^{2, 3}	<i>Acacia dodonaeifolia</i> <i>Acacia enterocarpa</i> <i>Acacia hexaneura</i> <i>Acacia imbricata</i> <i>Acacia pinguifolia</i> <i>Acacia rhigiophylla</i>	<ul style="list-style-type: none"> Land clearing has drastically reduced the area of land potentially suitable as habitat for all species listed and has caused isolation and fragmentation of populations.^{1, 2, 3} Further clearing of land would increase this impact 	<p>Yes.</p> <ul style="list-style-type: none"> Vegetation clearing, although kept to the minimum possible, is required as part of the Project. Any clearing of native vegetation exacerbates threats associated with clearing of habitat and fragmentation. 	3.1
				4.1
				4.2
				4.3
				4.4
				4.8
				4.9
				4.10
4.11				
4.12				
4.13				
4.14				
Salinity / changes in hydrology ²	<i>Acacia enterocarpa</i>	<ul style="list-style-type: none"> Alteration to drainage and riparian zones is thought to have a high impact on <i>Acacia enterocarpa</i> populations that occur in drainage areas.² 	<p>No.</p> <ul style="list-style-type: none"> The Project does not impact on any riparian or drainage areas. The <i>Acacia enterocarpa</i> populations within the Project Area are not situated in a drainage area. 	Not exacerbated by the Project.
Spray drift ^{2, 3}	<i>Acacia pinguifolia</i>	<ul style="list-style-type: none"> Populations occur adjacent farmland used for cropping. Spray drift from herbicide use on crops may occur. Similarly, herbicide used for vegetation, weed and fire management within road and rail reserves may also impact plants.³ 	<p>Yes.</p> <ul style="list-style-type: none"> Use of herbicide for weed control associated with the Project may exacerbate this threat if used near threatened <i>Acacias</i>. 	5.1 5.2 5.3

1: *Recovery Plan for the Endangered Jumping-Jack Wattle Acacia enterocarpa (2011)* (Moritz & Bickerton, 2011).

2: *Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia 2007-2012* (Pobke, 2007).

3: *Draft Recovery Plan for Acacia pinguifolia (Fat-leaved Wattle)* (Pound, Obst, How, & Bickerton, 2009).

7 SHRUBS OF WOODLANDS AND MALLEE

Within mallee and woodland habitats, covering several Vegetation Associations, there are 12 threatened shrub species that have been recorded in the Project Area. Two are listed as threatened under the EPBC Act and NPW Act (*Olearia pannosa* ssp. *pannosa* and *Pultenaea trichophylla*), while the remaining 9 species are listed under the NPW Act only.

They range from low shrubs, less than 1 m in height occurring, in heathy understorey, to taller shrubs of over 1 m. Many are threatened by habitat fragmentation, grazing activity and vegetation management, such as maintenance of road and rail corridors. Some have not previously had threats assessed in detail.

The threatened shrubs covered in this section are listed below.

- *Daviesia benthamii* ssp. *humilis* (Mallee Bitter-pea)
- *Daviesia pectinata* (Zig-zag Bitter-pea)
- *Eremophila gibbifolia* (Coccid Emubush)
- *Goodenia benthamiana* (Bentham's Goodenia)
- *Olearia adenolasia* (Musk Daisy-bush)
- *Olearia pannosa* ssp. *pannosa*
- *Philotheca angustifolia* ssp. *angustifolia* (Narrow-leaf Wax-flower)
- *Prostanthera chlorantha* (Green Mintbush)
- *Pultenaea trichophylla* (Tufted Bush-pea)
- *Spyridium bifidum* var. *bifidum* (Forked Spyridium)
- *Spyridium leucopogon* (Silvery Spyridium)
- *Spyridium spathulatum* (Spoon-leaf Spyridium)

7.1 *Daviesia benthamii* ssp. *humilis* (Mallee Bitter-pea)

7.1.1 Conservation Status

Daviesia benthamii ssp. *humilis* (Figure 26) is listed as Rare under the NPW Act in South Australia. The species is not listed as threatened under the EPBC Act.

7.1.2 Ecology

Biology and description

Daviesia benthamii ssp. *humilis* is a dense, multi-stemmed shrub, growing to 0.6 m in height. The plant has phyllodes that are terete and rigid, 5 – 30 mm long and 1 – 2 mm in diameter. Flowering occurs in September and October, with racemes of 4 – 6 flowers (Royal Botanic Gardens and Domain Trust, 2020a).

Habitat

Daviesia benthamii ssp. *humilis* grows in mallee on calcareous sandy or loamy soils.

7.1.3 Occurrence in the Project Area

Daviesia benthamii ssp. *humilis* is likely to occur in the Project Area between Hinks and Ironstone Hill Conservation Parks. Vegetation Associations in which it might occur include:

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee.
- *Eucalyptus diversifolia* +/- *Eucalyptus incrassata* Mallee over exotics and *Enchylaena tomentosa*.
- *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee over *Enchylaena tomentosa* and emergents (Figure 27).
- *Eucalyptus incrassata* +/- *Melaleuca uncinata* +/- *Melaleuca lanceolata* Mallee over *Ehrharta calycina*.
- *Eucalyptus incrassata* +/- *Melaleuca uncinata* +/- *Melaleuca lanceolata* Mallee.
- *Eucalyptus calycogona* ssp. *calycogona* +/- *Eucalyptus phenax* ssp. *phenax* Mallee over *Maireana brevifolia* and exotics.
- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Melaleuca uncinata* and *Calytrix tetragona*.



Figure 26. *Daviesia benthamii* ssp. *humilis*, photographed in the Project Area by EBS Ecology in 2013.



Figure 27. *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee, likely habitat for *Daviesia benthamii* ssp. *humilis*.

7.2 *Daviesia pectinata* (Zig-zag Bitter-pea)

7.2.1 Conservation Status

Daviesia pectinata (Figure 28) is listed as Rare under the NPW Act and is not listed as threatened under the EPBC Act.

7.2.2 Ecology

Biology and description

Daviesia pectinata is a rigid shrub to 1.5 m high. The phyllodes are flattened laterally, lanceolate tapering into a sharp point and up to 5 cm long. Flowers occur in axillary racemes of up to 10 buds and are orange-red in colour. The plant generally flowers in spring, from September to November (Government of South Australia, 2020d).

Habitat

This species grows in mallee and woodlands on dry stony or sandy soils (Royal Botanic Gardens Foundation Victoria, 2020a).

7.2.3 Occurrence in the Project Area

Daviesia pectinata occurs at 16 locations in the south of the Project Area (Table 16). It occurs in four woodland and mallee Vegetation Associations, as listed below:

- *Eucalyptus cladocalyx* Woodland / Open Woodland
- *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata*
- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee (Figure 29)
- *Eucalyptus peninsularis* +/- *Eucalyptus Dumosa* Mallee over *Gahnia deusta* and herbaceous annual spp.

Most locations were in road and rail corridor remnant vegetation, such as that shown in Figure 29. The locations of records collected by EBS Ecology are mapped in Figure 2.

Table 16. Location of known populations of *Daviesia pectinata* in the Project Area. Location information from EBS Ecology (2014 and 2019a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 588679E 6199154N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588816E 6199333N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588731E 6199358N	15	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588778E 6199383N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588833E 6199475N	>100	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588941E 6199542N	>50	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590702E 6202839N	30	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 595330E 6211140N	5	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>
53H 595366E 6211227N	6	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>
53H 598312E 6216335N	3	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> , <i>Melaleuca uncinata</i>
53H 598290E 6216385N	5	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> , <i>Melaleuca uncinata</i>
53H 601106E 6221802N	2	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee

Location	Number of plants	Vegetation Association
53H 601064E 6221811N	5	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 601061E 6221823N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 602996E 6225493N	1	<i>Eucalyptus peninsularis</i> +/- <i>Eucalyptus Dumosa</i> Mallee over <i>Gahnia deusta</i> and herbaceous annual spp.
53H 602897E 6225543N	1	<i>Eucalyptus peninsularis</i> +/- <i>Eucalyptus Dumosa</i> Mallee over <i>Gahnia deusta</i> and herbaceous annual spp.



Figure 28. *Daviesia pectinata*, photographed in the Project Area by EBS Ecology in 2013.



Figure 29. In the Project Area, *Daviesia pectinata* often occurs in roadside vegetation, such as *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee (photograph by EBS Ecology 2019a).

7.3 *Eremophila gibbifolia* (Coccid Emubush)

7.3.1 Conservation Status

Eremophila gibbifolia is listed as Rare under the NPW Act in South Australia. The plant is not threatened under the EPBC Act.

7.3.2 Ecology

Biology and description

Eremophila gibbifolia is a small shrub under 1 m high. The alternate leaves are very small (2-5 mm long and 1-2 mm wide), club-shaped and thick and warty. The lilac flowers are tube-shaped with a corolla up to 10.5 mm long (Royal Botanic Gardens Foundation Victoria, 2020d).

Flowering mainly occurs in August to January (Royal Botanic Gardens Foundation Victoria, 2020d).

Habitat

This species occurs in mallee, usually on sandy or sandy loam soils (Royal Botanic Gardens Foundation Victoria, 2020d).

7.3.3 Occurrence in the Project Area

Three records of *Eremophila gibbifolia* were collected in the Project Area by EBS Ecology in 2013 and 2019, as listed in Table 17. All occurred in *Eucalyptus cladocalyx* Woodland / Open Woodland (Figure 31) in the southern part of the Project Area (Figure 2).

Table 17. Location of known populations of *Daviesia benthamii* ssp. *humilis* in the Project Area. Location information from EBS Ecology (2014). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 585844E 6193976N	>5	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 585921E 6194090N	50	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588759E 6199194N	2	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland



Figure 30. *Eremophila gibbifolia*, photographed in the Project Area by EBS Ecology in 2013.



Figure 31. *Eucalyptus cladocalyx* Woodland / Open Woodland in the Project Area, habitat for *Eremophila gibbifolia* (photograph by EBS Ecology 2019a).

7.4 *Goodenia benthamiana* (Bentham) s *Goodenia*)

7.4.1 Conservation Status

Listed as Rare under the NPW Act, *Goodenia benthamiana* (Figure 32).

Goodenia benthamiana is not listed as threatened under the EPBC Act.

7.4.2 Ecology

Biology and description

Goodenia benthamiana is a small understorey shrub growing to only 40 cm tall. It is aromatic when crushed and has erect terete or sometimes slightly ridged stems. The ovate leaves, 0.8-2.5 cm long, are covered in short hairs and clasp the stem (Government of South Australia, 2020e).

Flowering in spring to summer, the flowers are yellow and occur in terminal racemes, having the typical *Goodenia* shape, as shown in Figure 32.

Habitat

Goodenia benthamiana is usually found in open forest, woodland and mallee Vegetation Associations.

7.4.3 Occurrence in the Project Area

In 2013 and 2019, EBS Ecology recorded *Goodenia benthamiana* at 13 locations in the Project Area, as listed in Table 18. All locations are in Mallee (Figure 33), including the following four Vegetation Associations:

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee,
- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Melaleuca uncinata* and *Calytrix tetragona*,
- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Leptospermum coriaceum*, *Phebalium bullatum*, *Triodia* spp. and *Calytrix tetragona*,
- *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee.

Records included single plants and groups of several individuals. The locations of EBS Ecology records of *Goodenia benthamiana* are mapped in Figure 3.

Table 18. Location of known populations of *Goodenia benthamiana* in the Project Area. Location information from EBS Ecology (2014 and 2019a). Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 659359E 6298998N	5	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 659707E 6299293N	4	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660695E 6300124N	15	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660728E 6300185N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660898E 6300252N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660808E 6300285N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660898E 6300362N	10	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 661025E 6300387N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 661145E 6300478N	4	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 664069E 6303021N	1	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 665078E 6303781N	1	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Melaleuca uncinata</i> and <i>Calytrix tetragona</i>
53H 666896E 6305162N	>5	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Leptospermum coriaceum</i> , <i>Phebalium bullatum</i> , <i>Triodia</i> spp. and <i>Calytrix tetragona</i>
53H 672817E 6309897N	3	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee



Figure 32. *Goodenia benthamiana*, photographed in the Project Area by EBS in 2019.



Figure 33. The habitat of *Goodenia benthamiana* in the Project Area (photograph by EBS Ecology2019a).

7.5 *Olearia adenolasia* (Musk Daisy-bush)

7.5.1 Conservation Status

Listed as Rare under the NPW Act, *Olearia adenolasia* (Figure 34).

The species is not listed as threatened under the EPBC Act.

7.5.2 Ecology

Biology and description

A small understorey shrub to 50 cm high, *Olearia adenolasia* has erect, woody stems. The sessile leaves are crowded and linear being up to 14 mm long and 1.5 mm wide. They are deep green above and covered with velvety hairs (Government of South Australia, 2020f).

Flowers consist of 9-15 white to blue ray florets and 20-25 disk florets that are yellow in colour. Flowers usually occur from August until October (Government of South Australia, 2020f).

Habitat

The typical habitat for this species is sandy soils in mallee Vegetation Associations (Government of South Australia, 2020f).

7.5.3 Occurrence in the Project Area

Olearia adenolasia occurs as an understorey low shrub in two mallee Vegetation Associations in the Project Area (Figure 35):

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee,
- *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee.

It was recorded by EBS Ecology in 2013 at 10 locations. In suitable habitat, the species was relatively common, with over 1000 plants at one location (Table 19). The species occurs in the following Vegetation Associations. The locations of EBS Ecology records are mapped in Figure 3.

Table 19. Location of known populations of *Olearia adenolasia* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 659357E 6299010N	19	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 659707E 6299293N	>1000	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660560E 6299959N	20	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660629E 6300038N	>500	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660693E 6300104N	>200	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660814E 6300198N	>150	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660772E 6300257N	20	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 660962E 6300329N	150	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee
53H 671858E 6309101N	>200	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee
53H 671913E 6309241N	10	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee



Figure 34. *Olearia adenolasia*, photographed in the Project Area by EBS Ecology in 2013.



Figure 35. Mallee vegetation in the Project Area, where *Olearia adenolasia* occurs (photograph by EBS Ecology 2019a).

7.6 *Olearia pannosa* ssp. *pannosa* (Silver Daisy-bush)

7.6.1 Conservation status

Olearia pannosa ssp. *pannosa* (Figure 36) is listed as Vulnerable under the EPBC Act. Populations on Eyre Peninsula are severely fragmented, with an estimated area of occurrence of less than 5000 km². Elsewhere, the species occurs in the Mount Lofty Ranges, Yorke Peninsula and south-east South Australia. Interstate, populations are found in Victoria and New South Wales (Pobke, 2007).

The species is also listed as Vulnerable under the NPW Act.

7.6.2 Ecology

Biology and description

Olearia pannosa ssp. *pannosa* is a low spreading shrub less than 1.5 m tall. The leaves, 3-9 cm long and 1.5-5 cm wide, are shiny above and white to rusty hairy below. Ray florets are usually white, although may be pale mauve, with yellow disk florets, with the plant flowering from August to October (Department for Environment and Heritage, 2008a).

Olearia pannosa ssp. *pannosa* is a long-lived perennial species, some plants thought to be over 100 years old. Adult plants shoot from any stems that lie in contact with the ground, often making the assessment of the number of plants at a location difficult (Department for Environment and Heritage, 2008a).

Habitat

This species grows on hill slopes with hard mottled-yellow and red duplex soils. It occurs in mallee, woodland and forest vegetation communities, often in association with *Eucalyptus cladocalyx*, *Allocasuarina verticillata* and *Melaleuca uncinata* (Pobke, 2007).

7.6.3 Occurrence in the Project Area

Three occurrences of *Olearia pannosa* ssp. *pannosa* in the Project Area have been recorded by EBS Ecology, in both 2013 and 2019 surveys (Table 20). The species was found in *Eucalyptus cladocalyx* Woodland and Very Open Woodland, such as that pictured earlier in Figure 31.

The species was recorded as single plants in the south of the Project Area, as shown in Figure 2, although 50 plants were recorded at one location (Table 20).

Table 20. Location of known populations of *Olearia pannosa* ssp. *pannosa* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 583549E 6189864N	1	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 587450E 6197050N	1	<i>Eucalyptus cladocalyx</i> Very Open Woodland over scattered native shrubs and exotics
53H 587784E 6198166N	50	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland



Figure 36. *Olearia pannosa* ssp. *pannosa*, photographed in the Project Area by EBS Ecology in 2013.

7.7 *Pultenaea trichophylla* (Tufted Bush-pea)

7.7.1 Conservation status

Pultenaea trichophylla (Figure 37) is listed as Endangered under the EPBC Act.

Pultenaea trichophylla is also listed as Rare under the NPW Act.

7.7.2 Ecology

Biology and description

Pultenaea trichophylla is a small slender shrub with reddish branches that are covered with white curly hairs when young. Leaves occur crowded at the end of small branchlets and are 8-10 mm long by 1-1.5 mm wide, lanceolate, hairless above but with long, soft hairs beneath (Department of Agriculture, Water and the Environment, 2020c).

Small yellow pea flowers, approximately 7 mm long, grow at the tips of short branchlets between November and February. Mass germination has been recorded after fire followed by good rain at one population (Pobke, 2007).

Habitat

Found in open woodland on hill crests, undulating plains and in gullies, *Pultenaea trichophylla* grows in pale brown or grey, acidic sandy clay-loam over ironstone. It also occurs in hard, red-brown gravelly clay-loam over laterite with outcroppings of quartzite. It is often associated with *Eucalyptus cladocalyx* and *Melaleuca uncinata* (Pobke, 2007).

7.7.3 Occurrence in the Project Area

The species is endemic to the Eyre Peninsula where it occurs as severely fragmented populations. Its area of occupancy is estimated to be less than 2000 km², with a continuing decline in population size (Pobke, 2007).

Pultenaea trichophylla occurs at 12 locations within the current Project Area (EBS Ecology 2014 and 2019a) (Table 21). It occurs in three *Eucalyptus* spp. dominated woodland and mallee Vegetation Associations and *Allocasuarina verticillata* woodland in the vegetation associations listed below:

- *Allocasuarina verticillata* Low Woodland (Figure 38),
- *Eucalyptus cladocalyx* Woodland / Open Woodland,
- *Eucalyptus incrassata* var. *angulosa* Mallee over *Melaleuca uncinata*,
- *Melaleuca uncinata* Shrubland,
- *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata*.

Table 21. Location of known populations of *Pultenaea trichophylla* in the Project Area. Location information from EBS Ecology 2014. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of plants	Vegetation Association
53H 589610E 6200772N	50	<i>Allocasuarina verticillata</i> Low Woodland
53H 589796E 6201260N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 589760E 6201058N	>1000	<i>Allocasuarina verticillata</i> Low Woodland
53H 589755E 6201129N	20	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590333E 6202176N	150	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i> (B5)
53H 590377E 6202191N	30	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>
53H 590393E 6202211N	Throughout	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>
53H 590398E 6202231N	3	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>
53H 590603E 6202704N	1	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590625E 6202755N	3	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 590663E 6202822N	4	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 594210E 6209214N	100	<i>Melaleuca uncinata</i> Shrubland (now outside the current Project Area)
53H 594246E 6209276N	70	<i>Melaleuca uncinata</i> Shrubland (now outside the current Project Area)
53H 594309E 6209439N	>100	<i>Melaleuca uncinata</i> Shrubland (now outside the current Project Area)
53H 595322E 6211157N	2	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>



Figure 37. *Pultenaea trichophylla*, photographed in the Project Area by EBS Ecology in 2013.



Figure 38. *Allocasuarina verticillata* Low Woodland, one Vegetation Association where *Pultenaea trichophylla* occurs (photograph by EBS Ecology 2019a).

7.8 *Philotheca angustifolia* ssp. *angustifolia* (Narrow-leaf Wax-flower)

7.8.1 Conservation Status

Philotheca angustifolia ssp. *angustifolia* is listed as Rare under the NPW Act.

Philotheca angustifolia ssp. *angustifolia* is not listed as threatened under the EPBC Act.

7.8.2 Ecology

Biology and description

Philotheca angustifolia ssp. *angustifolia* is a small shrub to 60 cm high with warty branchlets and corky older branches. Leaves are small, 2-10 mm long and 0.5-0.8 mm wide, terete, rounded at the apex and glandular-warty. The terminal inflorescences are up to 4-flowered with white to pink petals 5-9 mm long. Flowering occurs mainly in spring, but has been recorded sporadically throughout the year (Government of South Australia, 2020g).

Habitat

Philotheca angustifolia ssp. *angustifolia* occurs in mallee on sandy soils (Royal Botanic Gardens Foundation Victoria, 2020b).

7.8.3 Occurrence in the Project Area

The species occurs as single plants in two locations in the south of the Project Area (EBS Ecology 2014 and 2019a), as shown in Table 22 and mapped in Figure 2. It has been recorded in two woodland vegetation associations:

- *Eucalyptus cladocalyx* Woodland / Open Woodland,
- *Allocasuarina verticillata* Low Woodland (Figure 39).

Table 22. Location of known populations of *Philothea angustifolia* ssp. *angustifolia* in the Project Area. Location information from EBS Ecology (2014). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 585870E 6193981N	2	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 589600E 6200900N	20	<i>Allocasuarina verticillata</i> Low Woodland



Figure 39. *Allocasuarina verticillata* Low Woodland, one Vegetation Association where *Philothea angustifolia* ssp. *angustifolia* occurs in the Project Area.

7.9 *Prostanthera chlorantha* (Green Mintbush)

7.9.1 Conservation Status

Prostanthera chlorantha (Figure 40) is listed as Rare under the NPW Act.

The species is not listed as threatened under the EPBC Act.

7.9.2 Ecology

Biology and description

Prostanthera chlorantha grows as a wiry, irregularly branched shrub generally less than 1 m high. Tiny, egg-shaped leaves occur at widely spaced intervals along short side branches. The leaves are covered with small, branching hairs. Flowering occurs between August and January, the corolla being tube-shaped, 15-25 mm long pale green, green-red to mauve (Government of South Australia, 2020h).

Habitat

Growing as small populations of a few scattered plants, *Prostanthera chlorantha* occurs on sandy and loamy soils. It is often associated with *Banksia*, *Daviesia* and *Leptospermum* shrubland (Department for Environment and Heritage, 2008b).

7.9.3 Occurrence in the Project Area

Endemic to South Australia, *Prostanthera chlorantha* occurs in the Eyre Peninsula, Murray Lands, Southern Lofty and Kangaroo Island regions (Department for Environment and Heritage, 2008b).

Within the Project Area, *Prostanthera chlorantha* occurs at two locations in the south (EBS Ecology, 2014a), as listed in Table 23 and mapped in Figure 2. The species occurs in road corridors in two mallee and shrubland Vegetation Associations:

- *Eucalyptus odorata* +/- *Eucalyptus pileata* Mallee over *Acacia imbricata*, *Melaleuca uncinata*,
- *Melaleuca uncinata* Shrubland (Figure 41).

Table 23. Location of known populations of *Daviesia benthamii* ssp. *humilis* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 598308E 6216324N	1	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> Mallee over <i>Acacia imbricata</i> , <i>Melaleuca uncinata</i>
53H 598996E 6217932N	1	<i>Melaleuca uncinata</i> Shrubland



Figure 40. *Prostanthera chlorantha*, photographed in the Project Area by EBS Ecology in 2013.



Figure 41. *Melaleuca uncinata* Shrubland in which *Prostanthera chlorantha* occurs (photograph by EBS Ecology 2019a).

7.10 *Spyridium bifidum* ssp. *bifidum* (Forked Spyridium)

7.10.1 Conservation Status

Spyridium bifidum ssp. *bifidum* (Figure 42) is listed as Vulnerable under the NPW Act.

The species is not listed as threatened under the EPBC Act.

7.10.2 Ecology

Biology and description

Spyridium bifidum var. *bifidum* is a small shrub with slender, erect branches to 2 m high. Young stems are densely covered with white or greyish short hairs. Alternate leaves are Y-shaped, revolute, with a green upper surface covered in dense white hairs. The leaves are 3.2-10 mm long by 1.9-5 mm wide (Kellermann & Barker, 2012).

Flowering in June to September, the inflorescence is a dense globular head (10-12 mm diameter) of white flowers, covered in dense, long hairs. The 5-8 floral leaves are broader than the stem leaves and covered in a very dense white stellate (Kellermann & Barker, 2012).

Habitat

Typical habitat of *Spyridium bifidum* ssp. *bifidum* includes open mallee shrubland on sandy soils with quartzite and laterite (Kellermann & Barker, 2012).

7.10.3 Occurrence in the Project Area

Spyridium bifidum ssp. *bifidum* occurs only on Eyre Peninsula (Kellermann & Barker, 2012). The species was recorded by EBS Ecology in 2013 in an area now outside the Project Area (Table 24 and Figure 2). It was not recorded during surveys in the current Project Area in 2019. However, it is likely that the species occurs in *Melaleuca uncinata* Shrubland Vegetation Associations (Figure 43), where it was recorded in 2013.

Table 24. Location of known populations of *Spyridium bifidum* var. *bifidum* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 594302E 6209441N	Not counted	<i>Melaleuca uncinata</i> Shrubland
53H 594246E 6209276N	Not counted	<i>Melaleuca uncinata</i> Shrubland



Figure 42. *Spyridium bifidum* var. *bifidum*, photographed in the Project Area by EBS Ecology in 2013.



Figure 43. *Melaleuca uncinata* Shrubland in which *Spyridium bifidum* var. *bifidum* was recorded in 2013.

7.11 *Spyridium leucopogon* (Silvery Spyridium)

7.11.1 Conservation Status

Spyridium leucopogon (Figure 44) is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

7.11.2 Ecology

Biology and description

Spyridium leucopogon is a small slender shrub with narrow linear leaves, 3-6 mm long and 0.5-0.75 mm wide. Leaves are revolute, hiding the under surface, glabrous and often crowded so as to hide the branches. Flower occur in heads, 5-10 mm in diameter, and appear very white and woolly. They are surrounded by two or three white, hairy floral leaves that are broader than the stem leaves (Government of South Australia, 2020i).

Habitat

Spyridium leucopogon occurs in woodland and mallee habitats (Government of South Australia, 2020i).

7.11.3 Occurrence in the Project Area

Endemic to the Eyre Peninsula, *Spyridium leucopogon* occurs in the south of the Project Area at three locations in mallee and shrubland Vegetation Associations (Table 25) (EBS Ecology 2014a and 2019a). All locations are in the south of the Project Area, with populations ranging in size from one to 25 plants.

The plant has been found in two vegetation associations in the Project Area:

- *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata* (Figure 45),
- *Melaleuca uncinata* Shrubland.

The locations of EBS Ecology records are indicated on the map in Figure 2.

Table 25. Location of known populations of *Daviesia benthamii* ssp. *humilis* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 581367E 6185823N	10	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>
53H 594246E 6209276N	1	<i>Melaleuca uncinata</i> Shrubland (now outside the current Project Area)
53H 594302E 6209441N	3	<i>Melaleuca uncinata</i> Shrubland (now outside the current Project Area)
53H 598984E 621929N	8	<i>Melaleuca uncinata</i> Shrubland
53H 599114E 6217941N	25	<i>Melaleuca uncinata</i> Shrubland



Figure 44. *Spyridium leucopogon*, photographed in the Project Area by EBS Ecology in 2013.



Figure 45. *Spyridium leucopogon* occurs in *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata*.

7.12 *Spyridium spathulatum* (Spoon-leaf *Spyridium*)

7.12.1 Conservation Status

Spyridium spathulatum is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

7.12.2 Ecology

Biology and description

Spyridium spathulatum is an erect shrub to 2 m tall. The alternate leaves are obovate, 5-15 mm long and 2-6 mm wide. They are smooth green or silky-hairy above, hairy beneath with silvery or rusty coloured hairs. Flowers occur in crowded heads sporadically throughout the year. Individual flowers are small, white and covered in silky hairs. Each flower head has a single, silky white floral leaf (Costermans, 1994).

Habitat

Spyridium spathulatum occurs in sandy soils in mallee and shrubland.

7.12.3 Occurrence in the Project Area

Two occurrences of *Spyridium spathulatum* have been recorded in the Project Area by EBS Ecology in 2013 and 2019 Table 26. Each occurrence consists of a small number of plants within *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata* (Figure 45).

Occurrences of *Spyridium spathulatum* are mapped in Figure 2.

Table 26. Location of known populations of *Daviesia benthamii* ssp. *humilis* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 581592E 6186282N	4	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>
53H 581361E 6185800N	5	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i>

7.13 Management of Threats to Woodland and Mallee Shrubs

Known threats to five flora species discussed above, including the EPBC listed *Olearia pannosa* ssp. *pannosa* and *Pultenaea trichophylla*, have been identified in the following documents:

- *Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and the Mount Lofty Ranges, South Australia* (Department for Environment and Heritage, 2009).
- *Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia 2007-2012* (Pobke, 2007)

Threats include threatening processes that are understood to be widely impacting on plants in fragmented landscapes, but also includes more species-specific threats.

There is no formal documentation of threats impacting on the following species:

- *Daviesia benthamii* ssp. *humilis*,
- *Goodenia benthamiana*,
- *Olearia adenolasia*,
- *Philotheca angustifolia* ssp. *angustifolia*,
- *Spyridium bifidum* ssp. *bifidum*,
- *Spyridium spathulatum*.

It has been assumed that they are impacted by similar widespread threatening processes but are probably not impacted by more specific threats. This is based on the following:

- All species described above are shrubs found in woodland, open woodland and mallee habitats.
- All occur within a highly cleared and fragmented landscape.
- Due to current and past land use in the Project Area, threatening processes such as weed invasion, changed fire regimes, grazing and habitat loss and fragmentation are widespread.

Table 27 identifies nine threats as impacting on threatened shrub species. Of these, the following seven have the potential to be exacerbated by the Project:

- Site disturbance,
- Weed invasion,
- Disease,
- Grazing and disturbance by stock and feral herbivores,
- Habitat fragmentation,
- Inappropriate fire regimes,
- Vegetation clearing/habitat loss.

How these threats are potentially exacerbated by the Project is discussed in Table 27.

Threats that are exacerbated by the construction phase of the Project will be managed by implementing Management Actions also listed in Table 27. While ElectraNet has endeavoured to avoid impact wherever possible, these management actions aim to minimise impact where it can't be avoided.

Management Actions are described in detail in Section 15.

Table 27. Threats to woodland and mallee shrubs and management actions to minimise impacts exacerbated by the Project.

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Site disturbance ^{1, 2}	<i>Daviesia pectinata</i> <i>Olearia pannosa ssp. pannosa</i>	<ul style="list-style-type: none"> Indirect impact (such as trampling) may damage individuals in a population caused by access to the site by people, vehicles, machinery etc.¹. 	<p>Yes.</p> <ul style="list-style-type: none"> Site disturbance to populations of plants may be caused by construction activities occurring nearby. Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, creating more opportunity for disturbance. 	<p>3.1 3.2 3.5 3.6 3.8</p>
Weed invasion ^{1, 2}	<i>Daviesia benthamii ssp. humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i> <i>Olearia adenolasia</i> <i>Olearia pannosa ssp. pannosa</i> <i>Philotheca angustifolia ssp. angustifolia</i> <i>Prostanthera chlorantha</i> <i>Pultenaea trichophylla</i> <i>Spyridium bifidum ssp. bifidum</i> <i>Spyridium leucopogon</i> <i>Spyridium spathulatum</i>	<ul style="list-style-type: none"> Invasion by exotic weeds including <i>Asparagus aspargoides</i> (Bridal Creeper) and <i>Pinus halepensis</i> (Aleppo Pine) have the capacity to out-compete <i>Olearia pannosa ssp. pannosa</i> on Eyre Peninsula². Weed species have the potential to impact on the growth, recruitment and survival of native plant species¹. Weed species may cause exacerbation of other threats, such as increased risk of fire¹. 	<p>Yes.</p> <ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11</p>
Road and rail corridor management ^{1, 2}	<i>Daviesia benthamii ssp. humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i> <i>Olearia pannosa ssp. pannosa</i> <i>Pultenaea trichophylla</i> <i>Prostanthera chlorantha</i> <i>Spyridium bifidum ssp. bifidum</i> <i>Spyridium leucopogon</i> <i>Spyridium spathulatum</i>	<ul style="list-style-type: none"> Populations of plants listed occur in road and rail corridor vegetation. They are therefore susceptible to impacts from vegetation management carried out in these areas. 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any vegetation management activities within road or rail corridors 	<p>Not exacerbated by the Project.</p>
Grazing and disturbance by stock and feral herbivores ^{1, 2}	<i>Daviesia benthamii ssp. humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i>	<ul style="list-style-type: none"> Grazing by domestic stock is known to have restricted <i>Olearia pannosa ssp. pannosa</i> growth and recruitment. 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs 	

Threat	Species	Discussion	Exacerbated by the Project	Management Action
	<i>Olearia adenolasia</i> <i>Olearia pannosa ssp. pannosa</i> <i>Philotheca angustifolia ssp. angustifolia</i> <i>Prostanthera chlorantha</i> <i>Pultenaea trichophylla</i> <i>Spyridium bifidum ssp. bifidum</i> <i>Spyridium leucopogon</i> <i>Spyridium spathulatum</i>	Domestic stock are also known to graze <i>Pultenaea trichophylla</i> . <ul style="list-style-type: none"> It is likely that all plants in this section are susceptible to either to direct impact of grazing activities by use as fodder, and/or indirectly through trampling by stock. 	following vegetation management activities related to the transmission line. <ul style="list-style-type: none"> Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	
Small population/lack of recruitment²	<i>Olearia pannosa ssp. pannosa</i>	<ul style="list-style-type: none"> Small populations of <i>Olearia pannosa ssp. pannosa</i> probably rely on cross-pollination and are at risk of slow decline². 	No. It is unlikely that any action undertaken as part of the Project would influence recruitment in <i>Olearia pannosa ssp. pannosa</i> .	Not exacerbated by the Project
Disease²	<i>Olearia pannosa ssp. pannosa</i> <i>Pultenaea trichophylla</i>	<ul style="list-style-type: none"> <i>Phytophthora</i> has the potential to infect both species listed opposite². 	Yes. <ul style="list-style-type: none"> Vehicles, machinery and personnel may act as a vector of spread for <i>Phytophthora</i> if carrying contaminated soil. Contaminated construction materials brought into the Project Area (e.g. contaminated gravel/fill/sand) is a potential vector of spread. 	1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11
Habitat fragmentation²	<i>Daviesia benthamii ssp. humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i> <i>Olearia adenolasia</i> <i>Olearia pannosa ssp. pannosa</i> <i>Philotheca angustifolia ssp. angustifolia</i> <i>Prostanthera chlorantha</i> <i>Pultenaea trichophylla</i> <i>Spyridium bifidum ssp. bifidum</i> <i>Spyridium leucopogon</i>	<ul style="list-style-type: none"> Populations of species listed opposite are already highly fragmented due to historical habitat clearance. The resulting small populations are susceptible to further fragmentation and the exacerbation of associated impacts, such as inbreeding and lack of recruitment². 	Yes. <ul style="list-style-type: none"> Vegetation clearing, although kept to the minimum possible, is required as part of the Project. Any clearing of native vegetation exacerbates threats associated with clearing of habitat and fragmentation. 	3.1 3.4 4.1 4.2 4.3 4.4 4.8 4.9 4.10 4.11 4.12

Threat	Species	Discussion	Exacerbated by the Project	Management Action
	<i>Spyridium spathulatum</i>			4.13 4.14
Inappropriate fire regimes²	<i>Daviesia benthamii</i> ssp. <i>humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i> <i>Olearia adenolasia</i> <i>Olearia pannosa</i> ssp. <i>pannosa</i> <i>Philotheca angustifolia</i> ssp. <i>angustifolia</i> <i>Prostanthera chlorantha</i> <i>Pultenaea trichophylla</i> <i>Spyridium bifidum</i> ssp. <i>bifidum</i> <i>Spyridium leucopogon</i> <i>Spyridium spathulatum</i>	<ul style="list-style-type: none"> <i>Pultenaea trichophylla</i> is likely to require periodic fire events to enable successful recruitment. Long unburnt populations appear to be decreasing in size². Inappropriate fire management may impact all species listed opposite by causing changes in vegetation structure and increased weed invasion¹. 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition. 	2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 3.5
Vegetation clearing/habitat loss²	<i>Daviesia benthamii</i> ssp. <i>humilis</i> <i>Daviesia pectinata</i> <i>Eremophila gibbifolia</i> <i>Goodenia benthamiana</i> <i>Olearia adenolasia</i> <i>Olearia pannosa</i> ssp. <i>pannosa</i> <i>Philotheca angustifolia</i> ssp. <i>angustifolia</i> <i>Prostanthera chlorantha</i> <i>Pultenaea trichophylla</i> <i>Spyridium bifidum</i> ssp. <i>bifidum</i> <i>Spyridium leucopogon</i> <i>Spyridium spathulatum</i>	<ul style="list-style-type: none"> Clearing of vegetation may directly impact species listed opposite by removing individuals. Continuing clearance exacerbates other threats such as habitat fragmentation, lack of recruitment, weed invasion and site disturbance. 	<p>Yes.</p> <p>Vegetation clearing, although kept to the minimum possible, is required as part of the Project. Any clearing of native vegetation exacerbates threats associated with clearing of habitat and fragmentation.</p>	3.1 3.4 4.1 4.2 4.7 4.8 4.9 4.10 4.11 4.12 4.13 4.14 4.15

1: **Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and the Mount Lofty Ranges, South Australia** (Department for Environment and Heritage, 2009).

2: **Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia** (Pobke, 2007).

8 TREES AND SHRUBS OF SEMI-ARID SHRUBLAND AND WOODLAND

The far northern part of the Project Area consists largely of semi-arid shrublands and woodlands, often with a sparse *Acacia papyrocarpa* overstorey over chenopod shrubs, particularly *Maireana* spp. and *Atriplex* spp.

Three threatened plants were recorded by surveys within this environment carried out by EBS Ecology and are covered by this management plan:

- *Santalum spicatum*
- *Maireana excavata*
- *Maireana suaedifolia*.

8.1 *Santalum spicatum* (Sandalwood)

8.1.1 Conservation Status

Santalum spicatum (Figure 46) is listed as Vulnerable under the NPW Act. The species is not listed as threatened under the EPBC Act.

8.1.2 Ecology

Biology and description

Santalum spicatum is a shrub or small tree, growing up to 8 m tall, with rough, grey-brown bark on the trunk and branches. The waxy leaves are opposite, broad lanceolate in shape, 2-7 cm long by 0.5-2.5 cm wide. They are dark green to pale blue-green in colour. The green or red flowers, up to 3 mm long, occur in clusters in the leaf axils in March to June. They are followed by the yellow to red-brown fruit in November to December. The non-succulent fruits are smooth to slightly wrinkled and 1.5-2.5 cm in diameter (Berkinshaw, 2010).

Santalum spicatum is a root parasite that relies on a host plant. Host plants are often *Acacia*, *Allocasuarina* or *Melaleuca* trees or shrubs, but plants from other genera, including some herbaceous species, may also be suitable hosts (Pobke, 2007).

Habitat

Santalum spicatum grows in sandy, loamy and gravelly soils, sometimes at the base of granite outcrops. It occurs on dune crests, dune slopes and inter-dunes, as well as on ridges and hill crests and plains with loam to clay loam soils. It is most often recorded in mallee and *Acacia* woodland and shrubland Vegetation Associations (Pobke, 2007).

8.1.3 Occurrence in the Project Area

There are an estimated 5000 individual trees in up to 48 populations on the Eyre Peninsula. It is suspected there has been a reduction in the population size by at least 50% over the last three generations (Pobke, 2007).

The distribution of *Santalum spicatum* within the Project Area is well documented, with a targeted survey undertaken by EBS Ecology in 2019. Plants are located in the north of the Project Area, from 40 km west-south-west of Whyalla to an area within 10 km north of the town (EBS Ecology, 2019a).

The species was recorded in the following four Vegetation Associations:

- *Acacia papyrocarpa* Open Woodland over *Maireana sedifolia* / *Atriplex vesicaria* / *Maireana pyramidata*,
- *Maireana sedifolia* Low Shrubland +/- *Acacia papyrocarpa* over *Austrostipa* spp. and *Austrodanthonia caespitosa*,
- *Alectryon oleifolius* ssp. *canescens* Low Woodland over *Atriplex vesicaria* / *Maireana sedifolia* (Figure 47),
- *Maireana sedifolia* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Eucalyptus gracilis*, *Alectryon oleifolius* ssp. *canescens*.

Across all survey periods, a total of 58 plants were recorded. Locations have been generalised in Table 28 for clarity. However, all locations are listed in Appendix 2 and mapped in Figure 3.

Table 28. Location of known populations of *Santalum spicatum* in the Project Area. Location information from EBS Ecology (2019a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 735869E 6352744N	1	<i>Acacia papyrocarpa</i> Open Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i> / <i>Maireana pyramidata</i>
53H 729954E 6348436N	1	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Acacia papyrocarpa</i> over <i>Austrostipa</i> spp. and <i>Austrodanthonia caespitosa</i>
Between: 53H 728449E 6347029N And 53H 727355E 6345706N	45	<i>Alectryon oleifolius</i> ssp. <i>canescens</i> Low Woodland over <i>Atriplex vesicaria</i> / <i>Maireana sedifolia</i>
Between: 53H 712532E 6337523N And 53H 711553E 6336987N	4	<i>Acacia papyrocarpa</i> Open Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i> / <i>Maireana pyramidata</i>
53H 704803E 6333406N	1	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Myoporum platycarpum</i> , <i>Acacia papyrocarpa</i> , <i>Eucalyptus gracilis</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i>
Between: 53H 702426E 6332219N And 53H 702440E 6332157N	4	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Myoporum platycarpum</i> , <i>Acacia papyrocarpa</i> , <i>Eucalyptus gracilis</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i>



Figure 46. *Santalum spicatum*, photographed by EBS Ecology during targeted surveys for the species in 2019.



Figure 47. *Alectryon oleifolius* ssp. *canescens* Low Woodland over *Atriplex vesicaria* / *Maireana sedifolia*, where most *Santalum spicatum* in the Project Area occur (Photographed by EBS Ecology 2019a).

8.2 *Maireana excavata* (Bottle Fissure-plant)

8.2.1 Conservation Status

Maireana excavata is listed as Vulnerable under the NPW Act. It is not listed as threatened under the EPBC Act.

8.2.2 Ecology

Biology and description

Maireana excavata is a low growing, compact perennial shrub to 20 cm high that develops a stout taproot. When young, branches are loosely woolly with alternate, narrowly-oblong to elliptic leaves, 7-12 mm long. The fruit is winged, with the wing 10 mm in diameter, faintly veined with a radial slit (Royal Botanic Gardens and Domain Trust, 2020b).

Habitat

Red-brown clay loam soils in open grasslands and shrublands (Cunningham et al, 1981).

8.2.3 Occurrence in the Project Area

In the Project Area, *Maireana excavata* is limited in occurrence to a small area of semi-arid shrubland and woodland west of Whyalla (EBS Ecology, 2019a). It occurs at the locations listed in Table 29 and shown in Figure 3 within three Vegetation Associations:

- *Alectryon oleifolius* ssp. *canescens* Low Woodland over *Atriplex vesicaria* / *Maireana sedifolia*,
- *Casuarina pauper* Woodland over *Maireana sedifolia* / *Atriplex vesicaria* (Figure 48),
- *Maireana sedifolia* Low Shrubland +/- *Acacia papyrocarpa* over *Austrostipa* spp. and *Austrodanthonia caespitosa*.

Table 29. Location of known populations of *Maireana excavata* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 721509E 6342343N	1	<i>Casuarina pauper</i> Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i>
53H 722540E 6342830N	1	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Acacia papyrocarpa</i> over <i>Austrostipa</i> spp. and <i>Austrodanthonia caespitosa</i> .
53H 725670E 6344570N	1	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Acacia papyrocarpa</i> over <i>Austrostipa</i> spp. and <i>Austrodanthonia caespitosa</i> .
53H 727981E 6346339N	1	<i>Alectryon oleifolius</i> ssp. <i>canescens</i> Low Woodland over <i>Atriplex vesicaria</i> / <i>Maireana sedifolia</i>



Figure 48. *Maireana excavata* occurs in semi-arid woodland and shrubland, such as *Casuarina pauper* Woodland over *Maireana sedifolia* / *Atriplex vesicaria*, shown here. Photographed by EBS Ecology in 2019.

8.3 *Maireana suaedifolia* (Lax Bluebush)

8.3.1 Conservation Status

Maireana suaedifolia is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

8.3.2 Ecology

Biology and description

Maireana suaedifolia is a low spreading, dark blue-green shrub to 0.5 m high, although individuals up to 2.5 m high have been recorded. The branches are glaucous and dry to a purple or slate-grey colour. Alternate leaves are succulent, being narrower at their base, 5 mm long on fruiting stems and up to 25 mm long on the main branches. The fruiting perianth is pink when fresh. The species normally occurs in slightly saline soils (Royal Botanic Gardens and Domain Trust, 2020c).

8.3.3 Occurrence in the Project Area

Maireana suaedifolia is likely to occur in areas of native vegetation within the vicinity of historical records of the species. These occur in the Northern Project Area within Ironstone Hill Conservation Park. It includes the following Vegetation Associations:

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee.
- *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee.
- *Eucalyptus leptophylla* +/- *Eucalyptus oleosa* +/- *Melaleuca lanceolata* Mixed Mallee over *Cratystylis conocephala* and *Atriplex vesicaria*.
- *Senna artemisioides* ssp. *coriacea*, *Dodonaea lobulata* Tall Shrubland +/- *Myoporum platycarpum*, *Dodonaea viscosa* ssp. *angustissima* and *Acacia oswaldii*.
- *Eucalyptus oleosa* +/- *Eucalyptus* spp. Mallee over *Maireana sedifolia*.
- *Maireana sedifolia* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Eucalyptus gracilis*, *Alectryon oleifolius* ssp. *canescens* (Figure 49).
- *Acacia papyrocarpa* Low Open Woodland over *Maireana sedifolia* / *Atriplex vesicaria* / *Maireana pyramidata* (Figure 50).



Figure 49. *Maireana sedifolia* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Eucalyptus gracilis*, *Alectryon oleifolius* ssp. *Canescens*. Photographed by EBS Ecology in 2019.



Figure 50. *Acacia papyrocarpa* Low Open Woodland over *Maireana sedifolia* / *Atriplex vesicaria* / *Maireana pyramidata*. Photographed by EBS Ecology in 2019.

8.4 Management of Threats to Trees and Shrubs of Semi-arid Shrubland and Woodland

Threats known to impact on *Santalum spicatum* have been documented in the *Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia 2007-2012* (Pobke, 2007). That document identifies five threats that impact on that species, as listed in Table 30.

Threats to *Maireana excavata* and *Maireana suaedifolia* have not been documented. However, other threatened *Maireana* species are threatened by weed invasion and grazing activities (Department of Agriculture, Water and the Environment, 2020b). Within the Project Area, both species occur in Chenopod shrublands in the north. These areas exist as large areas of uncleared vegetation and are utilised for pastoral activities, specifically sheep grazing.

Generally, fuel loads within chenopod shrublands prevent wildfires from occurring, with long-lived chenopod shrubs (e.g. *Maireana* spp.) not reaching maturity until 30 years after fire (Cheal, 2010). Frequent fires may therefore lead to a decline in the condition of chenopod shrublands.

It is likely that grazing and inappropriate fire regime are the largest threats to *Maireana* species in the Project Area.

Of the five threats listed in Table 30, four would possibly be exacerbated by the Project:

- Grazing,
- Inappropriate disturbance and fire regime,
- Habitat fragmentation,
- Illegal collection and harvest.

Table 30. Threats to semi-arid trees and shrubs identified by the relevant species recovery plans, indicating those that may be exacerbated by the Project.

Threat	Species	Discussion	Exacerbated by the Project	Management Actions
Grazing¹	<i>Santalum spicatum</i> <i>Maireana excavata</i> <i>Maireana suaedifolia</i>	<ul style="list-style-type: none"> Most <i>Santalum spicatum</i> populations show evidence of high grazing pressure by feral goats, such as canopy grazing lines and damage to trunks and branches.¹ Heavy sheep grazing is known to be detrimental to Chenopod shrublands and <i>Maireana</i> spp. 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	
Inappropriate disturbance and fire regimes¹	<i>Santalum spicatum</i> <i>Maireana excavata</i> <i>Maireana suaedifolia</i>	<ul style="list-style-type: none"> <i>Santalum spicatum</i> is known to be fire sensitive. Large, intense fires have the potential to kill populations.¹ Chenopod shrublands and <i>Maireana</i> spp. generally require long intervals between fire events (Cheal, 2010). 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition. 	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 3.1 3.2 3.5 3.6 3.8</p>
Habitat fragmentation¹	<i>Santalum spicatum</i>	<ul style="list-style-type: none"> Fragmented populations of <i>Santalum spicatum</i> have low genetic variability and flow. Low genetic variability may reduce the resilience of the species to other environmental changes.¹ 	<p>Yes.</p> <ul style="list-style-type: none"> Clearing of vegetation associated with the transmission line corridor and access roads may potentially fragment populations <i>Santalum spicatum</i>. 	<p>4.1 4.2 4.3 4.4 4.8 4.9 4.10 4.11 4.12 4.13</p>
Lack of recruitment/small population¹	<i>Santalum spicatum</i>	<ul style="list-style-type: none"> <i>Santalum spicatum</i> populations often show good seed set with no recruitment evident, although the reasons for this are undertermined.¹ 	<p>No.</p> <ul style="list-style-type: none"> The Project does not include any actions that are likely to further inhibit the recruitment of <i>Santalum spicatum</i> or <i>Maireana</i> spp. 	Not exacerbated by the Project.

<p>Illegal collection and harvest¹</p>	<p><i>Santalum spicatum</i></p>	<ul style="list-style-type: none"> Illegal collection of seed and wood for the Sandalwood trade have threatened <i>Santalum spicatum</i> populations historically.¹ 	<p>Yes.</p> <ul style="list-style-type: none"> Construction of corridors and access roads may facilitate greater access by the public to <i>Santalum spicatum</i> populations in the Project Area. 	<p>3.5</p>
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1: *Draft Recovery Plan for 23 Threatened Flora Taxa on Eyre Peninsula, South Australia 2007-2012* (Pobke, 2007).

9 MALLEE EUCALYPTS

Mallee Vegetation Associations are distributed throughout the Project Area, although they become more prevalent towards the north. These Vegetation Associations typically have an overstorey of one or more mallee *Eucalyptus* spp.

Most *Eucalyptus* spp. in the Project Area are common and widespread and not likely to be impacted by the Project. However, one species, *Eucalyptus cretata*, listed as threatened under the NPW Act was recorded by surveys in the Project Area.

9.1 *Eucalyptus cretata* (Darke Peak Mallee)

9.1.1 Conservation Status

Listed as Rare under the NPW Act, *Eucalyptus cretata* is endemic to the central Eyre Peninsula. It is not listed as threatened under the EPBC Act.

9.1.2 Ecology

Biology and description

Eucalyptus cretata is a multi-stemmed mallee growing up to 9 m tall. The lanceolate leaves are thick, dull and grey-green. The young buds, fruits and branchlets are characteristically waxy, making this a distinctive species. *Eucalyptus cretata* flowers spasmodically throughout the year, with buds occurring in umbels of 7-9, 8-14 mm long by 4-8mm wide with prominently ribbed opercula. Fruit is usually ribbed, 6-11 mm long by 7-11 mm wide, with 4 or 5 valves set below the rim (Nicolle, 2013).

Habitat

Eucalyptus cretata grows in mallee communities on low hills and plains, generally in loamy to clay soils. It is particularly common in the Darke Peak and Carapsee Hill areas of Eyre Peninsula (Nicolle, 2013).

9.1.3 Occurrence in the Project Area

Eucalyptus cretata has previously been assessed as highly likely to occur in the Southern and Northern Project Area within the vicinity of Cleve. It is likely in the following Vegetation Associations:

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee.
- *Eucalyptus diversifolia* +/- *Eucalyptus incrassata* Mallee over exotics and *Enchylaena tomentosa* (Figure 51).
- *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee over *Enchylaena tomentosa* and emergents.
- *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee over *Gahnia deusta* and herbaceous annual spp. (Figure 52).

- *Eucalyptus incrassata* +/- *Melaleuca uncinata* +/- *Melaleuca lanceolata* Mallee over *Ehrharta calycina*.
- *Eucalyptus calycogona* ssp. *calycogona* +/- *Eucalyptus phenax* ssp. *phenax* Mallee over *Maireana brevifolia* and exotics.



Figure 51. *Eucalyptus diversifolia* +/- *Eucalyptus incrassata* Mallee over exotics and *Enchylaena tomentosa*. Photographed by EBS Ecology in 2019.



Figure 52. *Eucalyptus peninsularis* +/- *Eucalyptus dumosa* Mallee over *Gahnia deusta* and herbaceous annual spp. Photographed by EBS Ecology in 2019.

9.2 Management of Threats to Mallee Eucalypts

Although well-conserved population occur in a number of reserves, *Eucalyptus cretata* populations in the Project Area occur mainly in small remnant vegetation patches such as road and rail reserves (Lang & Brooker, 1990). Although there are no documented threats for this species, it is likely that populations are threatened by similar factors that impact other plants occurring as small, fragmented populations in isolated habitat remnants, such as:

- Weed invasion,
- Inappropriate fire regimes,
- Further clearing and fragmentation of habitat,
- Road and rail management activities.

It is possible that the former three threats listed above may be exacerbated by the Project, as discussed in Table 31.

Table 31. Threats and Management Actions for *Eucalyptus cretata* within the Project Area, including those potentially exacerbated by the Project.

Threat	Exacerbated by the Project	Management Actions
Weed invasion	Yes.	1.1
	• Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction.	1.2
		1.3
		1.4
	• Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction.	1.5
		1.6
		1.7

Threat	Exacerbated by the Project	Management Actions
	<ul style="list-style-type: none"> Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.8 1.9 1.10 1.11</p>
<p>Inappropriate fire regimes</p>	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. <p>Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition.</p>	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 3.5</p>
<p>Vegetation clearing and fragmentation</p>	<p>Yes.</p> <p>Vegetation clearing, although kept to the minimum possible, is required as part of the Project. Any clearing of native vegetation exacerbates threats associated with clearing of habitat and fragmentation.</p>	<p>3.1 4.1 4.2 4.3 4.4 4.8 4.9 4.10 4.11 4.12 4.13 4.14</p>
<p>Road and rail management activities</p>	<p>No</p> <ul style="list-style-type: none"> The Project does not include any road and/or rail corridor maintenance activities. 	<p>Not exacerbated by the Project.</p>

10 THREATENED GRASSES

Two threatened grass species were recorded in the Project Area during surveys carried out by EBS Ecology in 2012 and 2013: *Austrostipa breviglumis* (Bamboo Spear-grass) and *Austrostipa tenuifolia* (Long-awn Spear-grass).

Both species are listed as Rare under the NPW Act but are not listed as threatened under the EPBC Act.

10.1 *Austrostipa breviglumis* (Bamboo Spear-grass)

10.1.1 Conservation Status

Austrostipa breviglumis is listed as Rare under the NPW Act but is not listed as threatened under the EPBC Act.

10.1.2 Ecology

Biology and description

An often-rhizomatous grass, *Austrostipa breviglumis* has wiry culms, often branched, that 0.8-2 m high. Leaf blades are rolled, 4-30 cm long by 1-5 mm wide with a hairy upper surface. Panicles are 10-40 cm long and compact, the branches usually not spreading (Jessop, Dashorst, & James, 2006).

Habitat

Austrostipa breviglumis occurs in a range of soils including sandy to clay-loam and in rocky gullies and ridge tops. It grows in woodlands, often associated with *Eucalyptus odorata*, *Xanthorrhoea quadrangulata*, *Bursaria spinosa* and *Callitris glaucophylla* (Jessop, Dashorst, & James, 2006).

10.1.3 Occurrence in the Project Area

Austrostipa breviglumis is known to occur at one location in the Project Area, where more than 20 plants were recorded by EBS Ecology in 2013, as indicated in Table 32. It was found within a single Vegetation Association:

- *Melaleuca uncinata* Tall Shrubland +/- *Eucalyptus incrassata* and *Eucalyptus brachycalyx* (Figure 53).

The location of this population is shown in Figure 3.

Table 32. Location of known populations of *Austrostipa breviglumis* in the Project Area. Location information from EBS Ecology (2014a). Vegetation Associations are as they appear in EBS Ecology (2019a).

Location	Number of plants	Vegetation Association
53H 668628E 6306621N	>20	<i>Melaleuca uncinata</i> Tall Shrubland +/- <i>Eucalyptus incrassata</i> and <i>Eucalyptus brachycalyx</i>



Figure 53. *Melaleuca uncinata* Tall Shrubland +/- *Eucalyptus incrassata* and *Eucalyptus brachycalyx*, habitat in the Project Area for *Austrostipa breviglumis*. Photographed by EBS Ecology in 2019.

10.2 *Austrostipa tenuifolia* (Long-awn Spear-grass)

10.2.1 Conservation Status

Listed as Rare under the NPW Act, *Austrostipa tenuifolia* is not listed as threatened under the EPBC Act.

10.2.2 Ecology

Biology and description

Austrostipa tenuifolia is a tufted grass that does not usually develop a rhizome. The culms are unbranched and not wiry, 0.6-1 m tall with small hairs below each node. The leaf blades are usually rolled, 6-30 cm long and 0.5-2 mm wide and usually hairy on the upper surface. The sparse panicle is 10-35 cm long (Jessop, Dashorst, & James, 2006).

Habitat

Austrostipa tenuifolia is usually found in sandy soils in grasslands and is also often associated with *Callitris* or *Allocasuarina* species (Jessop, Dashorst, & James, 2006).

10.2.3 Occurrence in the Project Area

The species has previously been assessed as highly likely to occur in grassland and grassy open woodland Vegetation Associations and those where *Allocasuarina* sp. occurs. This includes the following associations:

- *Allocasuarina verticillata* Low Woodland (Figure 54).
- *Eucalyptus cladocalyx* Woodland / Open Woodland.
- *Rytidosprema* spp. / *Austrostipa* spp. +/- *Themeda triandra* Tussock Grassland (Figure 55).
- *Eucalyptus petiolaris* +/- *Eucalyptus odorata* +/- *Allocasuarina verticillata* Open Grassy Woodland.

- *Callitris gracilis* Low Woodland over *Geijera linearifolia* +/- *Allocasuarina verticillata* +/- *Pittosporum angustifolium* (Figure 56).
- *Eucalyptus porosa* Open Woodland +/- *Acacia notabilis* (Figure 57).
- *Callitris gracilis* Very Open Woodland over *Austrostipa* spp.

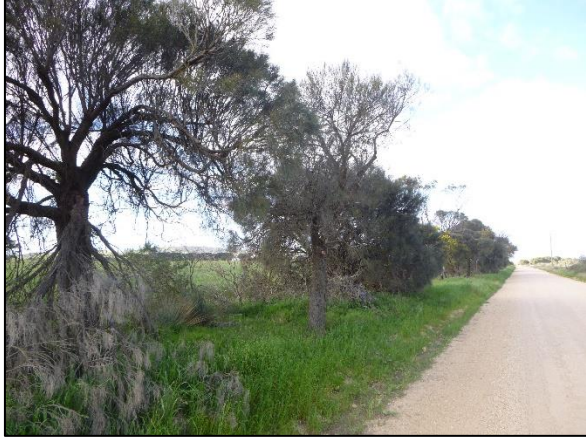


Figure 54. *Allocasuarina verticillata* Low Woodland, potential habitat for *Austrostipa tenuifolia*. Photographed by EBS Ecology in 2019.



Figure 55. *Rytidosprema* spp. / *Austrostipa* spp. +/- *Themeda triandra* Tussock Grassland. Photographed by EBS Ecology in 2019.



Figure 56. *Callitris gracilis* Low Woodland over *Geijera linearifolia* +/- *Allocasuarina verticillata* +/- *Pittosporum angustifolium*. Photographed by EBS Ecology in 2019.



Figure 57. *Eucalyptus porosa* Open Woodland +/- *Acacia notabilis*. Photographed by EBS Ecology in 2019.

10.3 Management of Threats to Grasses

There are no documented threats to the grasses described above. However, threats that are known to be detrimental to native grass species include:

- Weed invasion, including introduced grasses and woody shrubs,
- Vegetation management, including clearing and fragmentation of habitat,
- Inappropriate fire regimes and management,
- Grazing from domestic stock, feral and native herbivores.

These threats and the Management Actions that will be undertaken to minimise those exacerbated by the Project are further discussed in Table 33.

Table 33. Threats and Management Actions to minimise impacts to threatened grasses.

Threat	Species	Exacerbated by the Project	Management Actions
Weed invasion.	<i>Austrostipa breviglumis</i> <i>Austrostipa tenuifolia</i>	<p>Yes.</p> <ul style="list-style-type: none"> • Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. • Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. • Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11</p>
Vegetation clearing and fragmentation of habitat.	<i>Austrostipa breviglumis</i> <i>Austrostipa tenuifolia</i>	<p>Yes.</p> <ul style="list-style-type: none"> • Vegetation clearing, although kept to the minimum possible, is required as part of the Project. Any clearing of native vegetation exacerbates threats associated with clearing of habitat and fragmentation. 	<p>3.1 4.1 4.2 4.3 4.4 4.9 4.10 4.11 4.12 4.13 4.14 4.15</p>
Inappropriate fire management.	<i>Austrostipa breviglumis</i> <i>Austrostipa tenuifolia</i>	<p>Yes.</p> <ul style="list-style-type: none"> • Increased access to areas during construction presents an increased risk of ignition sources. • Operation of machinery, tools and vehicles increases ignition sources during construction. • Clearing of vegetation and access tracks for construction may make some areas more accessible to the public, increasing risk of ignition. 	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 3.5</p>
Grazing.	<i>Austrostipa breviglumis</i> <i>Austrostipa tenuifolia</i>	<p>Yes.</p> <ul style="list-style-type: none"> • There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. • Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	

11 MAMMALS

Targeted surveys and habitat modelling for one threatened mammal species, Sandhill Dunnart (*Sminthopsis psammophila*), were undertaken in the Project Area between 2009 and 2013 by Ecological Horizons Pty Ltd. Results of these surveys indicate that the presence of tall *Triodia* spp. (Spinifex) within vegetation at least 20 years post fire is the most critical component of Sandhill Dunnart habitat.

11.1 Sandhill Dunnart (*Sminthopsis psammophila*)

11.1.1 Conservation Status

The Sandhill Dunnart (Figure 58) is listed as Endangered under the EPBC Act.

The Sandhill Dunnart is also listed as Endangered under the NPW Act.

11.1.2 Ecology

Biology and description

The Sandhill Dunnart is a small, carnivorous marsupial. It has a head-body length of 8-12 cm and a tail length of 10-12 cm. It has a pale grey head and upper body, with black marking extending from the shoulders to between the eyes. Feet and underside are white. Sandhill Dunnarts can be distinguished from other similar dunnart species by the ventral crest of blackish-grey hairs on the terminal quarter of the tail (Threatened Species Scientific Committee, 2015) .

Sandhill Dunnarts are largely nocturnal, sheltering during the day in nests built in the centre of large hummock grasses, typically *Triodia* spp. (spinifex). Females also dig burrows up to 90 cm long containing a nest of leaves and bark. Males also occasionally utilise other nesting sites, including burrows, hollow logs and burrows constructed by other species, such as Mitchell's Hopping-mouse (*Notomys mitchelli*) (Threatened Species Scientific Committee, 2015).

Habitat

Sandhill Dunnarts are found in sandy habitats in semi-arid to arid areas. In South Australia, habitat is generally low open mallee woodland with a diverse shrub layer and relatively dense cover of *Triodia* spp. (spinifex) hummock grasses. The presence of *Triodia* spp. hummocks in association with sand dunes appears a critical element of Sandhill Dunnart habitat (Department for Environment and Water, 2019). Fire frequency is also an important characteristic of habitat, with tall *Triodia* spp. hummocks preferred by the species for nesting only present in vegetation 20 – 40 years post fire (Moseby, 2014).

11.1.3 Occurrence in the Project Area

All vegetation with a *Triodia* spp. understorey and sandy substrate in the northern Project Area between Sheoak Hill Conservation Park and the Middleback Range is likely to be important habitat for Sandhill Dunnart (Moseby, 2014).

Mapping of suitable habitat for the Sandhill Dunnart in the Project Area was carried out by EBS Ecology in 2019 (EBS Ecology, 2019c). These maps are reproduced in Appendix 3. Habitat includes the following Vegetation Associations, as described in EBS Ecology 2019a:

- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Leptospermum coriaceum*, *Phebalium bullatum*, *Triodia* spp. and *Calytrix tetragona* (Figure 59),
- *Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *Eucalyptus incrassata* +/- *Eucalyptus brachycalyx* (Figure 60),
- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee (Figure 61).



Figure 58. The Sandhill Dunnart (Moseby, 2014).



Figure 59. Sandhill Dunnart habitat – *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Leptospermum coriaceum*, *Phebalium bullatum*, *Triodia* spp. and *Calytrix tetragona*. Photographed by EBS Ecology in 2019.



Figure 60. Sandhill Dunnart habitat – *Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *Eucalyptus incrassata* +/- *Eucalyptus brachycalyx*. Photographed by EBS Ecology in 2019.



Figure 61. Sandhill Dunnart habitat – *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee. Photographed by EBS Ecology in 2019.

11.2 ***Management of Threats to Sandhill Dunnart***

The draft *National Recovery Plan for the Sandhill Dunnart (*Sminthopsis psammophila*) 2019* (Department for Environment and Water, 2019) considers that fragmentation and loss of habitat, predation by cats and foxes and altered and/or inappropriate fire regimes are the primary threats to Sandhill Dunnart populations. Fragmentation and loss of habitat is considered particularly relevant to Eyre Peninsula populations (Department for Environment and Water, 2019). These threats, together with other indirect threats identified by the Recovery Plan, are further discussed in Table 34.

Of the five threats listed in the table, all have the potential to be exacerbated by the Project:

- Predation by cats and foxes,
- Inappropriate fire regimes,
- Habitat loss and fragmentation,
- Weed invasion,
- Introduced herbivores (grazing).

How these threats relate to the Project is also discussed in Table 34.

This document identifies management actions that will be implemented by ElectraNet and its contractors to minimise the impact of the threatening processes exacerbated by the Project. These actions are discussed in detail in Section 15. Those actions that are relevant to the Sandhill Dunnart are listed in Table 34.

Table 34. Threats to the Sandhill Dunnart identified in the draft *National Recovery Plan for the Sandhill Dunnart (Sminthopsis psammophila)*. The table indicates those that may be exacerbated by the Project and management actions taken to minimise impact.

Threat	Discussion	Exacerbated by the Project	Management Action
Predation by cats and foxes	<ul style="list-style-type: none"> Listed as a Key Threatening Process under the EPBC Act, due to their role in the decline and extinction of many Australian native mammals. The extent of their impact on Sandhill Dunnart is unknown, with core populations surviving despite the presence of cats and foxes. Research suggests that where a dense cover of <i>Triodia</i> spp. is maintained, impact of predation is greatly reduced. (Department for Environment and Water, 2019) 	<p>Yes.</p> <ul style="list-style-type: none"> Linear clearance of vegetation increases the ability of cats and foxes to access Sandhill Dunnart habitat from nearby areas. Areas cleared of vegetation provide more suitable foraging areas for predators, increasing hunting success and predation pressure on native fauna. Disposal of food waste and rubbish on site by personnel may attract feral predators to the Project Area. 	<p>6.1 6.2 6.3 6.4</p>
Inappropriate fire regimes	<ul style="list-style-type: none"> Inappropriate fire regimes are considered a major threat to Sandhill Dunnarts in fragmented landscapes, such as on the Eyre Peninsula. Large-scale, uncontrolled fires have the potential to render large areas of habitat unsuitable for several years following the fire event, due to the removal of hummock grasses. (Department for Environment and Water, 2019) 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. 	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8</p>
Habitat loss and fragmentation	<ul style="list-style-type: none"> Particularly relevant to Eyre Peninsula populations, where over 50% of land has been cleared for agriculture and remaining vegetation is highly fragmented. Fragmentation increases the likelihood of local populations being wiped out by events such as large wildfires and reduces the potential for re-colonisation of those areas. Construction of linear developments such as roads and fence lines allows greater access by introduced predators and increases the chance of weed invasion. (Department for Environment and Water, 2019) 	<p>Yes.</p> <ul style="list-style-type: none"> The Project is a long, linear development that contributes to the fragmentation of vegetation patches where clearing is required. 	<p>4.1 4.2 4.3 4.4 4.8 4.9 4.10 4.12 4.13 4.14</p>
Weed invasion	<ul style="list-style-type: none"> Invasion and establishment of <i>Cenchrus ciliaris</i> (Buffel Grass) is considered a major threat to Sandhill Dunnart. Increasing dominance of <i>Cenchrus ciliaris</i> leads to changes in frequency and intensity of fire events that result in the loss of <i>Triodia</i> spp. hummocks. (Department for Environment and Water, 2019) 	<p>Yes.</p> <ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand contaminated by weed seeds) is a vector of spread for weeds during construction. 	<p>1.1 1.2 1.3 1.4 1.5 1.6 1.7</p>

		<ul style="list-style-type: none"> Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	<p>1.8 1.9 1.10 1.11</p>
<p>Introduced herbivores (grazing)</p>	<ul style="list-style-type: none"> Grazing by introduced herbivores, including cattle, sheep, goats, rabbits and camels, may impact indirectly on Sandhill Dunnarts by altering habitat in the following ways: <ul style="list-style-type: none"> Changing the structure of <i>Triodia</i> spp. hummocks, Reducing floristic diversity of habitats over an extended time period, Causing soil disturbance and compaction, Changing fire regimes, Sustaining higher numbers of introduced predators and encouraging their spread into areas that would otherwise only support very low population densities. <p>(Department for Environment and Water, 2019)</p>	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	

12 BIRDS OF WOODLAND AND MALLEE

Many birds found in woodland and mallee habitats are threatened by common threatening processes such as habitat loss and fragmentation and changed or inappropriate fire regimes. Ten threatened woodland or mallee bird species have been recorded in the Project Area by EBS Ecology surveys, including two that are listed under both the EPBC Act and NPW Act.

These ten species are listed below:

- Striated Grasswren (*Amytornis striatus*)
- Shy Heathwren (*Calamanthus cauta*)
- White-winged Chough (*Corcorax melanorhamphos*)
- Western Gerygone (*Gerygone fusca*)
- Purple-gaped Honeyeater (*Lichenostomus cratitius*)
- Malleefowl (*Leipoa ocellata*)
- Restless Flycatcher (*Myiagra inquieta*)
- Gilbert's Whistler (*Pachycephala inornata*)
- Diamond Firetail (*Stagonopleura guttata*)
- Southern Emu-wren (Eyre Peninsula) (*Stipiturus malachurus*)

12.1 *Striated Grasswren (Amytornis striatus)*

12.1.1 Conservation Status

The Striated Grasswren (Figure 62) is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

12.1.2 Ecology

Biology and description

The Striated Grasswren is similar in appearance to the related fairy-wrens, though significantly larger (14.5 - 18.5 cm). The upperparts are a soft reddish-brown, with white streaks while the underparts are buff with heavy white streaking on the breast. The eyebrow is rufous-brown and a heavy black whisker-streak is present. The throat is white, the bill blackish and legs bluish-grey. The tail is long and held cocked and is blackish in colour (NSW Office of Environment and Heritage, 2020c).

Striated Grasswrens forage for small invertebrates and seeds, largely on the ground. Recorded in pairs or small parties, they are difficult to observe and are often first detected by their calls. Nests are built within large *Triodia* sp. hummocks (NSW Office of Environment and Heritage, 2020c).

Habitat

The Striated Grasswren occurs in areas where mature *Triodia* spp. (Spinifex) occurs, usually in association with mallee on sandy soils. It is thought that fire history is an important habitat constraint. Birds do not reoccupying burnt vegetation until 6 – 8 years post-fire, preferring areas with large *Triodia* hummocks that most often occur 25 – 40 years after a fire (NSW Office of Environment and Heritage, 2020c).

12.1.3 Occurrence in the Project Area

EBS Ecology recorded Striated Grasswrens at three locations while undertaking surveys in the Northern Project Area (Table 35). All records were collected in *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee (Figure 63).

Given the species' habitat constraints and known distribution on the Eyre Peninsula, it is likely the species occurs in Vegetation Associations with a *Triodia* sp. understorey on sandy substrates in the Northern Project Area.

The locations of EBS Ecology records are mapped in Figure 5.

Table 35. Locations of EBS Ecology records of Striated Grasswren in the Project Area. Location information from EBS Ecology 2014a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 678258E 6314184N	Not counted	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee
53H 690890E 6324233N	1	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee
53H 690826E 6324246N	1	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee



Figure 62. Striated Grasswren (*Amytornis striatus*), photographed by EBS Ecology in 2013.



Figure 63. Mallee with a *Triodia* sp. understorey on sandy soil. Striated Grasswrens are likely in similar habitat in the north of the Project Area. Photographed by EBS Ecology in 2019.

12.2 *Shy Heathwren (Calamanthus cauta)*

12.2.1 Conservation Status

Shy Heathwren (Figure 64) is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

12.2.2 Ecology

Biology and description

The Shy Heathwren is a small (13-16 g) brown bird with a strongly cocked tail. It has unstreaked, brown upperparts with pale underparts that are heavily marked with dark streaks. Other distinguishing features include a prominent white eyebrow and rufous rump (Menkhorst, et al., 2019).

The Shy Heathwren is a secretive species that occurs in singles, pairs and small family groups. They sometimes sing from the top of low shrubs but are usually seen foraging on the ground or in low shrubs. When disturbed, they will run or fly low into thick cover (Menkhorst, et al., 2019).

Habitat

The Shy Heathwren inhabits dense shrubby or heathy understorey in mall and woodlands. It is found throughout the Eyre Peninsula (Menkhorst, et al., 2019).

12.2.3 Occurrence in the Project Area

EBS Ecology recorded Shy Heathwren at two locations while undertaking surveys in the Southern Project Area and was found in two Vegetation Associations:

- *Melaleuca halmaturorum* Tall Open Shrubland over *Juncus krausii* and *Juncus pallidus* (Figure 65).
- *Eucalyptus odorata* +/- *Eucalyptus pileata* / *Eucalyptus leptophylla* Mallee +/- *Melaleuca uncinata*.

These locations are listed in Table 36. However, suitable habitat is widespread throughout and the bird's distribution includes all of Eyre Peninsula. It is likely that the species occurs throughout the Project Area where suitable habitat occurs.

The locations of EBS Ecology records are mapped in Figure 4.

Table 36. Location of EBS Ecology records of Shy Heathwren in the Project Area. Location information from EBS Ecology 2014a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 576713E 6178602N	Not counted	<i>Melaleuca halmaturorum</i> Tall Open Shrubland over <i>Juncus krausii</i> and <i>Juncus pallidus</i> .
53H 581677E 6186226N	Not counted	<i>Eucalyptus odorata</i> +/- <i>Eucalyptus pileata</i> / <i>Eucalyptus leptophylla</i> Mallee +/- <i>Melaleuca uncinata</i> .



Figure 64. Shy Heathwren (*Calamanthus cauta*). Photograph provided by Peter Day.



Figure 65. Shy Heathwren was recorded in *Melaleuca halmaturorum* Tall Open Shrubland over *Juncus krausii* and *Juncus pallidus*. Photographed by EBS Ecology in 2019

12.3 White-winged Chough (*Corcorax melanorhamphos*)

12.3.1 Conservation Status

The White-winged Chough (Figure 66) is listed as Rare under the NPW Act and its population probably declining. It is not listed as threatened under the EPBC Act (Department for Environment and Heritage, 2008c).

12.3.2 Ecology

Biology and description

The White-winged Chough is a large, almost completely black, bird with a curved beak, white wing patch and red eye. The white wing patch is usually only visible in flight.

White-winged Choughs are sedentary, large territories (up to 1000 ha) occupied by a social group of seven to 10 individuals. A group normally consists of a breeding pair and offspring from previous years, young birds staying with the parents for up to four years.

White-winged Choughs forage mostly on the ground, raking through leaf litter for insects and seeds. They build characteristic bowl-shaped mud nests that can take several months to complete (Department for Environment and Heritage, 2008c).

Habitat

White-winged Choughs inhabit woodlands and tall mallee. They prefer damper areas with abundant leaf litter (Department for Environment and Heritage, 2008c).

12.3.3 Occurrence in the Project Area

The White-winged Chough was recorded at one location in the Southern Project Area (Table 37). It was recorded in *Eucalyptus cladocalyx* Woodland / Open Woodland where an active nest was found in roadside vegetation (Figure 67). The location of this record is shown in Figure 5, although it is likely that the species occurs elsewhere in the Project Area where suitable habitat occurs.

Table 37. Location of known populations of White-winged Chough in the Project Area. Location information from EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 574858E 6166222N	4	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland



Figure 66. White-winged Chough. Photograph provided by Peter Day.



Figure 67. *Eucalyptus cladocalyx* Woodland / Open Woodland, habitat for the White-winged Chough. Photographed by EBS Ecology in 2019.

12.4 *Western Gerygone (Gerygone fusca)*

12.4.1 Conservation Status

The Western Gerygone is listed as Rare under the NPW Act. It is widely distributed throughout mainland Australia and is not listed as Threatened under the EPBC Act.

12.4.2 Ecology

Biology and description

The Western Gerygone is a small, dull grey-brown bird, paler below, weighing 5-7 g. It has a distinctive black and white tail pattern, including a white base to the outer tail feathers, and red eye that distinguish it from similar looking species. A broken white eye-ring and black loreal stripe are also characteristic. The Western Gerygone has a distinctive song, calls often and can be readily identified by the call alone (Menkhorst, et al., 2019).

Western Gerygones are often seen singly or in pairs. Some populations are resident, while others are partially migratory, mostly moving from south to north in the winter (Menkhorst, et al., 2019).

Habitat

The Western Gerygone occurs in drier forests and woodlands and *Acacia* shrublands (Menkhorst, et al., 2019).

12.4.3 Occurrence in the Project Area

The Western Gerygone was recorded in 2019 by EBS Ecology at two locations, with a single bird detected at each (Table 38). The species was found in two woodland Vegetation Associations in the Southern Project Area, as listed below:

- *Eucalyptus cladocalyx* Woodland / Open Woodland,
- *Allocasuarina verticillata* Low Woodland (Figure 68).

The locations of EBS Ecology records are mapped in Figure 4.

Table 38. Locations of EBS Ecology records of Western Gerygone in the Project Area. Location information from EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation association
53H 574927E 6165749N	1	<i>Eucalyptus cladocalyx</i> Woodland / Open Woodland
53H 588501E 6198791N	1	<i>Allocasuarina verticillata</i> Low Woodland



Figure 68. The Western Gerygone is found in drier woodlands, such as *Allocasuarina verticillata* Low Woodland shown here. Photographed by EBS Ecology in 2019.

12.5 Purple-gaped Honeyeater (*Lichenostomus cratitius*)

12.5.1 Conservation Status

The Purple-gaped Honeyeater is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

12.5.2 Ecology

Biology and description

The Purple-gaped Honeyeater is a grey-olive coloured bird. It has yellow edging to its tail and wing feathers and grey-yellow, unstreaked underparts. The diagnostic head pattern consists of a grey forehead and crown, black mask across the face and yellow-tipped ear tufts. Purple facial skin from the base of the black bill to below the eye is inconspicuous (Menkhorst, et al., 2019).

It is mostly sedentary, although it probably moves locally in response to food availability. It feeds on nectar, lerps and other insects, foraging in low trees and shrubs. The Purple-gaped honeyeater is usually encountered in pairs or small groups (Menkhorst, et al., 2019).

Habitat

The Purple-gaped Honeyeater occurs in mallee, tall heath and low woodlands throughout the Eyre Peninsula (Menkhorst, et al., 2019).

12.5.3 Occurrence in the Project Area

This species was recorded by EBS Ecology at one location while surveying the Northern Project Area (Table 39). However, it is likely that it occurs throughout suitable habitat in the Southern Project Area also. The single record was collected in the mallee Vegetation Association listed in Table 39 and pictured in Figure 69.

Table 39. Locations of EBS Ecology records of Purple-gaped Honeyeater in the Project Area. Location information from EBS Ecology 2014a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 659266E 6298811N	Not counted	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee.



Figure 69. The Purple-gaped Honeyeater is found in mallee Vegetation Associations, such as that shown here. Photographed by EBS Ecology in 2019.

12.6 *Malleefowl (Leipoa ocellata)*

12.6.1 Conservation Status

The Malleefowl is listed as Vulnerable under the EPBC Act. In South Australia, it has undergone a decline in all parts of its distribution and is listed as Endangered under the NPW Act.

12.6.2 Ecology

Biology and description

Malleefowl are large ground birds, weighing up to 2.2 kg, not likely to be confused with any other in the Project Area. Its wings and back are mottled and barred with grey, black, brown and white. The head and neck are grey, with a distinctive black stripe down the fore-neck. It has large, strong legs and feet (Menkhorst, et al., 2019).

Malleefowl are distinctive in that they incubate their eggs within a large nest mound, constructed of sand, leaves, bark and twigs. The mound is constructed by the male and can be up to 5 m in diameter and 1 m high. The male attends the mound constantly, maintaining the temperature within by adding or removing layers of material (Menkhorst, et al., 2019). Eggs are laid in the mound from September until late summer and hatch after about 60 days. Chicks receive no parental care after hatching (Benshemesh, 2007).

Malleefowl are generalist feeders, foraging on the ground for seeds, fruits, insects and other invertebrates (Benshemesh, 2007).

Habitat

Typical Malleefowl habitat includes semi-arid to arid low woodlands, mallee and shrublands. A sandy substrate with an abundance of leaf litter is required for construction of nest mounds (Benshemesh, 2007).

12.6.3 Occurrence in the Project Area

The Malleefowl is known to occur in suitable habitat along a 35 km section of the Northern Project Area (EBS Ecology, 2014a). ElectraNet has commissioned several Malleefowl mound surveys, including LiDAR and follow-up ground truthing investigations. This work resulted in 81 confirmed mounds being mapped within the vicinity of the Project Area (Figure 70), although many were inactive (Figure 71). Mound locations are listed by Vegetation Association in Table 40 and mapped in Figure XX. Mapping is based on EBS Ecology 2019d.

In addition, EBS Ecology recorded fresh Malleefowl tracks (Figure 72) at the locations listed in Table 41. Evidence of Malleefowl was detected in 13 Vegetation Associations as listed below and shown on the maps in Appendix 4:

- *Eucalyptus socialis* / *Eucalyptus oleosa* / *Eucalyptus brachycalyx* +/- *Eucalyptus leptophylla* Mallee.
- *Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *Eucalyptus incrassata* +/- *Eucalyptus brachycalyx*.
- *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee.

- *Eucalyptus incrassata* +/- *Callitris verrucosa* Mallee over *Leptospermum coriaceum*, *Phebalium bullatum*, *Triodia* spp. and *Calytrix tetragona* (Figure 73).
- *Geijera linearifolia* +/- *Senna artemisioides* ssp. *coriacea* +/- *Callitris gracilis* +/- *Acacia notabilis* +/- *Alyxia buxifolia* Shrubland (Figure 74).
- *Eucalyptus leptophylla* +/- *Eucalyptus oleosa* +/- *Melaleuca lanceolata* mixed Mallee over *Cratystylis conocephala* and *Atriplex vesicaria*.
- *Senna artemisioides* ssp. *coriacea*, *Dodonaea lobulata* Tall Shrubland +/- *Myoporum platycarpum*, *Dodonaea viscosa* ssp. *angustissima* and *Acacia oswaldii*,
- *Melaleuca uncinata* Shrubland,
- *Eucalyptus brachycalyx* +/- *Callitris verrucosa* Mallee over *Calytrix involucrata*, and *Phebalium bullatum*,
- *Eucalyptus brachycalyx* +/- *Callitris verrucosa* Mallee over *Melaleuca uncinata* and *Calytrix tetragona*,
- *Melaleuca uncinata* Tall Shrubland +/- *Eucalyptus incrassata* and *Eucalyptus brachycalyx*,
- *Callitris gracilis* Low Woodland over *Alyxia buxifolia* and *Beyeria lechenaultii* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Dodonaea viscosa* ssp. *angustissima*,
- *Eucalyptus porosa* Mallee over *Dodonaea viscosa* ssp. *angustissima*, *Senna artemisioides* ssp. *coriacea* and *Acacia wilhelmiana*.

Table 40. Confirmed Malleefowl mounds (EBS Ecology, 2014a) in the Project Area and Vegetation Associations (EBS Ecology, 2019a).

Mound No.	Vegetation Association
C001-004, C006-010, C046, C076-078	<i>Eucalyptus socialis</i> / <i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> +/- <i>Eucalyptus leptophylla</i> Mallee.
C005	<i>Acacia wilhelmiana</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Eucalyptus gracilis</i> +/- <i>Melaleuca uncinata</i> Tall Shrubland over <i>Triodia</i> spp. +/- <i>Eucalyptus incrassata</i> +/- <i>Eucalyptus brachycalyx</i> .
C012, C040, C042-045, C062, C064, C065, C069-073, C075, C079-081	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee.
C016	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Leptospermum coriaceum</i> , <i>Phebalium bullatum</i> , <i>Triodia</i> spp. and <i>Calytrix tetragona</i> .
C051	<i>Geijera linearifolia</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Callitris gracilis</i> +/- <i>Acacia notabilis</i> +/- <i>Alyxia buxifolia</i> Shrubland.
C053, C055, C056, C059	<i>Eucalyptus leptophylla</i> +/- <i>Eucalyptus oleosa</i> +/- <i>Melaleuca lanceolata</i> mixed Mallee over <i>Cratystylis conocephala</i> and <i>Atriplex vesicaria</i> .

Table 41. Location of Malleefowl records collected by EBS Ecology (EBS Ecology, 2019a).

Location	Record Type	Vegetation Association
53H 674182E 6310955N	Tracks	<i>Eucalyptus incrassata</i> +/- <i>Callitris verrucosa</i> Mallee over <i>Leptospermum coriaceum</i> , <i>Phebalium bullatum</i> , <i>Triodia</i> spp. and <i>Calytrix tetragona</i> .

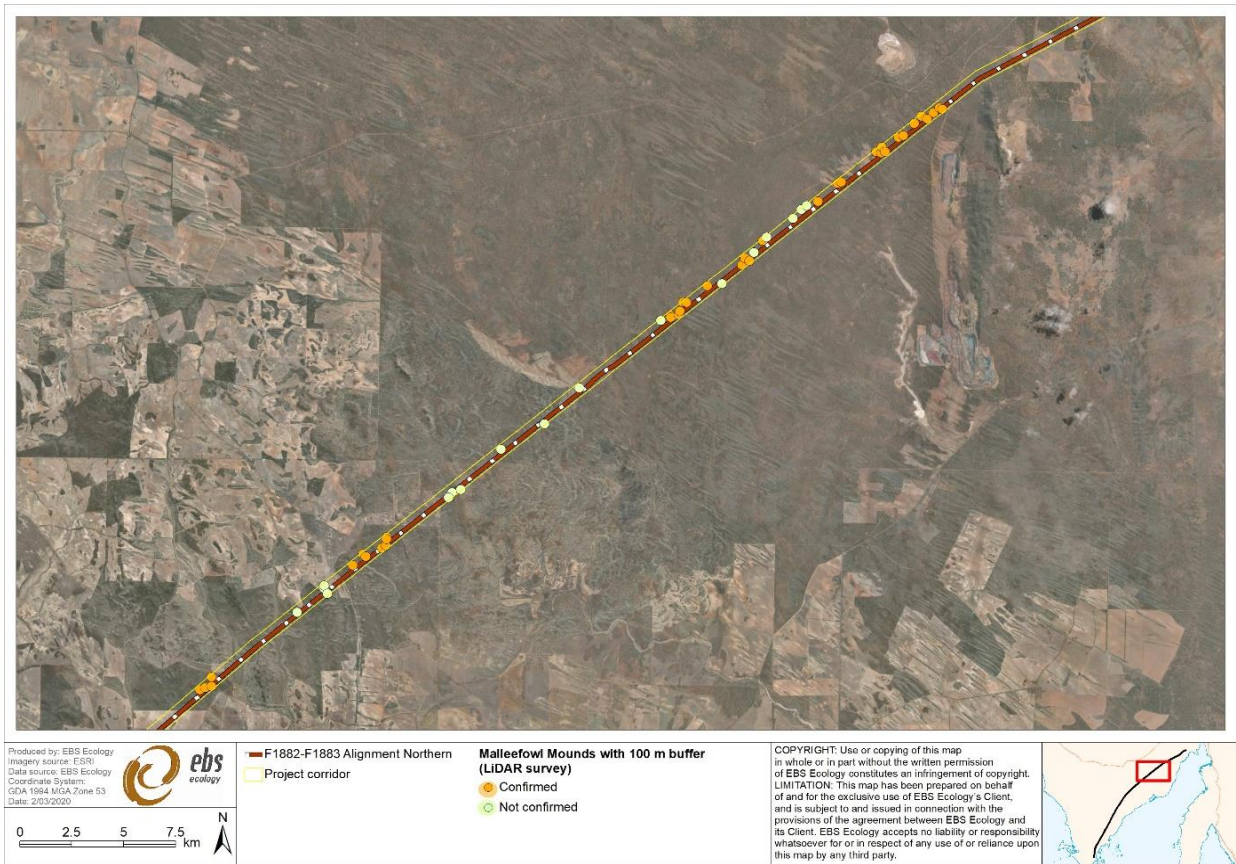


Figure 70. Location of Malleefowl mounds located by LiDAR and ground surveys.



Figure 71. An inactive Malleefowl mound located in the Project Area by EBS Ecology in 2013.



Figure 72. Malleefowl tracks in the Project Area (EBS Ecology 2019a).



Figure 73. Confirmed Malleefowl mounds are found in Vegetation Association such as *Eucalyptus incassata* +/- *Callitris verrucosa* Mallee over *Leptospermum coriaceum*, *Phebalium bullatum*, *Triodia spp.* and *Calytrix tetragona*. Photographed by EBS Ecology in 2019.



Figure 74. Malleefowl mounds were also confirmed in shrublands such as *Geijera linearifolia* +/- *Senna artemisioides ssp. coriacea* +/- *Callitris gracilis* +/- *Acacia notabilis* +/- *Alyxia buxifolia* Shrubland. Photographed by EBS Ecology in 2019.

12.7 *Restless Flycatcher (Myiagra inquieta)*

12.7.1 Conservation Status

The Restless Flycatcher (Figure 75) is listed as Rare under the NPW Act.

It is not listed as threatened under the EPBC Act.

12.7.2 Ecology

Biology and description

The Restless Flycatcher (Figure 75) has an unmarked glossy black head and upperparts and is white below. Females have a buff-coloured upper breast. Noisy and conspicuous, they occur in singles or pairs and forage for insects by pouncing from a low perch (Menkhorst, et al., 2019).

Habitat

Restless Flycatchers are found in open forests and woodlands and are often seen in adjacent farmland. They are also sometimes encountered in open mallee habitats (Department for Environment and Heritage, 2008e).

12.7.3 Occurrence in the Project Area

Restless Flycatchers were recorded by EBS Ecology at one location in the Northern Project Area (Table 42 and Figure 5). It was recorded in the following Vegetation Association:

- *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee (Figure 76).

The known distribution of the species includes northern and southern Eyre Peninsula. Given the extent of suitable habitat, it is not likely to occur throughout the Project Area.

Table 42. Locations of EBS Ecology records of Restless Flycatcher in the Project Area. Location information from EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 684355E 6319033N	Not counted	<i>Eucalyptus oleosa</i> / <i>Eucalyptus brachycalyx</i> Mallee



Figure 75. Restless Flycatcher (*Myiagra inquieta*). Photograph provided by Peter Day.



Figure 76. *Eucalyptus oleosa* / *Eucalyptus brachycalyx* Mallee, habitat for the Restless Flycatcher. Photographed by EBS Ecology in 2019.

12.8 *Gilbert's Whistler (Pachycephala inornata)*

12.8.1 Conservation Status

Gilbert's Whistler (Figure 77) is listed as Rare under the NPW Act.

It is not listed as threatened under the EPBC Act.

12.8.2 Ecology

Biology and description

Gilbert's Whistler is a stocky bird, 17 – 20 cm long, with a short, robust bill. Males are brown-grey with a black patch between red eye and bill and a distinctive rufous coloured chin and throat. The female lacks the black and rufous face markings and can be difficult to distinguish from more common whistler species (NSW Office of Environment and Heritage, 2020b).

Gilbert's whistler forages on the ground in shrub thickets as well as on the tops of low trees. It mainly feeds on invertebrates, but also seeds and fruit. Pairs may hold and defend permanent territories, with no regular movements recorded. They breed between August and November (NSW Office of Environment and Heritage, 2020b).

Habitat

Gilbert's Whistler is found in a range of mallee, shrubland and woodland habitats, but always where a dense shrub layer is present. It is often found in mallee with an understorey of low shrubs over *Triodia* spp. (NSW Office of Environment and Heritage, 2020b).

12.8.3 Occurrence in the Project Area

Gilbert's Whistler was recorded at one location within the Northern Project Area (Table 43 and Figure 5). The bird was observed in *Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *Eucalyptus incrassata* +/- *Eucalyptus brachycalyx* (Figure 78).

As suitable habitat for Gilbert's Whistler includes mallee and shrubland habitat more broadly and the species is widely distributed throughout the Eyre Peninsula, it is likely that the species occurs in the Project Area wherever a shrub layer occurs beneath mallee or woodland.

Table 43. Locations of EBS Ecology records of Gilbert's Whistler in the Project Area. Location information from EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 681465E 6316738N	Not counted	<i>Acacia wilhelmiana</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Eucalyptus gracilis</i> +/- <i>Melaleuca uncinata</i> Tall Shrubland over <i>Triodia</i> spp. +/- <i>Eucalyptus incrassata</i> +/- <i>Eucalyptus brachycalyx</i> .



Figure 77. Gilbert's Whistler (*Pachycephala inornata*). Photograph provided by Peter Day.



Figure 78. Suitable habitat for Gilbert's Whistler in the Project Area (*Acacia wilhelmiana* +/- *Senna artemisioides* ssp. *coriacea* +/- *Eucalyptus gracilis* +/- *Melaleuca uncinata* Tall Shrubland over *Triodia* spp. +/- *Eucalyptus incrassata* +/- *Eucalyptus brachycalyx*). Photographed by EBS Ecology in 2019.

12.9 *Diamond Firetail (Stagonopleura guttata)*

12.9.1 Conservation Status

The Diamond Firetail (Figure 79) is listed as Rare under the NPW Act..

It is not listed as threatened under the EPBC Act.

12.9.2 Ecology

Biology and description

The Diamond Firetail is a distinctive, stocky finch with prominent white spots on black flanks and scarlet rump. It has a grey head with black lores and red bill, with brown back and wings. The birds underparts are white with a prominent black breast-band separating the white throat and belly (Menkhorst, et al., 2019).

It is often seen in pairs and small flocks at the edges of dry forests and woodlands. It feeds primarily on the seeds of native and introduced grasses, foraging mainly on the ground (Menkhorst, et al., 2019).

Habitat

Diamond Firetails are found in a wide range of grassy, *Eucalyptus* dominated Vegetation Associations, including woodland, forest and mallee. Availability of suitable seed throughout the year is required and a diversity of native grasses appears a critical element of habitat. Larger areas of habitat are important, and it persists only in areas of >50 ha (Department for Environment and Heritage, 2008d).

12.9.3 Occurrence in the Project Area

Diamond Firetails were recorded by EBS Ecology at four locations in the Southern Project Area (Table 44 and Figure 4). It was recorded in the following three Vegetation Associations:

- *Eucalyptus diversifolia* Mallee (Figure 80).
- *Melaleuca halmaturorum* Tall Open Shrubland over *Juncus kraussii* and *Juncus pallidus*.
- *Eucalyptus incrassata* var. *angulosa* Mallee over *Melaleuca uncinata*.

Given the extent of similar habitat throughout, it is likely that the species occurs elsewhere in the Southern Project Area. Based on the known distribution of the species that includes only the southern Eyre Peninsula, it is not likely to occur in the north.

Table 44. Locations of EBS Ecology records of Diamond Firetail in the Project Area. Location information from EBS Ecology 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 574480E 6160341N	1	<i>Eucalyptus diversifolia</i> Mallee.
53H 575094E 6166316N	4	<i>Melaleuca halmaturorum</i> Tall Open Shrubland over <i>Juncus kraussii</i> and <i>Juncus pallidus</i> .
53H 575068E 6168650N	Not counted	<i>Melaleuca halmaturorum</i> Tall Open Shrubland over <i>Juncus kraussii</i> and <i>Juncus pallidus</i> .

Location	Number of individuals	Vegetation Association
53H 591750E 6204904N	5	<i>Eucalyptus incrassata</i> var. <i>angulosa</i> Mallee over <i>Melaleuca uncinata</i>



Figure 79. Diamond Firetail (*Stagonopleura guttata*). Photographed by Peter Day.



Figure 80. *Eucalyptus diversifolia* Mallee, habitat for the Diamond Firetail. Photographed by EBS Ecology in 2019.

12.10 Southern Emu-wren (Eyre Peninsula) (*Stipiturus malachurus parimeda*)

12.10.1 Conservation Status

The Southern Emu-wren (Eyre Peninsula) is listed as Vulnerable under the EPBC Act and Endangered under the NPW Act.

12.10.2 Ecology

Biology and description

The Southern Emu-wren is a small bird, with an overall length of 17–19 cm (including tail) and body mass of about 7 g. It has short rounded wings and a relatively long tail (11–13 cm) comprised of six emu-like feathers. Both sexes are tawny-brown with dark striations on the upperparts, and males are distinguished by their pale-blue upper-breast, throat and eyebrows (Pickett, 2006).

A secretive and cryptic species, it is a poor flier and tends to hop and scramble through its habitat. Short bursts of sustained flight between cover are often little more than a few metres. They feed mainly on insects, generally foraging amongst the foliage of dense vegetation and occasionally on the ground near dense cover (Pickett, 2006).

Southern Emu-wrens are sedentary, occupying territories of at least 1 ha in size. Due to their poor flight capabilities and reliance of dense, low shrub cover, they do not disperse widely.

Habitat

On Eyre Peninsula, Southern Emu-wrens are found in wet sedgeland/shrubland or dry heathy mallee/shrubland. They seem to use habitat based on structural rather than floristic composition – a dense cover of low shrubs and/or sedges is critical (Pickett, 2006).

12.10.3 Occurrence in the Project Area

The Southern Emu-wren was not recorded by EBS Ecology in any surveys undertaken in the Project Area. However, suitable habitat for the species was mapped by EBS Ecology in 2019 (EBS Ecology, 2019e). Suitable habitat is limited to the Southern Project Area and includes the following three Vegetation Associations:

- *Gahnia* spp. / *Juncus krausii* Sedgeland +/- *Eucalyptus petiolaris*.
- *Melaleuca halmaturorum* Tall Open Shrubland over *Juncus krausii* and *Juncus pallidus*.
- *Juncus* spp. Sedgeland (Figure 81).

Maps of potential Southern Emu-wren habitat within the Project Area are reproduced in Appendix 5.



Figure 81. *Juncus* spp. Sedgeland (foreground). This represents potential habitat for the Southern Emu-wren. Photographed by EBS Ecology in 2019.

12.11 Management of Threats to Birds of Woodland and Mallee

Known threats to many of the bird species in Section 12 are documented in literature including species recovery plans and species profiles. These sources are listed in Table 45. There are no documented threats to Western Gerygone, however management of threats to other woodland birds of similar habitats is likely to also benefit this species.

Table 45. Documentation of threats to birds of woodlands and mallee.

Species	Reference
White-winged Chough	<i>Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and the Mount Lofty Ranges, South Australia</i> (Wilson & Bignall, 2009).
Restless Flycatcher	
Diamond Firetail	
Purple-gaped Honeyeater	<i>Purple-gaped Honeyeater – Profile</i> (NSW Office of Environment and Heritage, 2020a).
Gilbert’s Whistler	<i>Gilbert’s Whistler – Profile</i> (NSW Office of Environment and Heritage, 2020b).
Striated Grasswren	<i>Striated Grasswren – Profile</i> (NSW Office of Environment and Heritage, 2020c).
Shy Heathwren	<i>Shy Heathwren – Profile</i> (NSW Office of Environment and Heritage, 2020d).
Southern Emu-wren	<i>Habitat Management Guidelines for the Eyre Peninsula Southern Emu-wren</i> (Pickett, 2006).
Malleefowl	<i>National Recovery Plan for Malleefowl</i> (Benshemesh, 2007).

The documents listed in Table 45 identify 10 threats and threatening processes as impacting on woodland and mallee birds. Of these, road and rail corridor management, habitat fragmentation and habitat loss threaten all nine species that might occur in the Project Area.

All documented threats to the bird species covered in Section 12 are discussed in Table 46. As shown in the table, seven are possibly or likely to be exacerbated by the Project. This document identifies management actions that will be implemented by ElectraNet and its contractors to minimise the impact of the threatening processes exacerbated by the Project. These actions are discussed in detail in Section 15.

Those actions that are relevant to the woodland and mallee birds are listed in Table 46.

Table 46. Threats to woodland and mallee birds as documented by the relevant literature. The table indicates those that may be exacerbated by the Project and lists the management actions that will be implemented to minimise impacts.

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Grazing (stock and feral animals)	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl Restless Flycatcher Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Overgrazing by stock and feral animals causes the loss of understorey vegetation, including shrubs and grasses¹. Changes in vegetation structure and composition caused by grazing influences the diversity and abundance of vertebrate prey and plant foods^{2, 3}. Removal of litter layer by over grazing reducing foraging habitat⁴. Known to be a major threat to Southern Emu-wren, through decreased density of low vegetation due to trampling, especially by cattle⁵. 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	
Introduced predators (including cats, foxes, dogs)	Striated Grasswren Shy Heathwren Malleefowl Gilbert's Whistler	<ul style="list-style-type: none"> Predation by foxes, and to a lesser extent cats and raptors, is a major cause of mortality for Malleefowl³. Predation by introduced predators may be increasingly threatening for small bird species whose populations are already small and fragmented and impacted by other processes^{2, 6}. 	<p>Yes.</p> <ul style="list-style-type: none"> Linear clearance of vegetation increases the ability of cats and foxes to access habitat from nearby areas. Areas cleared of vegetation provide more suitable foraging areas for predators, increasing hunting success and predation pressure on native fauna. Disposal of food waste and rubbish on site by personnel may attract feral predators to the Project Area. 	<p>6.1 6.2 6.3 6.4</p>
Competition from introduced birds	Gilbert's Whistler	<ul style="list-style-type: none"> Aggressive exclusion from habitat by over-abundant Noisy Miners (<i>Manorina melanocephala</i>) is thought to be a threat to populations of Gilbert's Whistler in NSW⁴. 	<p>No.</p> <ul style="list-style-type: none"> Eyre Peninsula is not within the distribution of the Noisy Miner. The closely related Yellow-throated Miner (<i>Manorina flavigula</i>) occurs but has not been identified as a threat to Gilbert's Whistler, or any other species in this management plan. 	Not exacerbated by the Project.
Weed invasion	Southern Emu-wren White-winged Chough Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Invasion by weed species such as <i>Asparagus asparagoides</i>, <i>Senecio pterophorous</i> and grassy species can cause changes in vegetation structure and diversity⁵. Invasion of exotic grasses may be detrimental to the prevalence of native species, which are 	<p>Yes.</p> <ul style="list-style-type: none"> Movement to, from and within the Project Area by machinery, vehicles and personnel is a vector of spread for weeds during construction. Contaminated construction materials brought into the Project Area (e.g. gravel/fill/sand 	<p>1.1 1.2 1.3 1.4 1.5 1.6</p>

Threat	Species	Discussion	Exacerbated by the Project	Management Action
		often an important food source in winter/spring ⁷ .	contaminated by weed seeds) is a vector of spread for weeds during construction. <ul style="list-style-type: none"> Land newly cleared of vegetation increases the opportunity for weed establishment, particularly colonising species that are advantaged by disturbance. 	1.7 1.8 1.9 1.10 1.11
Inappropriate fire management	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl Restless Flycatcher Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Large fires are a major threat to Malleefowl and other mallee birds. Populations may be eliminated from large areas by such fires, with limited opportunity for re-colonisation in fragmented habitats^{3, 5}. Fire at high frequency impacts density of shrub layer, vegetation structure and composition^{4, 6}. Removal of dead timber and leaf litter by fire reduces foraging suitability of habitat for some species (e.g. Restless Flycatcher)⁸. 	Yes. <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. 	2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 3.5
Road and rail corridor management	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl White-winged Chough Purple-gaped Honeyeater Restless Flycatcher Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Where remnant habitat is located within road and rail corridors, maintenance of the infrastructure and associated vegetation management may contribute to further habitat loss/fragmentation. 	No. <ul style="list-style-type: none"> ElectraNet is not responsible for the maintenance or management of any road or rail corridors. 	Not exacerbated by the Project.
Habitat fragmentation	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl White-winged Chough Purple-gaped Honeyeater Restless Flycatcher Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Clearing of mallee and woodlands for agriculture has resulted in the fragmentation of habitats that were once contiguous over extensive landscapes resulting in small populations of species isolated by intervening areas of non-suitable habitat^{3, 5} Reduces dispersal opportunities and gene flow between populations^{3, 5} Fragmentation is likely to exacerbate the effects of other threats such as poor fire management³ 	Yes. <ul style="list-style-type: none"> The Project is a long, linear development that contributes to the fragmentation of vegetation patches where clearing is required. 	4.1 4.2 4.3 4.4 4.8 4.9 4.10 4.11 4.12 4.13

Threat	Species	Discussion	Exacerbated by the Project	Management Action
Habitat Loss	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl White-winged Chough Purple-gaped Honeyeater Restless Flycatcher Diamond Firetail Gilbert's Whistler	<ul style="list-style-type: none"> Historically, clearing of woodland and mallee is likely to have been the greatest threat to these species leading to decline³. Habitat loss has been greatest in higher rainfall areas on fertile soils, which coincide with the best habitat for species like Malleefowl, with remnants mostly occurring in marginal habitat less suitable for agriculture³. Clearing habitat removes food resources and nesting sites⁹. 	<p>Yes.</p> <ul style="list-style-type: none"> The Project requires clearing of vegetation and thus contributes to loss of habitat. 	4.14
	Infrastructure development	Southern Emu-wren	<ul style="list-style-type: none"> Particularly relevant to Southern Emu-wren, where construction of infrastructure such as roads, powerlines and fences occurs near limited habitat patches⁵. 	
Site disturbance	Striated Grasswren Shy Heathwren Southern Emu-wren Malleefowl White-winged Chough Purple-gaped Honeyeater Restless Flycatcher Diamond Firetail Gilbert's Whistler Western Gerygone	<ul style="list-style-type: none"> While not identified in any of the literature referenced, site disturbance may impact bird species indirectly. 	<p>Yes.</p> <ul style="list-style-type: none"> Nesting birds may respond to disturbance by abandoning eggs and/or chicks. Increased vehicle traffic on access roads and transmission line easement increases the risk of mortality or injury due to vehicle strikes. 	<p>3.2 3.3 3.4 3.5 3.6 3.7 3.8</p>

¹*Amytornis textilis myall* (**Western Grasswren (Gawler Ranges) Conservation Advice**) (Threatened Species Scientific Committee, 2014).

²*Striated Grasswren – Profile* (NSW Office of Environment and Heritage, 2020c).

³*National Recovery Plan for Malleefowl Leipoa ocellata* (Benshemesh, 2007).

⁴*Gilbert's Whistler – Profile* (NSW Office of Environment and Heritage, 2020b).

⁵*Habitat Management Guidelines for the Eyre Peninsula Southern Emu-wren* (Pickett, 2006).

⁶*Shy Heathwren – Profile* (NSW Office of Environment and Heritage, 2020d).

⁷*Adelaide and Mount Lofty Ranges South Australia Threatened Species Profile – Diamond Firetail* (Department for Environment and Heritage, 2008d).

⁸*Adelaide and Mount Lofty Ranges South Australia Threatened Species – Restless Flycatcher* (Department for Environment and Heritage, 2008e).

⁹*Purple-gaped Honeyeater – Profile* (NSW Office of Environment and Heritage, 2020a).

13 BIRDS OF CHENOPOD SHRUBLANDS

13.1 *Slender-billed Thornbill, (western subspecies) (Acanthiza iredalei iredalei)*

13.1.1 Conservation Status

The western subspecies of Slender-billed Thornbill is listed as Rare under the NPW Act. It is not listed as threatened under the EPBC Act.

13.1.2 Ecology

Biology and description

The Slender-billed Thornbill is a small bird about 10 cm in length and weighing only 5-6 g. They are olive-grey/brown in colour with a black patch with white edges on their forehead. While they are usually seen in pairs or in small groups of up to 10 birds, they occasionally form flocks of up to 60. They feed on invertebrates and leaves and stems of some plants, foraging in low shrubs and on the ground (Natural Resources Adelaide and Mt Lofty Ranges).

Habitat

The Slender-billed Thornbill's preferred habitat includes shrublands, sometimes near mangroves, salt lakes, or salt flats. They usually choose chenopod shrublands dominated by *Sarcocornia* spp., *Maireana* spp. or *Atriplex* spp. Sometimes they have been seen in low heath on sand plains as well (Natural Resources Adelaide and Mt Lofty Ranges).

13.1.3 Occurrence in the Project Area

The species was recorded at three locations in the Northern Project Area. These locations, listed in Table 47 and mapped in Figure 5, were all within woodland or shrubland with a chenopod understorey, including the following associations:

- *Maireana sedifolia* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Eucalyptus gracilis*, *Alectryon oleifolius* ssp. *canescens* (Figure 82).
- *Acacia papyrocarpa* Open Woodland over *Maireana sedifolia* / *Atriplex vesicaria* / *Maireana pyramidata*.
- *Acacia papyrocarpa* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Myoporum platycarpum* mixed Low Open Woodland over *Atriplex vesicaria* / *Austrostipa* spp.

Table 47. Locations of EBS Ecology records of Slender-billed Thornbill in the Project Area. Location information from EBS Ecology 2014a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 703167E 6332520N	Not counted	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Myoporum platycarpum</i> , <i>Acacia papyrocarpa</i> , <i>Eucalyptus gracilis</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i> .
53H 704210E 6333185N	Not counted	<i>Acacia papyrocarpa</i> Open Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i> / <i>Maireana pyramidata</i> .

53H 710761E 6336547N	>5	<i>Acacia papyrocarpa</i> +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> +/- <i>Myoporum platycarpum</i> mixed Low Open Woodland over <i>Atriplex vesicaria</i> / <i>Austrostipa</i> spp.
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Figure 82. *Maireana sedifolia* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Eucalyptus gracilis*, *Alectryon oleifolius* ssp. *Canescens*. Photographed by EBS Ecology in 2019.

13.2 *Western Grasswren (Gawler Ranges) (Amytornis textilis myall)*

13.2.1 Conservation Status

The Western Grasswren (Gawler Ranges) is listed as Vulnerable under the EPBC Act and Vulnerable under the MPW Act.

13.2.2 Ecology

Biology and description

Western Grasswrens are medium-sized, thickset grasswrens with long bills and long tails. The upperparts are dark brown to rufous with paler streaks, while the underparts are pale grey-buff with fine streaking from the chin to the breast. They have a white patch on the centre of the belly (Threatened Species Scientific Committee, 2014).

It is usually seen in pairs or small groups, but sometimes occurs singly. They feed primarily on seeds, fruits and insects, foraging on the ground at the base of in leaf litter (Threatened Species Scientific Committee, 2014).

Habitat

Chenopod shrublands in the Gawler Ranges and northern Eyre Peninsula are the primary habitat of the Western Grasswren, most commonly low shrublands, chiefly comprising *Maireana pyramidata* and *Lycium australe* They are also known to occur in low woodlands, mostly comprising *Acacia papyrocarpa*. Most of the subspecies habitat is found along drainage lines but occasionally habitat also includes low rocky hills and semi-arid low woodlands (Threatened Species Scientific Committee, 2014).

13.2.3 Occurrence in the Project Area

Western Grasswrens have been recorded at four locations in the Northern Project Area by EBS Ecology (Table 48 and Figure 5). In addition, EBS Ecology carried out mapping of suitable habitat in 2014. These maps are provided in Appendix 6, overlaid with vegetation mapping from EBS Ecology 2019a. This indicates that potential Western Grasswren habitat includes the following Vegetation Associations:

- *Acacia papyrocarpa* Open Woodland over *Maireana sedifolia* / *Atriplex vesicaria* / *Maireana pyramidata*.
- *Maireana pyramidata* Low Shrubland +/- *Myoporum platycarpum*, *Acacia papyrocarpa*, *Alectryon oleifolius* ssp. *Canescens* (Figure 83).
- *Maireana sedifolia* Low Shrubland +/- *Acacia papyrocarpa* over *Austrostipa* spp. and *Austrodanthonia caespitosa*.

About 20% of the population of Western Grasswren is known to occur within the Cultana Training Area (Threatened Species Scientific Committee, 2014).

Table 48. Locations of EBS Ecology Western Grasswren records in the Project Area. Location information from EBS Ecology 2014a and 2019a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 704048E 6332983N	Not counted	<i>Acacia papyrocarpa</i> Open Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i> / <i>Maireana pyramidata</i> .
53H 708780E 6335487N	Not counted	<i>Maireana pyramidata</i> Low Shrubland +/- <i>Myoporum platycarpum</i> , <i>Acacia papyrocarpa</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i> .
53H 727124E 6345050N	Not counted	<i>Acacia papyrocarpa</i> Open Woodland over <i>Maireana sedifolia</i> / <i>Atriplex vesicaria</i> / <i>Maireana pyramidata</i> .
53H 728591E 6349537N	1	<i>Maireana sedifolia</i> Low Shrubland +/- <i>Acacia papyrocarpa</i> over <i>Austrostipa</i> spp. and <i>Austrodanthonia caespitosa</i> .



Figure 83. *Maireana pyramidata* Low Shrubland in the Cultana training area. This is habitat for Western Grasswren. Photographed by EBS Ecology in 2019.

13.3 Management of Threats to birds of Chenopod Shrublands

Known threats to the Slender-billed Thornbill (western subspecies) and Western Grasswren (Gawler Ranges) are documented in the following sources:

- *Slender-billed Thornbill (Western)* (Natural Resources Adelaide and Mt Lofty Ranges).
- *Amytornis textilis myall (Western Grasswren (Gawler Ranges)) Conservation Advice* (Threatened Species Scientific Committee, 2014).

These documents identify three threats as impacting on the two species. All are potentially exacerbated by the Project. These are discussed in Table 49.

Table 49. Threats and management of impacts to birds of chenopod shrublands, indicating those that may be exacerbated by the Project.

Threat	Species	Discussion	Exacerbated by the Project	Management Actions
Grazing (stock and feral animals)	Slender-billed Thornbill Western Grasswren	<ul style="list-style-type: none"> Intensive grazing by sheep and rabbits is thought to be the greatest threat to Slender-billed Thornbill due to the changes in vegetation structure and composition that results¹. Overgrazing by stock and feral animals (goats and rabbits) causes the loss of understorey vegetation and has been shown to cause declines in Western Grasswren populations². The extinction of other subspecies of Western Grasswren in Western Australia and Northern Territory has been directly attributed to grazing pressures². 	<p>Yes.</p> <ul style="list-style-type: none"> There is anecdotal evidence (John Read pers. Com.) that an increase in the local impact of grazing occurs following vegetation management activities related to the transmission line. Increased impact results from native and feral grazers preferentially grazing areas of new growth that follows clearing. 	
Inappropriate fire management	Slender-billed Thornbill Western Grasswren	<ul style="list-style-type: none"> Chenopod shrublands generally don't burn very frequently. Long-lived <i>Maireana</i> spp. may take up to 50 years to mature (Cheal, 2010). Mature shrubs are an important component of habitat for both species. 	<p>Yes.</p> <ul style="list-style-type: none"> Increased access to areas during construction presents an increased risk of ignition sources. Operation of machinery, tools and vehicles increases ignition sources during construction. 	<p>2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8</p>
Introduced predators	Western Grasswren	<ul style="list-style-type: none"> It is thought that extinction of the Western Grasswren from the Yellabinna region may be due to predation by foxes and/or cats, as the area has not been subjected to livestock grazing². 	<p>Yes.</p> <ul style="list-style-type: none"> Linear clearance of vegetation increases the ability of cats and foxes to access habitat from nearby areas. Areas cleared of vegetation provide more suitable foraging areas for predators, increasing hunting success and predation pressure on native fauna. Disposal of food waste and rubbish on site by personnel may attract feral predators to the Project Area. 	<p>6.1 6.2 6.3 6.4</p>

¹ *Slender-billed Thornbill (Western)* (Natural Resources Adelaide and Mt Lofty Ranges).

² *Amytornis textilis myall (Western Grasswren (Gawler Ranges)) Conservation Advice* (Threatened Species Scientific Committee, 2014).

14 THREATENED RAPTORS

14.1 *Peregrine Falcon (Falco peregrinus)*

14.1.1 Conservation Status

The Peregrine Falcon (Figure 84) is listed as Rare under the NPW Act.

14.1.2 Ecology

Biology and description

The Peregrine Falcon is a powerfully built bird of prey with black hood, blue-black upperparts and creamy white chin, throat and underparts with fine barring from the breast to the tail. The long, tapered wings have a straight trailing edge in flight and tail is relatively short. The bird has a heavy yellow, black-tipped bill and yellow eye ring. Its legs and feet are also yellow (Department for Environment and Heritage, 2008f).

Birds are often observed flying high, with each pair occupying a large, permanent territory. The breeding season is August to December, with pairs nesting in the same location, often a cliff or rock ledge, for many years. Peregrine Falcons feed on birds, but also mammals such as rabbits (Department for Environment and Heritage, 2008f).

Habitat

Peregrine Falcons are found in most habitats in Australia. In South Australia, most records are from woodlands and habitats within the vicinity of gorges with rock faces and cliffs (Department for Environment and Heritage, 2008f).

14.1.3 Occurrence in the Project Area

Peregrine Falcons were recorded at two locations in the Northern Project Area by EBS Ecology in 2013 (Table 50 and Figure 4). Birds were observed perched on transmission line structures, which possibly serve as nest sites within the shrubland Vegetation Association in which they were recorded.

However, since this species can occur in almost any habitat where abundant prey occurs, it is likely that it is widely distributed throughout the north and south of the Project Area, including areas of cleared agricultural land.

Table 50. Location of EBS Ecology records of Peregrine Falcon in the Project Area. Location information from EBS Ecology 2014a. Vegetation Associations are as they appear in EBS Ecology 2019a.

Location	Number of individuals	Vegetation Association
53H 685109E 6319642N	1	<i>Geijera linearifolia</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Callitris gracilis</i> +/- <i>Acacia notabilis</i> +/- <i>Alyxia buxifolia</i> Shrubland.
53H 685447E 6319899N	2	<i>Geijera linearifolia</i> +/- <i>Senna artemisioides</i> ssp. <i>coriacea</i> +/- <i>Callitris gracilis</i> +/- <i>Acacia notabilis</i> +/- <i>Alyxia buxifolia</i> Shrubland.



Figure 84. A Peregrine Falcon perched on a transmission line structure in the Project Area. Photographed by EBS Ecology in 2012.

14.2 Management of Threats to the Peregrine Falcon

Peregrine Falcons are naturally rare and were threatened in the past by the widespread use of some pesticides that are now not in use (Department for Environment and Heritage, 2008f). Nevertheless, two potential threats to the Peregrine Falcon have been identified by the *Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and the Mount Lofty Ranges, South Australia* (Wilson & Bignall, 2009) and *The Peregrine Falcon (*Falco peregrinus*)* (Department of Agriculture, Water and the Environment, 2020d). Both threats have the potential to be exacerbated by the Project, as discussed in Table 51.

Table 51. Threats to the Peregrine Falcon, including those exacerbated by the Project.

Threat	Discussion	Exacerbated by the Project	Management Actions
Site disturbance	<ul style="list-style-type: none"> Peregrine Falcons are vulnerable to disturbance, particularly at nest sites where disturbance can cause birds to abandon eggs or chicks². 	<p>Yes.</p> <ul style="list-style-type: none"> Construction works and associated activities have the potential to disturb falcons utilising existing transmission line towers and structures in the Project Area. Increased vehicle traffic on access tracks and transmission line easement increases the risk of impacts from vehicle strikes. 	<p>3.2 3.3 3.4 3.5 3.6 3.7 3.8</p>
Pollution and poisoning	<ul style="list-style-type: none"> Historically, the greatest threat to the Peregrine Falcon has been secondary poisoning from pesticides, specifically DDT². Accidental and secondary poisoning from baits left during for foxes/dogs/dingoes can occur². 	<p>Yes.</p> <ul style="list-style-type: none"> Incorrect disposal or chemical spills on site may cause pollution. Any predator control programme implemented risks non-target kills and secondary poisoning of native fauna. 	<p>9.1 9.2 9.3 9.4 9.5</p>

²The Peregrine Falcon (*Falco peregrinus*) (Department of Agriculture, Water and the Environment, 2020d).

15 CONSTRUCTION MANAGEMENT MEASURES

ElectraNet and its contractors will endeavour to avoid impact to threatened species during construction of the Project by undertaking the following:

- Project design – micro siting of infrastructure, access roads and other activities requiring vegetation clearing will occur to avoid known occurrences of threatened species and communities.
- The Project Area generally follows existing electricity infrastructure easements, using existing access roads and in-easement tracks.

Where impacts cannot be avoided, ElectraNet and its contractors will implement Management Actions that address threats and threatening processes discussed in this TSMP. By implementing these actions, unavoidable impact will be minimised. Management Actions are listed in Table 52.

While the majority of Management Actions are required wherever native vegetation occurs in the Project Area, some actions are specific to the Southern or Northern Project Areas, as indicated in the table.

Table 52. Management Actions for the minimisation of impacts to threatened species and communities as a result of the Project.

Threat	Management Action	Location	Timing	Responsibility
1. Weed Invasion and disease	1.1 Construction contractor to have a Weed, Pest and Disease Management Plan (including Phytophthora) approved by ElectraNet. The plan will be developed based on baseline winter and summer weed surveys undertaken prior to construction.	Project Area	Planning Construction	Principal Contractor
	1.2 Limit entry/exit points to the Project Area to the minimum number possible.	Project Area	Planning Construction	Principal Contractor
	1.3 Undertake weed surveys of all proposed disturbance areas prior to commencement of construction works.	Project Area	Planning	Principal Contractor
	1.4 Relocate entry/exit points and stockpile/laydown areas that have a high risk for the spread of weeds . If not possible, take corrective action (e.g. weed control).	Project Area	Planning	Principal Contractor
	1.5 Designate/establish vehicle and machinery washdown and inspection sites.	Project Area	Planning	Principal Contractor
	1.6 All fill materials required for construction (e.g. sand, soil, gravel) will be sourced from certified weed and phytophthora free sites.	Project Area	Construction	Principal Contractor
	1.7 Restrict all vehicle and machinery traffic to designated (existing and new) roads and access tracks that are approved by landowners.	Project Area	Construction	Principal Contractor
	1.8 All vehicles and machinery accessing the Project Area will be washed down and inspected by a trained responsible officer in accordance with the Weed Management Plan. This will occur at the designated washdown/inspection sites. Heavy vehicles/machinery must be certified weed and soil free by the responsible officer prior to entering the Project Area.	Project Area	Construction	Principal Contractor
	1.9 Location of entry and exit points, laydown areas and vehicle and machinery washdown and inspection procedures will form part of toolbox meetings for site crews.	Project Area	Planning Construction	Principal Contractor
	1.10 The Project Area and construction sites will be regularly surveyed for weed outbreaks. Outbreaks and recommended corrective action will be communicated to ElectraNet.	Project Area	Construction	Principal Contractor
	1.11 New weed outbreaks will be controlled in accordance with the Weed, Pest and Disease Management Plan. Any weed control will be undertaken only after consent from landowners.	Project Area	Construction	Principal Contractor
2. Inappropriate fire regimes	2.1 Construction contractor to have a Bushfire Management Plan approved by ElectraNet.	Project Area	Planning	Principal Contractor

Threat	Management Action	Location	Timing	Responsibility
	2.2 All vehicles accessing Project Area will be fitted with fire extinguishers or other suitable firefighting equipment such as water carts that are inspected regularly.	Project Area	Construction	Principal Contractor
	2.3 Hot works will only occur on days of total fire ban under appropriate permit, in compliance with the documented plan and regulations. Restrictions will be in place on catastrophic rating days.	Project Area	Construction	Principal Contractor
	2.4 Contractors' work safety documentation will include emergency response procedures for the event of fire.	Project Area	Construction	Principal Contractor
	2.5 Personnel will be informed of daily CFS Fire Danger Rating at daily toolbox meetings. The Fire Danger Rating will form part of the daily risk analysis at these meetings.	Project Area	Construction	Principal Contractor
	2.6 At all times during the declared Bushfire Danger Season, or on days of Total Fire Ban outside the declared season, light vehicles will carry fire-fighting backpacks for each personnel in vehicle. From spring to autumn, all light vehicles will carry one fire fighting backpack and shovel as a minimum regardless of the fire danger rating.	Project Area	Construction	Principal Contractor
	2.7 Any incidents of unplanned ignition will be immediately (or as soon as practicable) reported to the CFS and ElectraNet.	Project Area	Construction	Principal Contractor
	2.8 Procedures relating to fire management in the Project Area, including contact details of relevant authorities (e.g. CFS) and information sources, will be clearly communicated to all personnel during inductions.	Project Area	Construction	Principal Contractor
	3. Site disturbance	3.1 Construction contractor to have a Sedimentation, Erosion and Drainage Management Plan approved by ElectraNet.	Project Area	Planning Construction
3.2 Threatened EPBC listed plant individuals or populations in proximity to vegetation being cleared will be fenced using temporary flagging or otherwise clearly marked.		Project Area	Planning Construction	Principal Contractor
3.3 Construction activities will occur during daylight hours wherever possible so as not to disturb nocturnal wildlife or roosting raptors.		Project Area	Construction	Principal Contractor
3.4 Where access to structures is required on the existing transmission line where raptor nests are located, nest locations will be mapped and temporary flagging and signage installed.		Project Area	Planning	Principal Contractor

Threat	Management Action	Location	Timing	Responsibility
	3.5 No vegetation clearing or construction activity shall be undertaken until Management Actions 3.1 and 3.2 are certified as complete by ElectraNet (or Principal Contractor).	Project Area	Planning	Principal Contractor
	3.6 Where access points and tracks intersect public roads, they will be fenced with access restricted by locked gates where possible and only with landholder agreement.	Project Area	Construction	Principal Contractor
	3.7 The following speed limits will be imposed on all access roads and within the transmission line easement: - On farm roads 60 kph - On pasture 30 kph; and - Near houses, sheds and water points 20 kph.	Project Area	Construction	Principal Contractor
	3.8 Maintain log of incidents involving fauna injury/death resulting from construction activities.	Project Area	Construction	Principal Contractor
	3.9 Designated Construction Activity Zones will be planned and approved by ElectraNet via a Land Disturbance Permit. All works will be confined to those approved activity zones.	Project Area	Construction	ElectraNet/Principal Contractor
4. Vegetation clearing / habitat loss / fragmentation / infrastructure development / loss of hollow-bearing trees	4.1 Construction contractor to have a Biodiversity Management Plan, that includes clearing procedures, approved by ElectraNet. This will include the use of geospatial data and mapping for identification of protected areas and establishment of No-Go zones and recommendations for clearing of different vegetation types.	Project Area	Planning	Principal Contractor
	4.2 Construction contractor to have a Rehabilitation Management Plan approved by ElectraNet including rehabilitation targets and recommendations for different vegetation types	Project Area	Planning Construction	Principal Contractor
	4.3 Vegetation clearing will be restricted to the smallest area possible to allow construction, as documented in Eyre Peninsula Transmission Line – EPBC Assessment (EBS Ecology, 2019b).	Project Area	Planning Construction	Principal Contractor
	4.4 Areas of vegetation within the Construction Activity Zone to be retained will be clearly delineated using fencing, flagging, roping off and/or signage.	Project Area	Planning Construction	Principal Contractor
	4.5 Where vegetation being cleared adjoins <i>Eucalyptus petiolaris</i> woodland EEC, the EEC will be clearly delineated using fencing, flagging, roping off and/or signage.	Southern Project Area	Planning	Principal Contractor
	4.6 Areas of vegetation likely to have hollow-bearing trees being removed will be surveyed for hollow-bearing trees prior to clearing. Hollow-bearing trees will be mapped and clearly	Southern Project Area	Planning	Principal Contractor

Threat	Management Action	Location	Timing	Responsibility
	marked in the field. Where the removal of a hollow-bearing tree is required, the hollows will be retained on site to provide fauna habitat. Bush rocks and tree barrels will also be retained where they are identified as providing valuable habitat.			
	4.7 An ecologist or suitably qualified person in the identification and handling of fauna will be present during the removal of any hollow-bearing trees to remove/relocate any fauna displaced as a result.	Southern Project Area	Construction	Principal Contractor
	4.8 4.8 No vegetation clearing shall be undertaken on a property until Management Action 4.2, 4.3, 4.4, and 4.5 is certified as complete by ElectraNet (or Principal contractor). Vegetation clearance will be managed through a Land Disturbance Permit (LDP) issued by ElectraNet to the Principal Contractor.	Project Area	Planning	Principal Contractor
	4.9 All vehicle and machinery parking, laydown areas and stockpiles will be restricted to designated construction activity zones (CAZ). No clearing, parking, laydown, stockpiles or other disturbance of native vegetation outside of CAZ	Project Area	Planning Construction	Principal Contractor
	4.10 Unless clearance is required for access, stability or safety reasons, ground vegetation will be rolled rather than cleared to minimise disturbance to topsoil, seedstock and rootstock.	Project Area	Construction	Principal Contractor
	4.11 All areas not required for ongoing operational access will be rehabilitated. Progressive rehabilitation will be implemented where it does not impede the progress or safety of construction.	Project Area	Construction	Principal Contractor
	4.12 Residual impact of vegetation clearing will be offset by ElectraNet's SEB contribution and other offsetting as approved under the EPBC Act.	Project Area	Operation	ElectraNet
	4.13 All personnel will be inducted as to the locations of sensitive vegetation and threatened flora species.	Project Area	Construction	Principal Contractor
	4.14 Where earthworks are required, topsoil and vegetation cleared will be stockpiled on site and respread over areas to be rehabilitated on completion of construction.	Project Area	Construction	Principal Contractor
	4.15 An ecologist or suitably qualified person in the identification and handling of fauna will be present on site to inspect native vegetation for fauna including active nests prior to clearance and arrange for relocation where impacts cannot be avoided.	Project Area	Construction	Principal Contractor
	4.16 Malleefowl mounds will be managed in accordance with the Malleefowl Management Plan (see separate plan) including	Project Area	Construction	Principal Contractor/ElectraNet

Threat	Management Action	Location	Timing	Responsibility
	delineation, avoidance of impacts in protection buffers, fauna inspections and rehabilitation of habitat within 50m of a mound.			
5. Spray drift	5.1 Any weed control will be undertaken in accordance with the Weed Control Handbook for Declared Plants in South Australia (Invasive Species Unit, Biosecurity SA, 2018) and the Weed, Pest and Disease Management Plan	Project Area	Construction	Principal Contractor
	5.2 Herbicides and chemicals will only be stored and used in accordance with the manufacturers' directions and with the consent of the relevant landowners.	Project Area	Construction	Principal Contractor
	5.3 Populations of threatened plants will be identified as per Management Actions 3.2 and 4.1.	Project Area	Planning	Principal Contractor
6. Predation by foxes and cats	6.1 All contractors to have a Weed, Pest and Disease Management Plan approved by ElectraNet.	Project Area	Planning Construction	Principal Contractor
	6.2 Construction contractor to have a Waste Management Plan approved by ElectraNet.	Project Area	Planning Construction	Principal Contractor
	6.3 All waste, including food wrappers and food scraps, will be removed and disposed of within a licensed waste disposal facility and in accordance with a Waste Management Plan.	Project Area	Construction	Principal Contractor
	6.4 ElectraNet will investigate undertaking a predator baiting and monitoring programme as part of their offset as approved under the EPBC Act.	Project Area	Operation	Principal Contractor
7. Illegal harvest and collection	7.1 Signage will be installed at entry/exit points that intersect public roads to minimise trespass. Where required by the landholder, entry/exit points will be fenced and gated.	Northern Project Area	Construction	Principal Contractor
	7.2 Gates will be left as they are found (i.e. don't close and lock a gate that was found open on arrival).	Northern Project Area	Construction	Principal Contractor
	7.3 Access will be further restricted under direction from landowners if required.	Northern Project Area	Construction	Principal Contractor
	7.4 Access tracks that are not required during the operational phase of the Project will be ripped and rehabilitated, unless otherwise directed by a landowner.	Northern Project Area	Construction	Principal Contractor
8. Lack of pollination and loss of genetic diversity	8.1 Manage vegetation clearing associated with the Project according to Management Actions 4.1 to 4.13.	Project Area	Planning Construction	Principal Contractor

Threat	Management Action	Location	Timing	Responsibility
9. Pollution and poisoning	9.1 All construction contractors to have a Waste Management Plan approved by ElectraNet.	Project Area	Planning Construction	Principal Contractor
	9.2 Refuelling of machinery and vehicles will occur in a designated area only. Spill kits will be installed at these locations.	Project Area	Construction	Principal Contractor
	9.3 Any chemicals used during construction or for vegetation management will be disposed of off-site and in accordance with the product directions.	Project Area	Construction	Principal Contractor
	9.4 Any incident of fuel or chemical spill will be managed in accordance with the Principal Contractor's Construction Environmental Management Plan.	Project Area	Construction	Principal Contractor
	9.5 Any predator control programme will be designed to include monitoring for non-target kills and secondary poisoning, following an adaptive management approach.	Project Area	Planning Construction	Principal Contractor

16 MONITORING AND ADAPTIVE MANAGEMENT

Throughout the construction phase of the Project it is possible that, despite the best efforts to consider all threats and impacts to threatened species, unforeseen impacts could occur. For this reason, ElectraNet and its contractors will take an adaptive management approach through continual monitoring and improvement, as documented in the CEMP and its sub-plans.

Monitoring undertaken for these components and any subsequent adaptive management will support the management of threatened species and their habitats, as specified in ElectraNet's offset strategy approved under the EPBC Act.

Specific Monitoring Measures have been developed to monitor success of the Management Actions and are listed by threat/impact as shown in Table 53.

Table 53. Threats and impacts caused by the Proposal and references for monitoring measures.

Threat	Monitoring Measure Reference
Weed invasion and disease	Table 54
Inappropriate fire regimes	Table 55
Site disturbance	Table 56
Vegetation clearing / habitat loss / fragmentation / infrastructure development / loss of hollow-bearing trees	Table 57
Spray drift	Table 58
Predation by foxes and cats	Table 59
Illegal harvest and collection	Table 60
Lack of pollination and loss of genetic diversity	Table 61
Pollution and poisoning	Table 62

Table 54. Adaptive management approach to impacts associated with weed invasion and disease.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
1.1	ElectraNet approved Weed, Pest and Disease Management Plan (including Phytophthora).	Complete Weed, Pest and Disease Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
1.2	Entry/exit points approved by ElectraNet, mapped and documented in relevant material.	Where additional entry/exit points are deemed necessary, undertake Management Actions 1.3, 1.4 and 1.9.	Planning	Principal Contractor
	Undertake periodic review of entry/exit point requirements.		Construction	Principal Contractor
	Toolbox meetings for site crews to include overview of site access and daily toolbox meetings to include location of entry/exit points and stockpile/laydown areas.	Toolbox meetings completed to ElectraNet's standards.	Planning Construction	Principal Contractor
1.3	Weed survey report and risk assessment of proposed entry/exit points and stockpile/laydown areas.	Locate entry/exit points and stockpile/laydown areas in accordance with weed risk assessment.	Planning	Principal Contractor
1.4	Undertake periodic weed monitoring of all proposed disturbance areas.	Where new outbreaks of weeds are detected, undertake Management Actions 1.10.	Construction	Principal Contractor
1.5	Vehicle and machinery washdown and inspection sites documented in Weed Management Plan.	Complete Weed Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
1.6	Certification documentation from supplier.	Discontinue use of supplier if documents can't be supplied	Construction	Principal Contractor
1.7	Network of approved access tracks mapped and maintained by ElectraNet	Complete required maps.	Planning Construction	Principal Contractor
	Undertake periodic review of access track requirements, including landowner consultations.	Communicate any changes in access agreements/arrangements to all contractors and update relevant documentation.	Construction	Principal Contractor
	Toolbox meetings for site crews to include location of approved access tracks.	Toolbox meetings completed to ElectraNet's standards.	Planning Construction	Principal Contractor
1.8	Inspection log of vehicles accessing the Project Area is maintained.	Vehicles/machinery that fails inspection will not be allowed to access the Project Area	Construction	Principal Contractor

1.9	Records of toolbox meetings and attendees maintained.	Undertake additional meetings where required.	Planning Construction	Principal Contractor
1.10	Periodic weed survey reports submitted to ElectraNet.	Where new weed outbreaks are detected, undertake Management Actions 1.3, 1.4 and 1.9.	Construction	Principal Contractor
1.11	Weed, Pest and Disease Management Plan approved by landowners. Periodic monitoring of weed control sites to determine success.	Modify Weed, Pest and Disease Management Plan to accommodate landowner recommendations. Undertake follow-up weed control if required.	Planning Construction	Principal Contractor

Table 55. Adaptive management approach to impacts associated with inappropriate fire regimes.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
2.1	ElectraNet approved Bushfire Management Plan	Complete Bushfire Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
2.2	All vehicles accessing the Project Area will be inspected for the presence of a fire extinguisher. Fire extinguishers must be full, in good working order and accompanied by a fire shovel or rake.	Vehicles that fail inspection will not be allowed to access the Project Area.	Construction	Principal Contractor
2.3	ElectraNet approved Bushfire Management Plan	Complete Bushfire Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
2.4	Construction contractors' emergency response procedures approved by ElectraNet.	Emergency response procedure approved by ElectraNet prior to commencement of construction.	Planning	Principal Contractor
2.5	Log of daily fire danger ratings maintained by construction contractor and reviewed by ElectraNet.	Enforce compliance if required.	Construction	Principal Contractor
2.6	PPE and facilities available in accordance with the Bushfire Management Plan.	Complete Bushfire Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
2.7	Log of incidents maintained by construction contractor and ElectraNet.	Should an incident occur, Fire Management Actions will be immediately reviewed and modified as required.	Construction.	Principal Contractor
2.8	ElectraNet to approve contractors' induction procedure and documents.	Ensure induction process includes fire management procedures.	Planning Construction	Principal Contractor

Table 56. Adaptive management approach to impacts associated with site disturbance.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
3.1	Approved Sedimentation, Erosion and Drainage Management Plan.	Complete Sedimentation, Erosion and Drainage Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
3.2	Audit of flagged/marked threatened plant populations.	Undertake any recommendations made by environmental contractor.	Planning	Principal Contractor
3.3	ElectraNet to approve contractors' Vegetation Management Plan and clearing procedures.	Vegetation Management Plan and clearing procedures specify that clearing will occur only during daylight hours.	Planning Construction	Principal Contractor
3.4	Audit of mapped raptor nests and buffer areas.	Undertake any recommendations made by environmental contractor.	Planning	Principal Contractor
3.5	Management Actions 3.1 and 3.2 completed.	Complete Management Actions 3.1 and 3.2, including any recommendations made following audit.	Planning	Principal Contractor
3.6	Installation of gates and locks confirmed by ElectraNet audit of access points.	Undertake any recommendations made by auditor.	Planning Construction	Principal Contractor
3.7	Contractors' induction process includes speed restrictions.	Contractors' induction programme completed to ElectraNet's standards.	Planning	Principal Contractor
3.8	ElectraNet to undertake periodic review of fauna incident log.	Where incidents have occurred, seek advice from suitable qualified contractor and implement any additional management actions recommended.	Construction	Principal Contractor
3.9	Land Disturbance Permit obtained.	Obtain Land Disturbance Permit	Construction	ElectraNet/Principal Contractor

Table 57. Adaptive management approach to impacts associated with vegetation clearing, habitat loss, fragmentation, infrastructure development and the loss of hollow-bearing trees.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
4.1	Approved Biodiversity Management Plan.	Complete Biodiversity Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
4.2	Approved Rehabilitation Management Plan.	Complete Rehabilitation Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
4.3	Environmental contractor to undertake periodic inspection of vegetation clearing.	Where over-clearing is detected, report to ElectraNet and recommend corrective management action.	Construction	Principal Contractor

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
4.4	Audit of flagged/marked vegetation.	Undertake any recommendations made by environmental contractor.	Planning	Principal Contractor
4.5	Audit of flagged/marked EEC.	Undertake any recommendations made by environmental contractor.	Planning	Principal Contractor
4.6	Audit of marked hollow-bearing trees.	Undertake any recommendations made by environmental contractor.	Planning	Principal Contractor
4.7	Hollow-bearing tree reports completed by environmental contractor and submitted to ElectraNet.	ElectraNet to enforce compliance if required.	Construction	Principal Contractor
4.8	Audit by ElectraNet of Management Actions 4.1 – 4.5 indicates they're complete.	Complete Management Actions as required.	Planning	Principal Contractor
4.9	Locations of parking, laydown and stockpile sites approved by ElectraNet.	Re-locate sites if required.	Planning	Principal Contractor
4.10	Biodiversity Management Plan approved by ElectraNet.	Edit Biodiversity Management Plan as directed by ElectraNet.	Planning	Principal Contractor
4.11		ElectraNet to enforce compliance with Biodiversity Management Plan where required.	Construction	
4.12	Impact offsets approved by ElectraNet and State and Commonwealth regulators.	Undertake recommendations made by regulators.	Planning	ElectraNet
4.13	Induction documentation and procedures approved by ElectraNet.	Complete induction documents and procedures to standard required by ElectraNet.	Planning	Principal Contractor
	Log of personnel inductions maintained by contractor and periodically reviewed by ElectraNet.	Enforce compliance with inducted personnel log if required.		
4.14	Biodiversity Management Plan approved by ElectraNet.	Edit Biodiversity Management Plan as directed by ElectraNet. ElectraNet to enforce compliance with Biodiversity Management Plan where required.	Planning Construction	Principal Contractor
4.15	Ecologist's report or similar record of inspection complete.	Undertake pre-clearing surveys	Construction	Principal Contractor
4.16	Malleefowl Management Plan complete.	Complete Malleefowl Management Plan.	Planning	Principal Contractor/ElectraNet

Table 58. Adaptive management approach to impacts associated with spray drift.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
5.1	Weed, Pest and Disease Management Plan approved by ElectraNet.	Complete Weed, Pest and Disease Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
5.2		ElectraNet to enforce compliance with Weed Management Plan where required.	Construction	
5.3	Audit completion of Management Actions 3.2 and 4.1.	Complete Management Actions.	Planning	Principal Contractor

Table 59. Adaptive management approach to impacts associated with predation by foxes and cats.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
6.1	Approved Weed, Pest and Disease Management Plan.	Complete Weed, Pest and Disease Management Plan that conforms to ElectraNet's standards.	Planning Construction	Principal Contractor
6.2	Approved Waste Management Plan.	Complete Waste Management Plan that conforms to ElectraNet's standards.	Planning	Principal Contractor
6.3		ElectraNet to enforce compliance with Waste Management Plan where required.		
6.4	As directed by approved ElectraNet offset strategy			

Table 60. Adaptive management approach to impacts associated with illegal harvest and collection.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
7.1	Installation of gates and locks confirmed by ElectraNet audit of access points.	Undertake any recommendations made by auditor.	Planning	Principal Contractor
7.2			Construction	
7.3	Signed landowner access agreements.	Negotiate access agreements with landowners.	Planning Construction	Principal Contractor
7.4	Biodiversity Management Plan approved by ElectraNet.	Edit Biodiversity Management Plan as directed by ElectraNet.	Planning Construction	Principal Contractor

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
		ElectraNet to enforce compliance with Biodiversity Management Plan where required.		

Table 61. Adaptive management approach to impacts associated with lack of pollination and loss of genetic diversity.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
8.1	Biodiversity Management Plan approved by ElectraNet.	Edit Biodiversity Management Plan as directed by ElectraNet. ElectraNet to enforce compliance with Biodiversity Management Plan where required.	Planning Construction	Principal Contractor

Table 62. Adaptive management approach to impacts associated with pollution and poisoning.

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
9.1	Waste Management Plan approved by ElectraNet.	Edit Waste Management Plan as directed by ElectraNet. ElectraNet to enforce compliance with Waste Management Plan where required.	Planning Construction	Principal Contractor
9.2	Audit location of refuelling locations and placement of spill kits.	Undertake any recommendations specified by audit.	Planning Construction	Principal Contractor
9.3	Waste Management Plan approved by ElectraNet.	Edit Waste Management Plan as directed by ElectraNet. ElectraNet to enforce compliance with Waste Management Plan where required.	Planning Construction	Principal Contractor
9.4	ElectraNet to review incident reports.	Clean-up spills as directed within Waste Management Plan. Undertake additional management actions as determined by review.	Construction	Principal Contractor
9.5	Monitoring survey of non-target kills from any predator baiting programme.	Implement management recommendations.	Predator control programme.	Principal Contractor

Management Action	Monitoring Measure	Corrective Action (where applicable)	Timing	Responsibility
	Report on results, including recommended actions for improvement, submitted to ElectraNet.			

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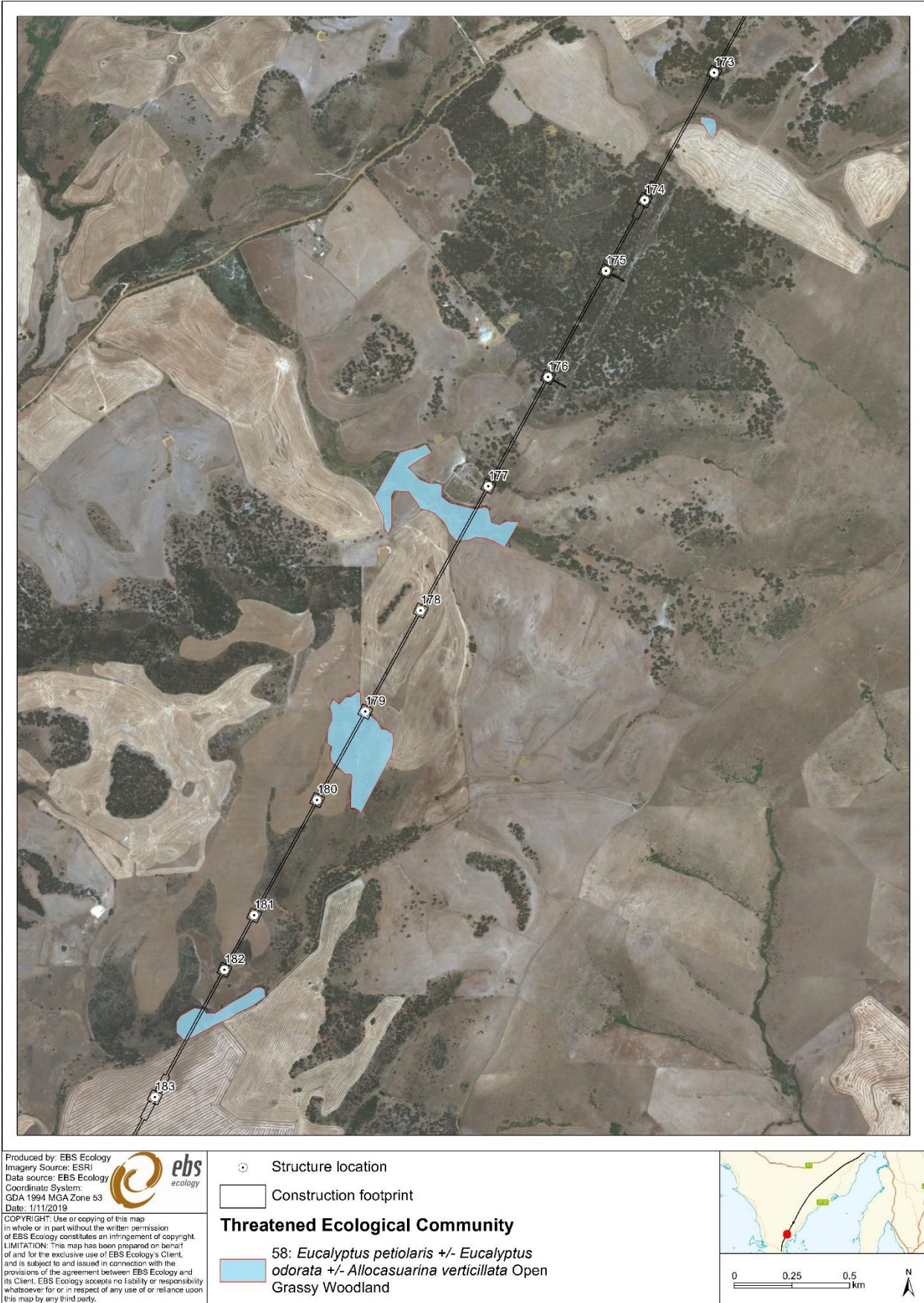
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18APPENDICES

***Appendix 1. Mapping of Eucalyptus petiolaris (Eyre Peninsula Blue Gum)
Woodland EEC.***







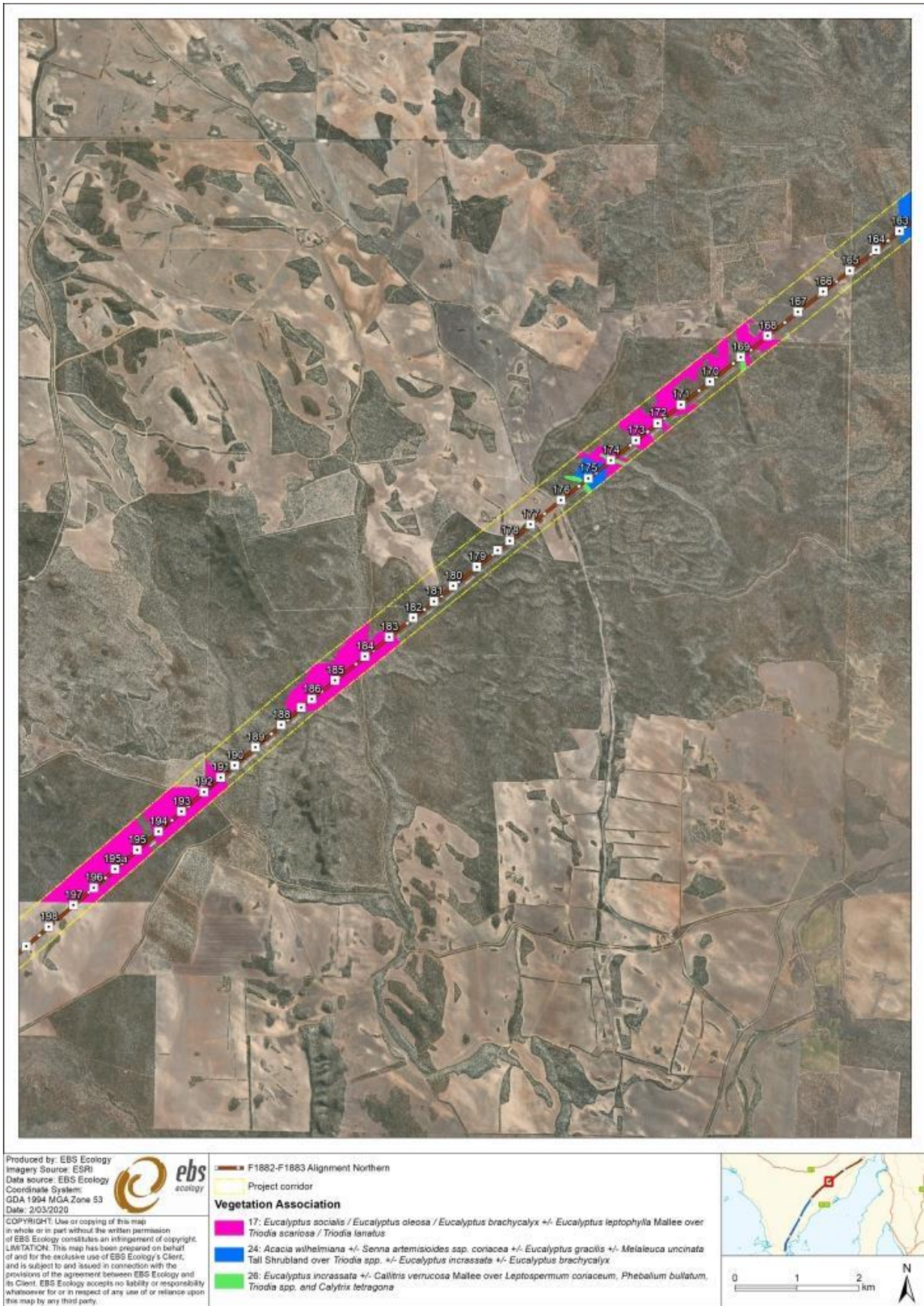
Appendix 2. The location of *Santalum spicatum* (Sandalwood) records within the Project Area collected by EBS Ecology in 2013 and 2019 surveys.

Species Name	Common Name	Easting	Northing
<i>Santalum spicatum</i>	Sandalwood	729954	6348436
<i>Santalum spicatum</i>	Sandalwood	727355	6345706
<i>Santalum spicatum</i>	Sandalwood	727420	6345684
<i>Santalum spicatum</i>	Sandalwood	727489	6345783
<i>Santalum spicatum</i>	Sandalwood	727525	6345812
<i>Santalum spicatum</i>	Sandalwood	727893	6346204
<i>Santalum spicatum</i>	Sandalwood	727938	6346224
<i>Santalum spicatum</i>	Sandalwood	727962	6346297
<i>Santalum spicatum</i>	Sandalwood	727905	6346292
<i>Santalum spicatum</i>	Sandalwood	727862	6346291
<i>Santalum spicatum</i>	Sandalwood	727871	6346306
<i>Santalum spicatum</i>	Sandalwood	727882	6346314
<i>Santalum spicatum</i>	Sandalwood	727877	6346330
<i>Santalum spicatum</i>	Sandalwood	728277	6346580
<i>Santalum spicatum</i>	Sandalwood	728273	6346610
<i>Santalum spicatum</i>	Sandalwood	728255	6346615
<i>Santalum spicatum</i>	Sandalwood	728259	6346646
<i>Santalum spicatum</i>	Sandalwood	728229	6346645
<i>Santalum spicatum</i>	Sandalwood	728216	6346648
<i>Santalum spicatum</i>	Sandalwood	728413	6346670
<i>Santalum spicatum</i>	Sandalwood	728410	6346681
<i>Santalum spicatum</i>	Sandalwood	728435	6346686
<i>Santalum spicatum</i>	Sandalwood	728417	6346715
<i>Santalum spicatum</i>	Sandalwood	728627	6346866
<i>Santalum spicatum</i>	Sandalwood	728636	6346844
<i>Santalum spicatum</i>	Sandalwood	728597	6346837
<i>Santalum spicatum</i>	Sandalwood	728059	6346474
<i>Santalum spicatum</i>	Sandalwood	727851	6346234
<i>Santalum spicatum</i>	Sandalwood	727823	6346212
<i>Santalum spicatum</i>	Sandalwood	735869	6352744
<i>Santalum spicatum</i>	Sandalwood	735930	6352791
<i>Santalum spicatum</i>	Sandalwood	728449	6347029
<i>Santalum spicatum</i>	Sandalwood	728216	6346637
<i>Santalum spicatum</i>	Sandalwood	728080	6346619
<i>Santalum spicatum</i>	Sandalwood	728086	6346525
<i>Santalum spicatum</i>	Sandalwood	728029	6346512
<i>Santalum spicatum</i>	Sandalwood	727970	6346495
<i>Santalum spicatum</i>	Sandalwood	727956	6346415
<i>Santalum spicatum</i>	Sandalwood	727948	6346400
<i>Santalum spicatum</i>	Sandalwood	727854	6346399
<i>Santalum spicatum</i>	Sandalwood	727849	6346372

EP Transmission Line Threatened Species Management Plan

<i>Santalum spicatum</i>	Sandalwood	728275	6346579
<i>Santalum spicatum</i>	Sandalwood	727963	6346301
<i>Santalum spicatum</i>	Sandalwood	728062	6346477
<i>Santalum spicatum</i>	Sandalwood	728086	6346525
<i>Santalum spicatum</i>	Sandalwood	728096	6346579
<i>Santalum spicatum</i>	Sandalwood	728258	6346645
<i>Santalum spicatum</i>	Sandalwood	728270	6346609
<i>Santalum spicatum</i>	Sandalwood	728256	6346613
<i>Santalum spicatum</i>	Sandalwood	702426	6332219
<i>Santalum spicatum</i>	Sandalwood	702421	6332204
<i>Santalum spicatum</i>	Sandalwood	702442	6332162
<i>Santalum spicatum</i>	Sandalwood	702440	6332157
<i>Santalum spicatum</i>	Sandalwood	704803	6333406
<i>Santalum spicatum</i>	Sandalwood	711553	6336987
<i>Santalum spicatum</i>	Sandalwood	711740	6337084
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<i>Santalum spicatum</i>	Sandalwood	712532	6337523

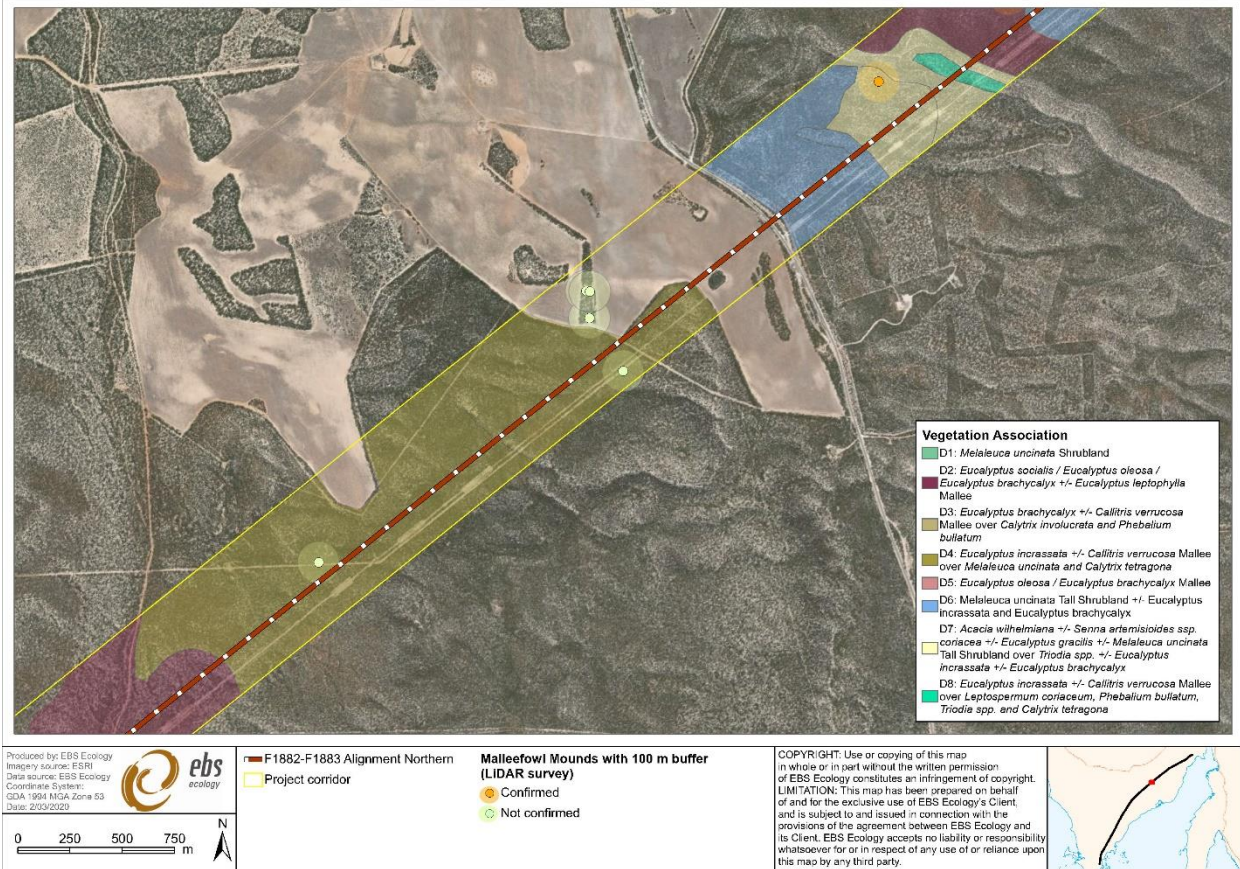
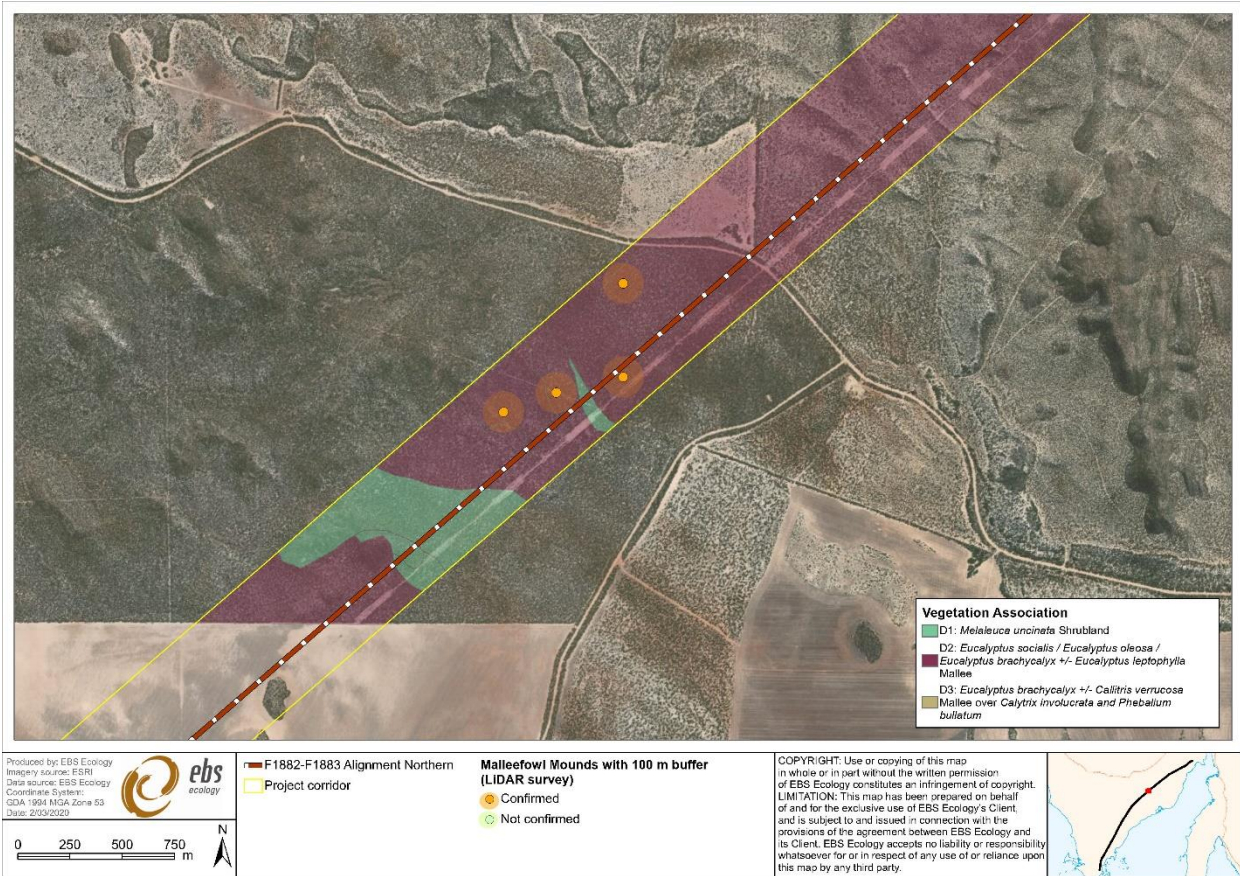
Appendix 3. Suitable habitat for the Sandhill Dunnart in the Project Area as mapped by EBS Ecology 2019c.

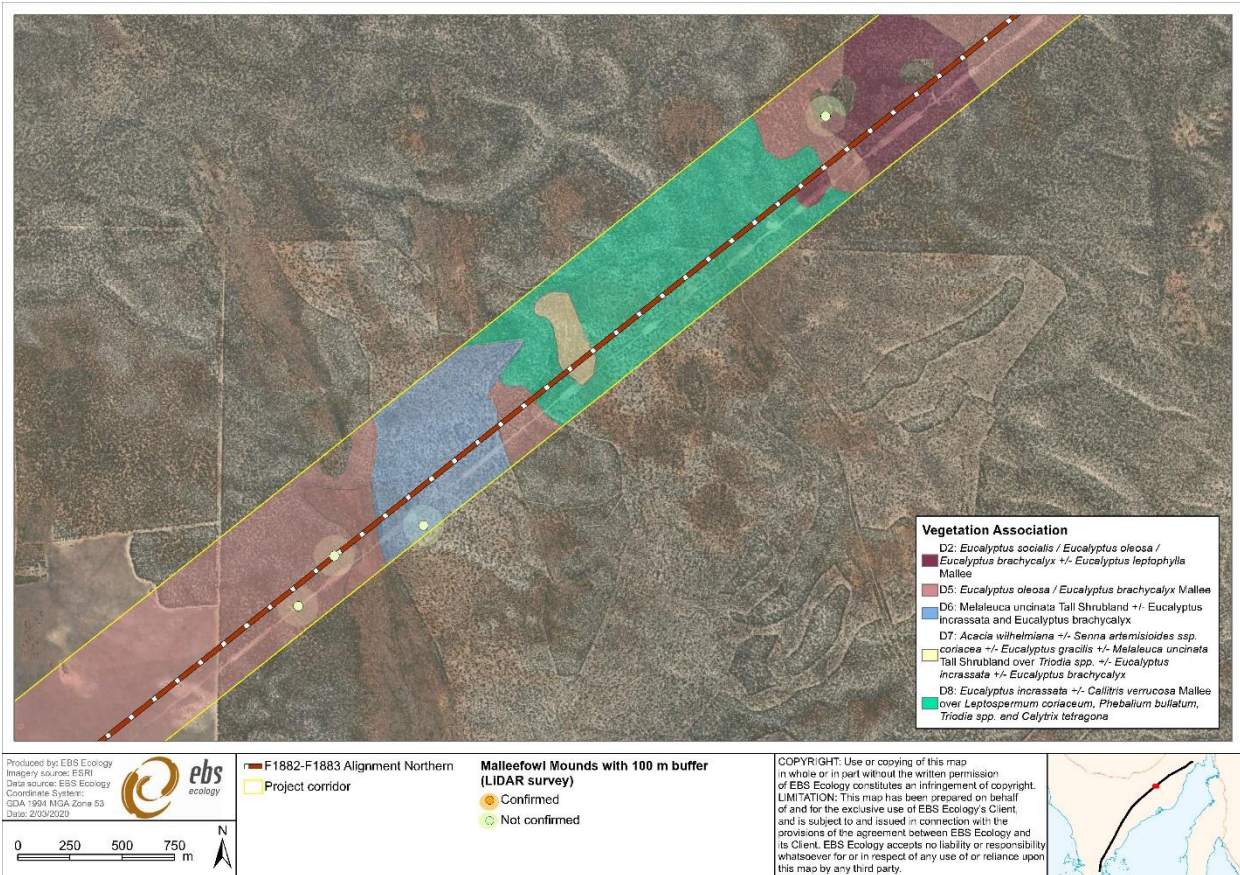
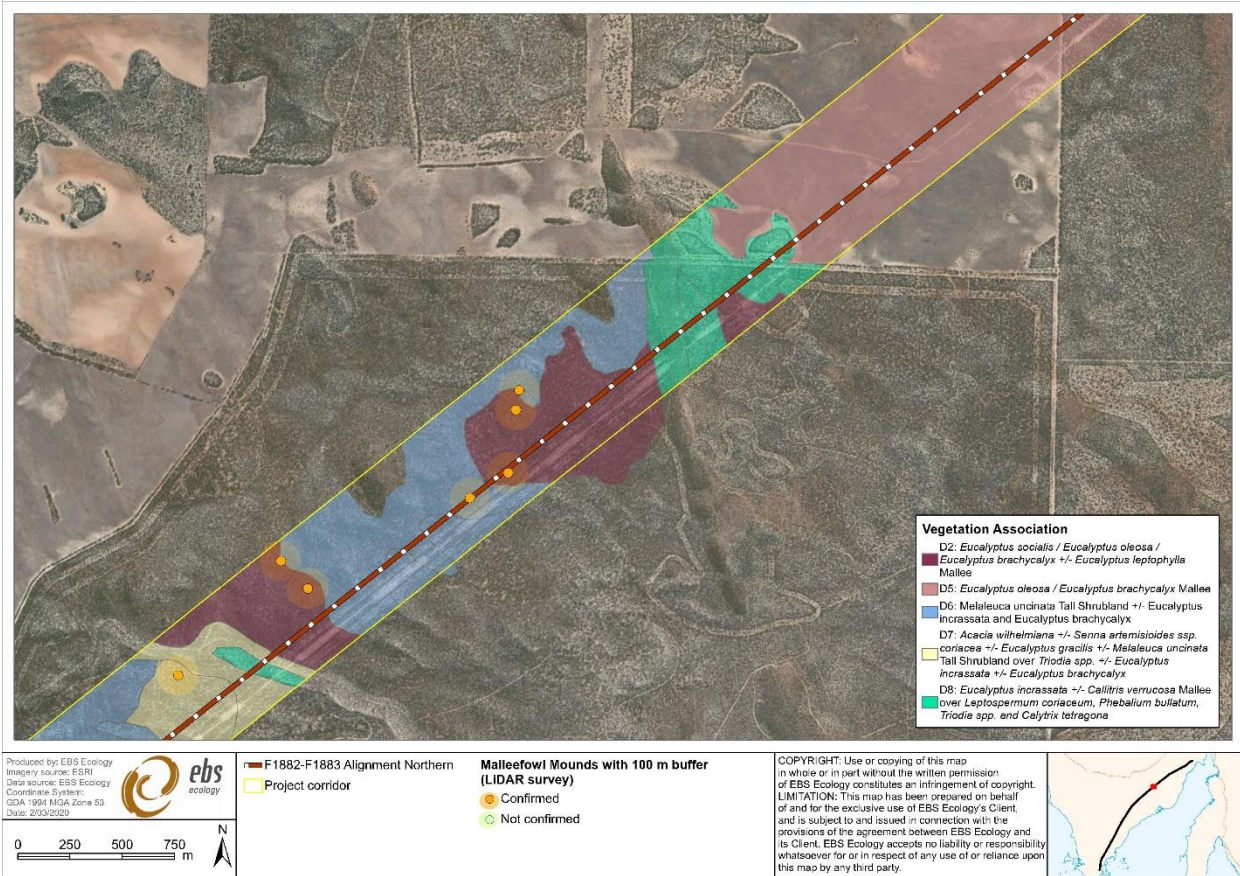


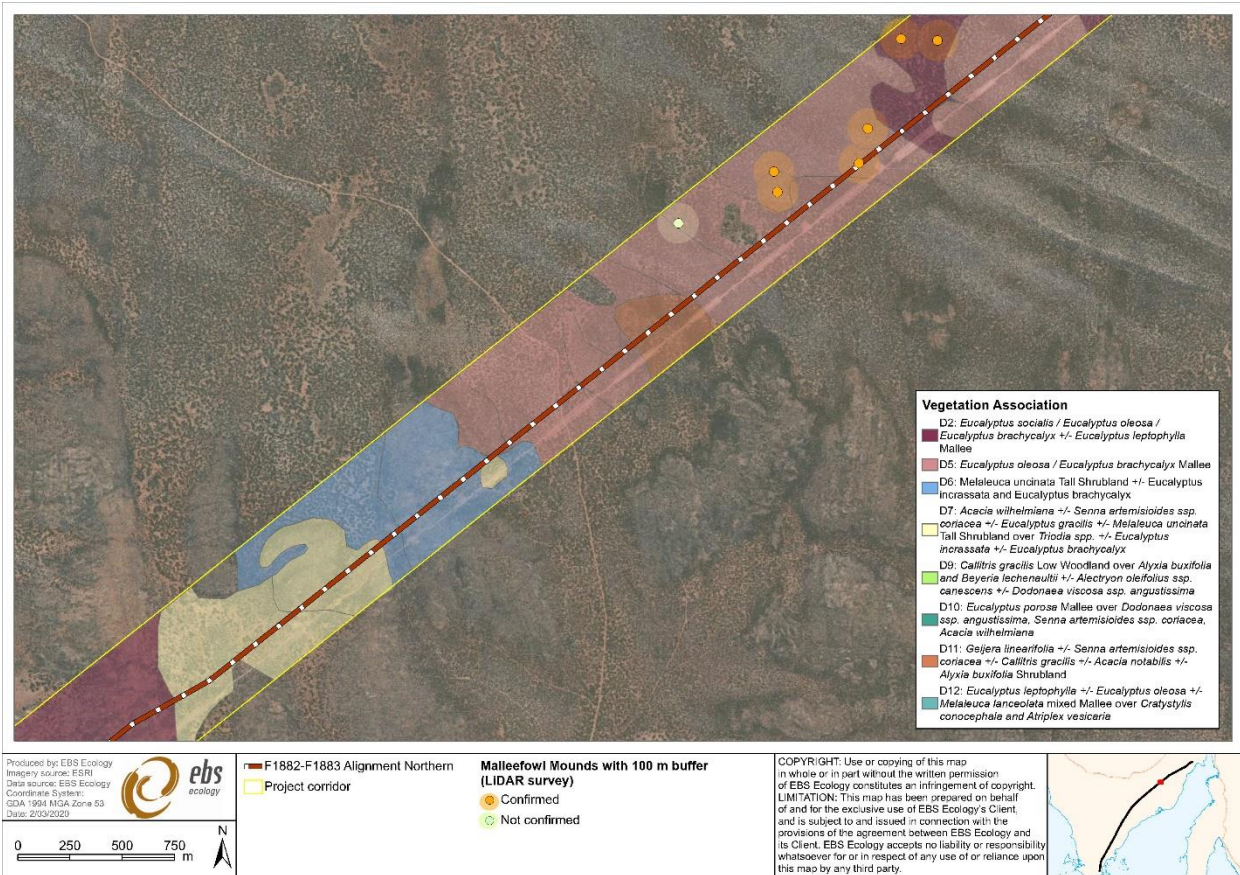
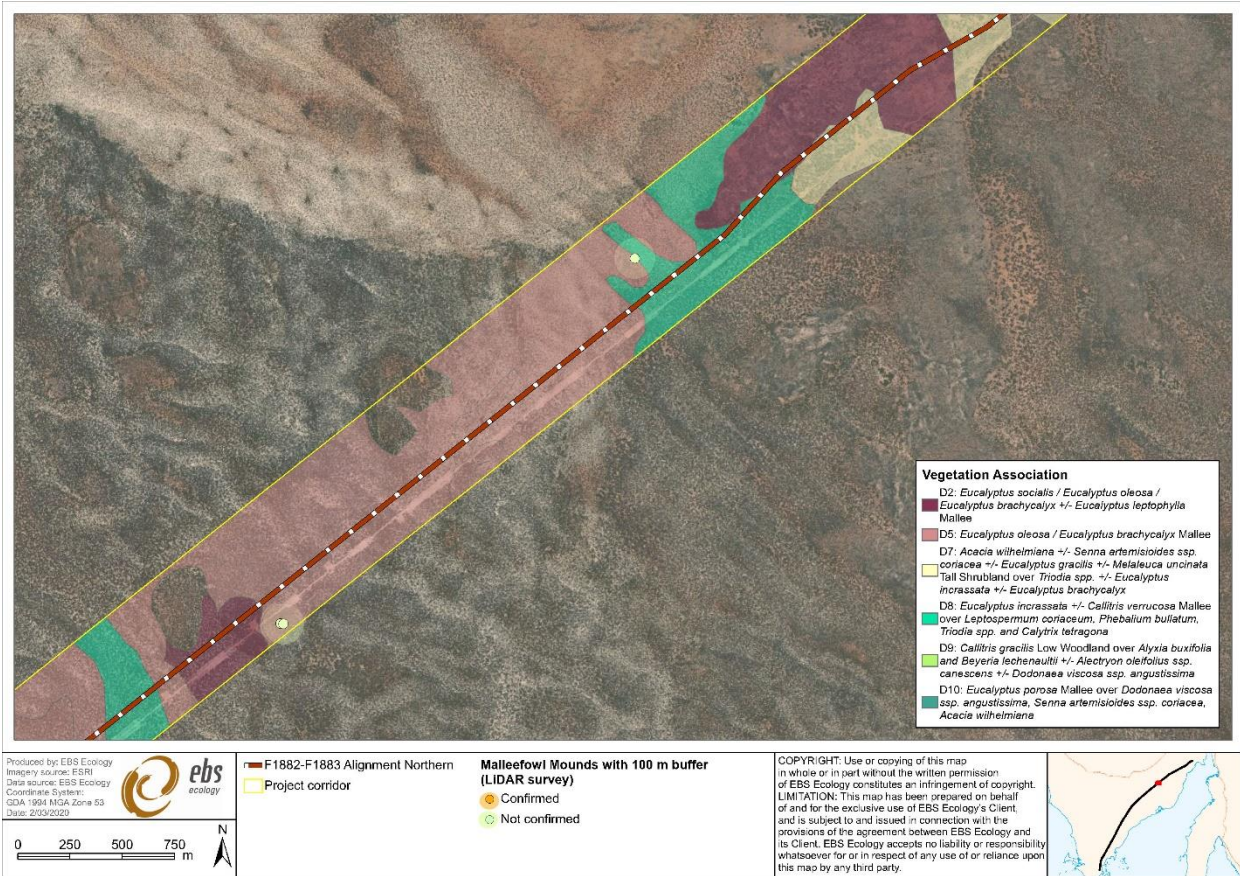


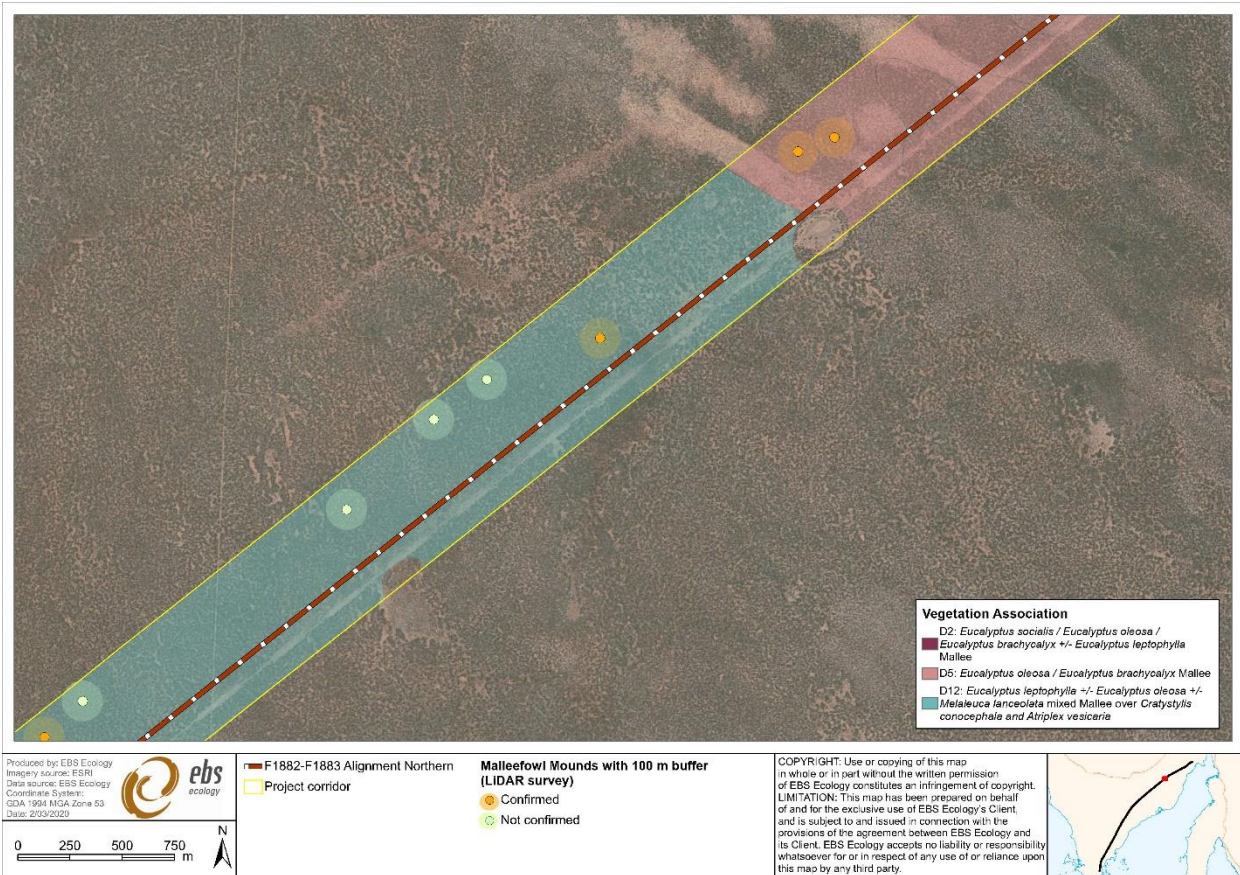
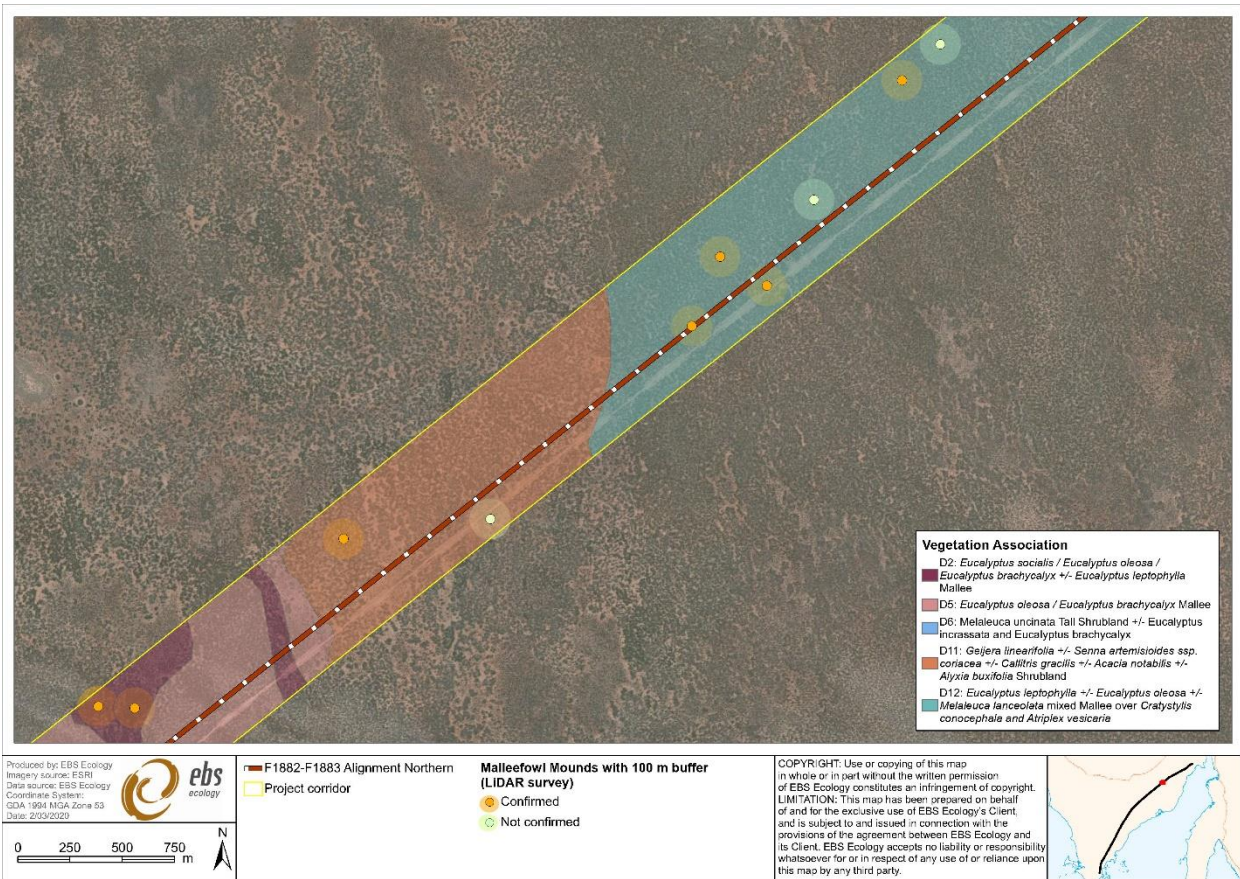


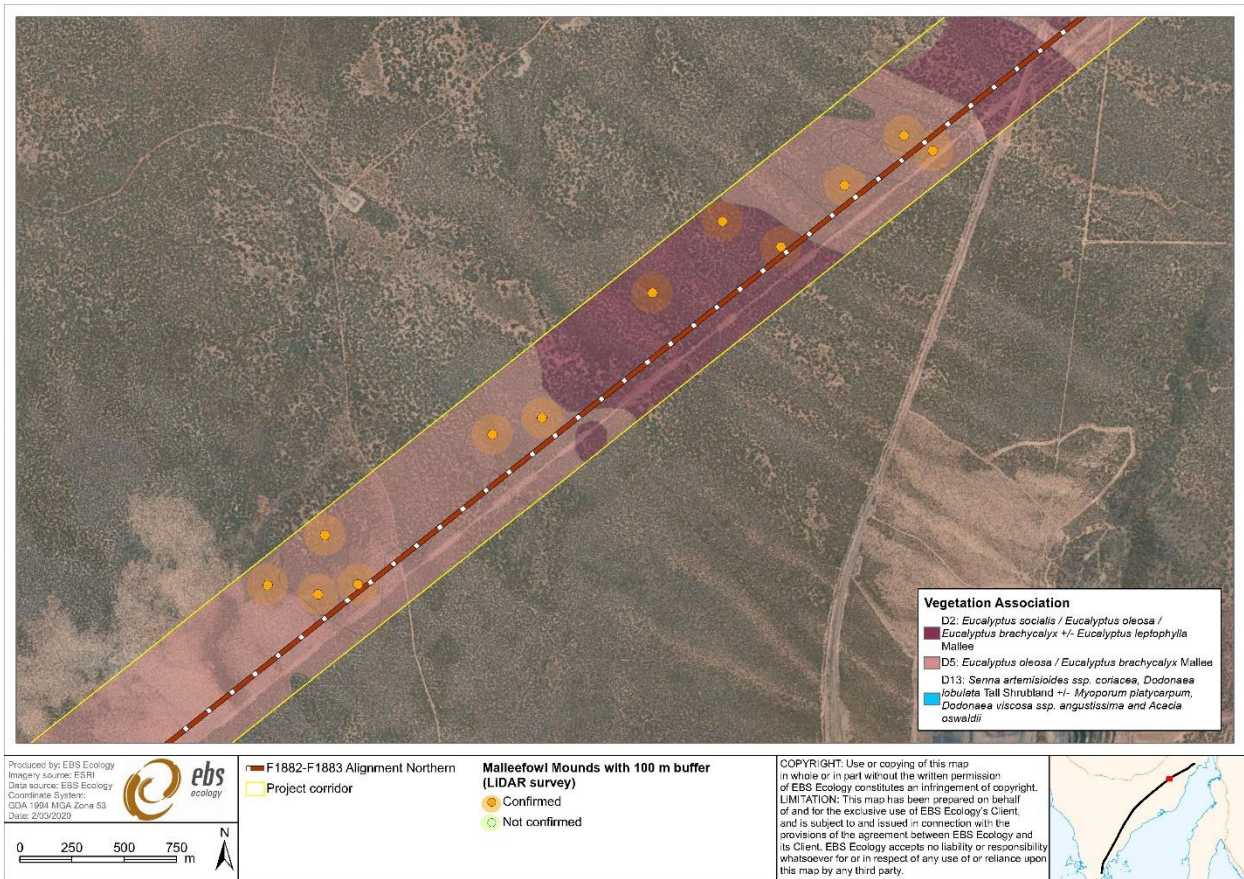
Appendix 4. Potential Malleefowl mounds identified by LiDAR and confirmed by on-ground survey (EBS Ecology, 2019d).



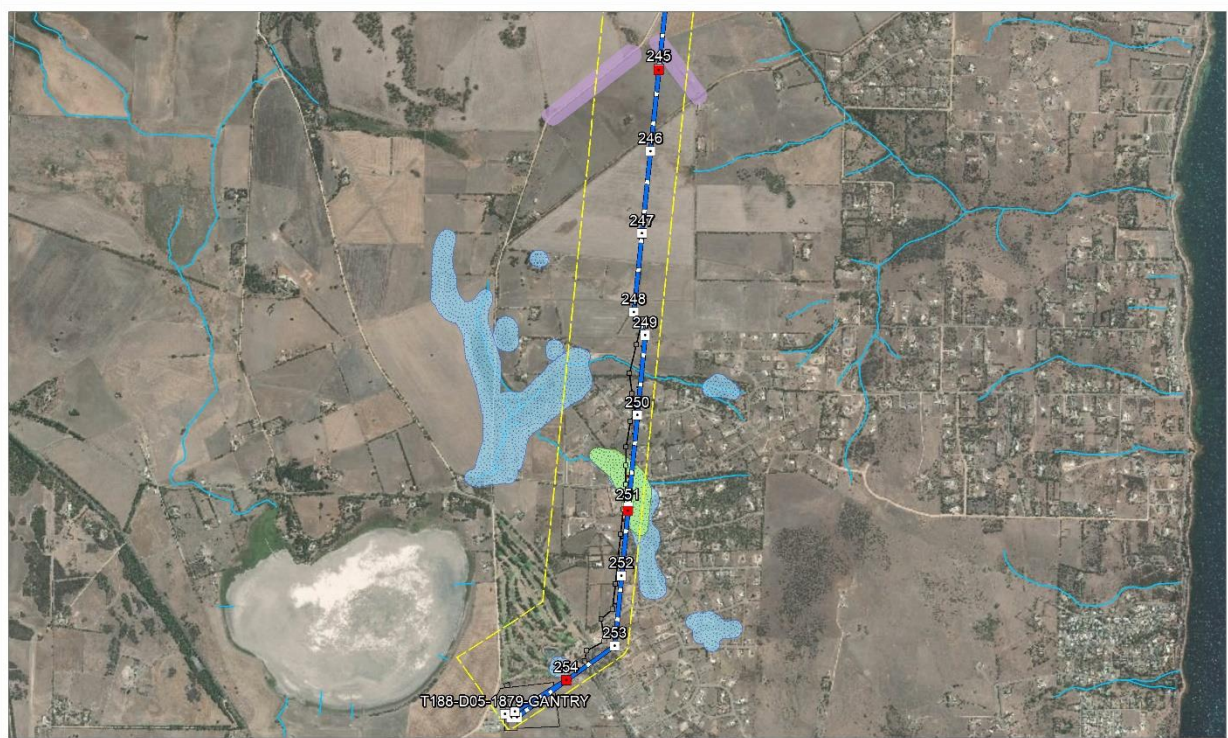








Appendix 5. Suitable habitat for the Southern Emu-wren in the Project Area as mapped by EBS Ecology 2019e.

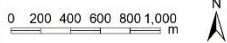


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 Date: 2/03/2020

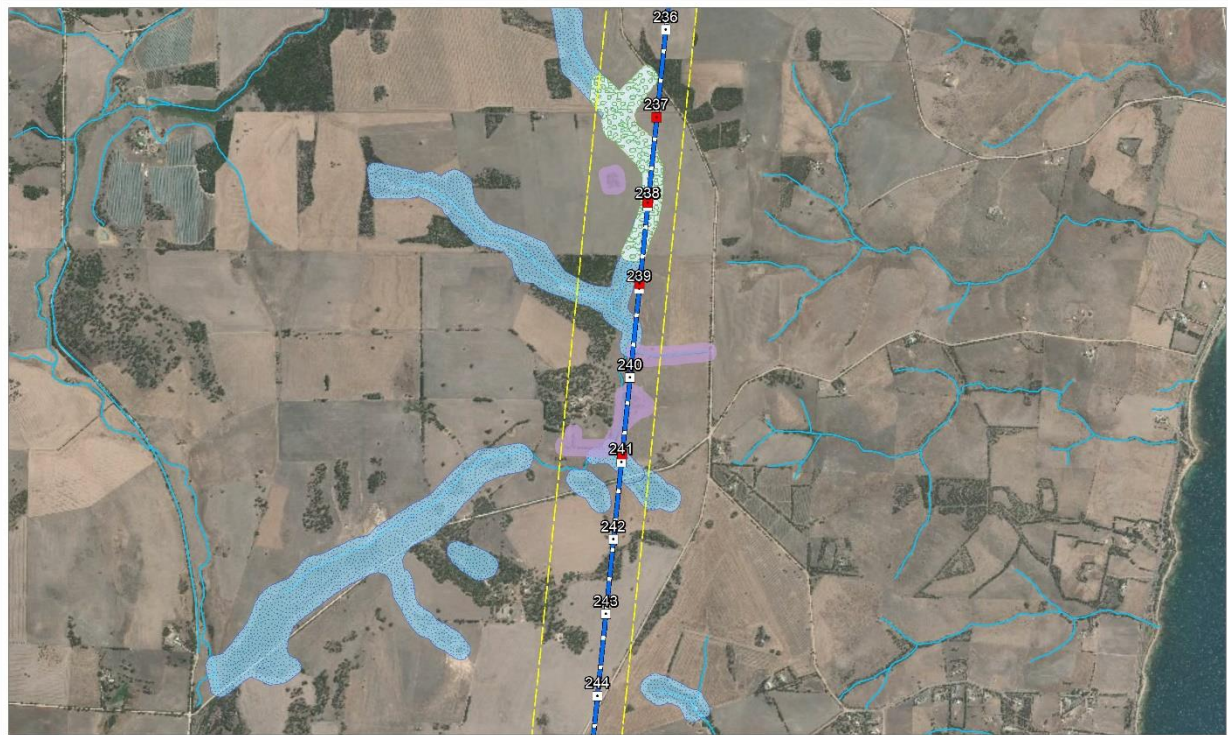


- F 1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F 1879-F1880 Alignment Southern
- Construction footprint
- Project corridor

- Water courses
- Water bodies
- Riparian Vegetation**
- Gahnia* spp. / *Juncus kraussii* Sedgeland
- +/- *Eucalyptus petiolaris*
- Planted



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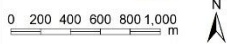


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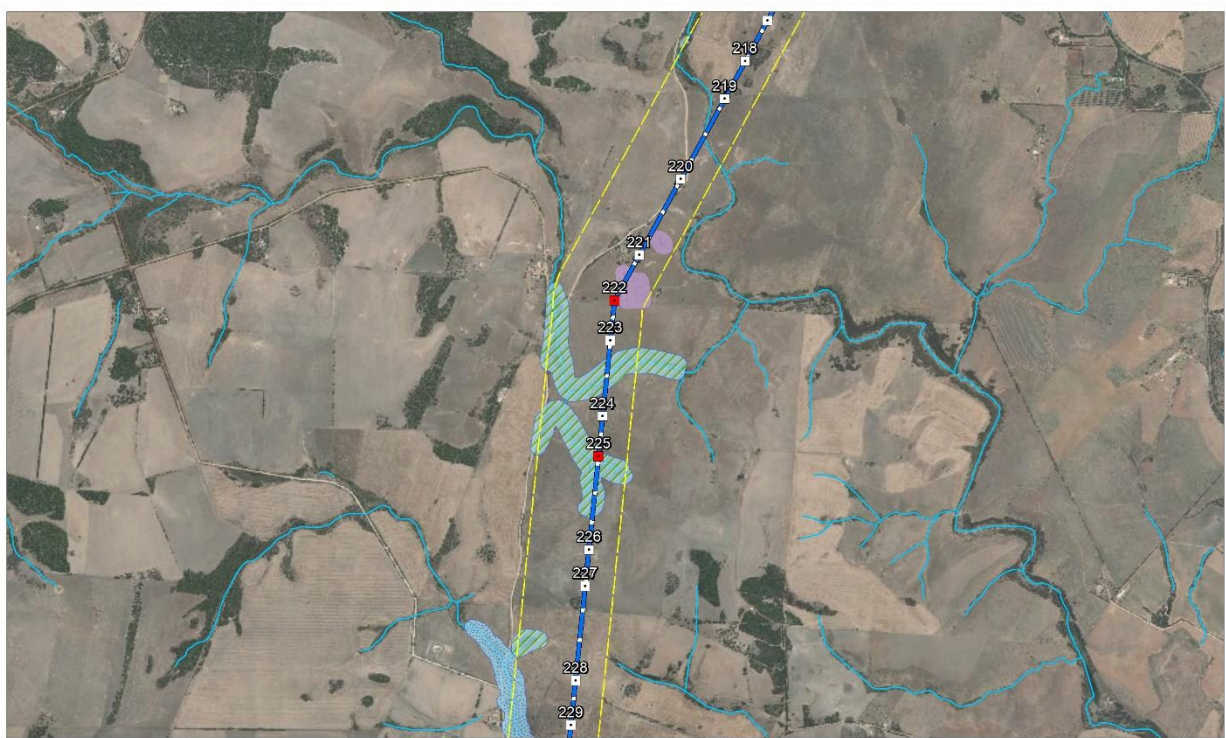
- F 1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F 1879-F1880 Alignment
- Construction footprint
- Project corridor

- Water courses
- Water bodies
- Riparian Vegetation**
- Juncus acutus* Sedgeland
- Planted



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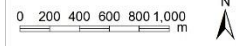


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- F1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F1879-F1880 Alignment
- ▭ Construction footprint
- ▭ Project corridor

- Water courses
- Water bodies
- Riparian Vegetation**
- *Juncus* spp. Sedgeland
- Planted



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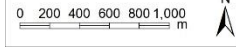


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- F1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F1879-F1880 Alignment Southern
- ▭ Construction footprint
- ▭ Project corridor

- Water courses
- Water bodies
- Riparian Vegetation**
- *Gahnia* spp. / *Juncus kraussii* Sedgeland
- +/- *Eucalyptus petiolaris*
- Planted



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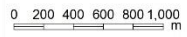


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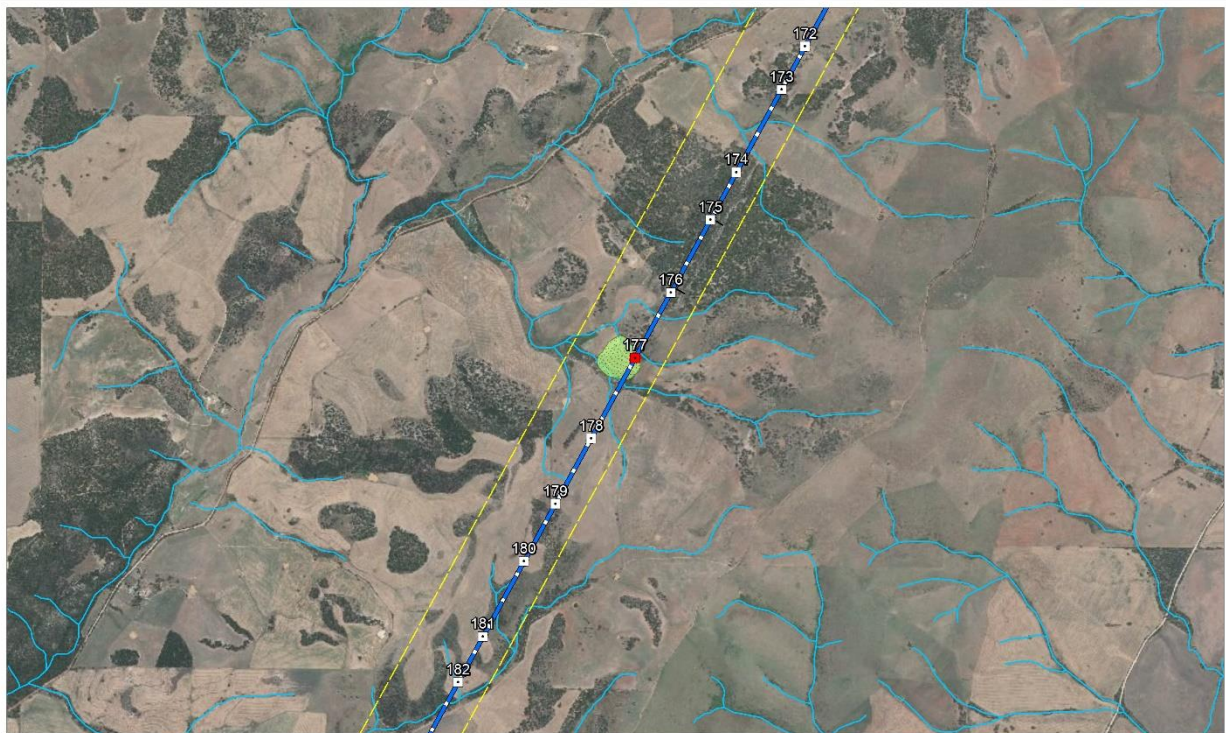


- F 1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F 1879-F1880 Alignment
- ▭ Construction footprint
- ▭ Project corridor

- Water courses
- Riparian Vegetation**
- *Gahnia* spp. / *Juncus kraussii* Sedgeland
- +/- *Eucalyptus petiolaris*



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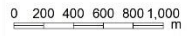


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 Coordinate System:
 GDA 1984 MGA Zone 53
 Date: 2/03/2020



- F 1879-F1880 Structure Southern
- Structures within/adjacent Southern Emu-wren Habitat
- F 1879-F1880 Alignment
- ▭ Construction footprint
- ▭ Project corridor

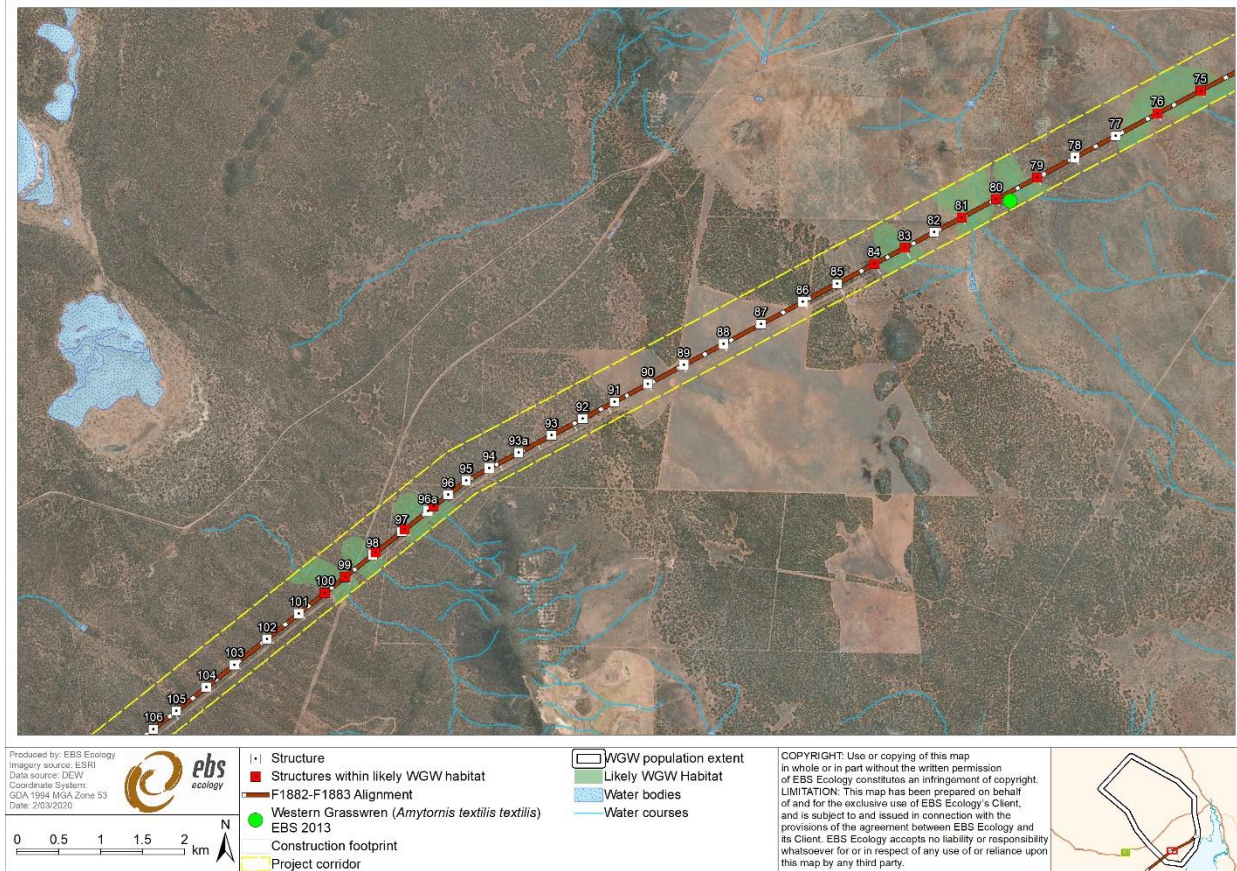
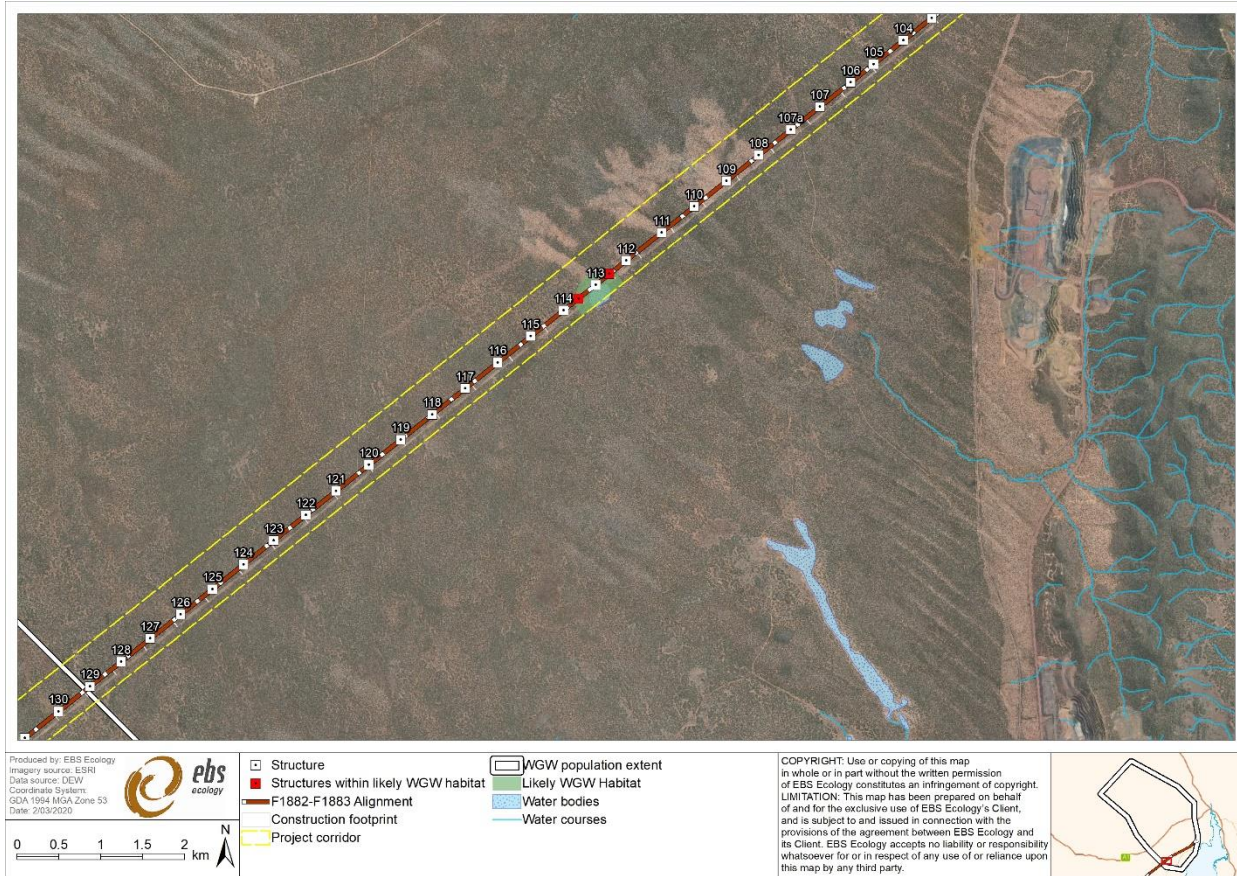
- Water courses
- Riparian Vegetation**
- *Gahnia* spp. / *Juncus kraussii* Sedgeland
- +/- *Eucalyptus petiolaris*



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***Appendix 6. Suitable habitat for the Western Grasswren in the Project Area
as mapped by EBS Ecology 2019f.***





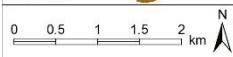
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- [-] Structure
- Structures within likely WGW habitat
- F1882-F1883 Alignment
- Western Grasswren (*Amytornis textilis textilis*) EBS 2013
- Construction footprint
- Project corridor

- WGW population extent
- Likely WGW Habitat
- Water bodies
- Roads
- Water courses

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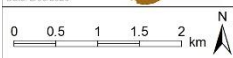
Produced by: EBS Ecology
 Imagery source: ESRI
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 Coordinate System:
 GDA 1984 MGA Zone 53
 Date: 2/03/2020

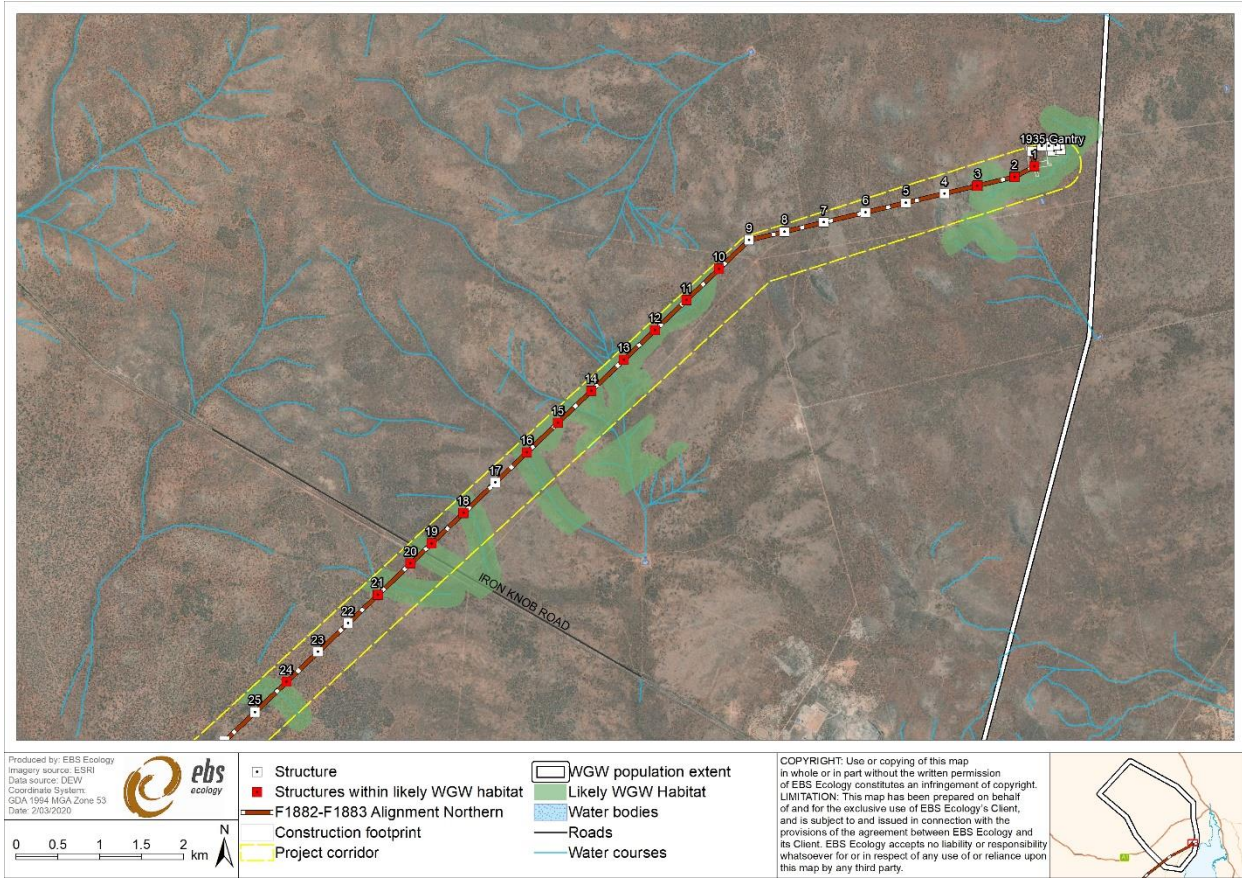


- [-] Structure
- Structures within likely WGW habitat
- F1882-F1883 Alignment
- Western Grasswren (*Amytornis textilis textilis*) EBS 2013
- Construction footprint
- Project corridor

- WGW population extent
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