Twin Creek Wind Farm Flora and Fauna Assessment

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Prepared by EBS Ecology for RES

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Cover photograph: Northern extent of the proposed wind farm looking south along one of the ridgelines.

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GLOSSARY AND ABBREVIATION OF TERMS

AML NRM	Adelaide and Mount Lofty Ranges Natural Resources Management Board
BDBSA	Biological Database of South Australia (managed by DEWNR)
DEH	Department of Environment and Heritage (now known as DEWNR)
DENR	Department of Environment and Natural Resources (now known as DEWNR)
DEWNR	Department of Environment, Water and Natural Resources
DotEE	Department of the Environment and Energy
EBS	Environmental and Biodiversity Services / EBS Ecology
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
NPW Act	*National Parks and Wildlife Act 1972*
NRM Act	*Natural Resources Management Act 2004*
PBTL	Pygmy Blue-tongue Lizard
Project boundary	Development area, Infrastructure zone and proposed grid route; also referred to as the project site
RES	RES Australia Pty Ltd
SEB	Significant Environmental Benefit
ssp.	sub-species
spp.	species (plural)
TEC	Threatened Ecological Community
TSA	Transport SA (now the Department of Transport, Energy and Infrastructure)
WTGs	Wind turbine generators

EXECUTIVE SUMMARY

EBS Ecology (EBS) was engaged by RES Australia to assess the potential flora and fauna constraints for the proposed Twin Creek Wind Farm. Investigations, findings and recommendations of EBS have informed the design, siting and layout of infrastructure for both the principal wind farm infrastructure area (wind turbine generators and associated infrastructure) as well as the transmission line (hereby referred to as the project boundary). EBS Ecology have undertaken the following surveys:

Survey type	Date	Season	Description
Flora and fauna assessment	8-11 September 2015	Spring	General assessment and condition rating of vegetation, bird, bat and PBTL assessment
Targeted Lomandra assessment	8 October 2015	Spring	Assess whether Lomandra Grasslands qualified as a TEC
Bird survey	3-5 February 2016	Summer	Revisit bird count surveys established in spring 2015
Bird survey	18-20 April 2016	Autumn	Revisit bird count surveys established in spring 2015
Bird survey	26-28 August 2016	Winter	Revisit bird count surveys established in spring 2015 and undertake nest checks
Targeted PBTL survey and Bat survey	22 Feb – 4 March 2016	Summer/Autumn	Detailed assessment of PBTL habitat and occupation across the site. Anabat survey repeated from September 2015 survey due to poor weather conditions
Additional PBTL survey	5, 8 and 14 April 2016	Autumn	Investigate additional routes within areas of likely habitat
Additional PBTL survey	31 Oct – 11 Nov 2016	Spring	Targeted areas and additional infrastructure
Additional PBTL survey	22 Nov – 25 Nov 2016	Spring	Targeted areas and additional infrastructure
Vegetation Assessment	23, 24, 29, 30 Nov and 1 Dec 2016	Summer	Vegetation assessment of additional turbine, substation and transmission line
Additional PBTL survey	6-9 December 2016	Summer	Targeted areas and additional infrastructure
Additional PBTL survey	9 Jan – 13 Jan 2017	Summer	Targeted areas and additional infrastructure
Vegetation Assessment	5 April 2017	Autumn	Vegetation assessment of 2nd substation and potential shift of transmission line easement

The online Protected Matters Search Tool was used to identify any species or ecological communities of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur or may have suitable habitat within the project area. A 20 km buffer was applied to the search to incorporate the current infrastructure zone (which includes wind turbines, \substation, transmission line, access tracks and associated infrastructure, as of June 2017).

EBS recorded 11 vegetation associations within the project boundary (with a Significant Environmental Benefit (SEB) condition range of 0:1 to 6:1). The best quality vegetation was generally observed along the transmission line. These vegetation associations are described as follows:

	Vegetation association	Area	Condition
1	*Lomandra effusa* + *Austrostipa sp*. grasslands	196.2 ha	1:1-6:1
2	*Austrostipa sp*. grassland	1751.7 ha	1:1-5:1
3	Planted species	21.8 ha	0:1
4	*Eucalyptus leucoxylon* +/- *Eucalyptus porosa* +/- *Callitris gracilis* open woodland	64.7 ha	2:1-6:1
5	*Juncus spp.* (Rush) and *Juncus pallidus* (Pale rush) Sedgeland +/- *Phragmites australis* (Common Reed)	52.1 ha	3:1
6	Cropping	1388.8 ha	0:1
7	*Eucalyptus porosa*+/- *Eucalyptus odorata*+/- *Eucalyptus gracilis* open woodland	2.4 ha	4:1
8	Pasture grassland / exotic grassland	868.2 ha	0:1-1:1
9	*Eucalyptus odorata* +/- *Eucalyptus porosa* closed woodland over grassy understorey	6.8 ha	4:1
10	*Eucalyptus camaldulensis* ssp. *camaldulensis* +/- *Eucalyptus leucoxylon* Closed Tall Shrubland over *Austrostipa* sp. (Spear-grass) near creeklines	2.3 ha	6:1
11	*Eucalyptus leucoxylon* Tall Open Woodland over shrubby understorey	3.6 ha	5:1-6:1

During the spring 2015 field survey 59 native fauna species were recorded, including one reptile species and two bird species of national or state conservation significance:

- Pygmy Blue-tongue Lizard (*Tiliqua adelaidensis*) nationally endangered;
- Rainbow Bee-eater (*Merops ornatus*) nationally migratory, and
- Blue-winged Parrot (*Neophema chrysostoma)* state vulnerable.

EBS recorded 1448 bird sightings of 48 species recorded via point count surveys and opportunistic observations during the spring 2015 survey. Three Wedge-tailed Eagle nests we recorded within a *Eucalyptus leucoxylon* ssp. woodland area situated just outside of the project boundary. One out of the three nests recorded was active during the September 2015 and winter 2016 survey; the August 2016 survey recorded a Wedge-tailed Eagle sitting on Nest 3 however, neither eggs nor young were discernable at the time

Other native fauna species recorded during the spring 2015 survey were:

- Two amphibian sightings from two species;
- 20 reptile sightings from five species;
- 21 mammal sightings from three species (excluding bat species); and
- 484 bat echolocation calls from seven species (September 2015). The summer/autumn bat survey (February/March 2016) resulted in 1249 bat echolocation calls from at least seven species.

EBS observed the following bird species across the four seasonal surveys within the project boundary:

- Spring 2015 survey - 1,448 individuals from 48 bird species;
- Summer 2016 survey - 1,255 individuals from 24 bird species;

- Autumn 2016 survey - 751 individuals from 30 bird species; and
- Winter 2016 survey – 743 individuals from 30 bird species.

No species of conservation significance were observed during the summer, autumn or winter 2016 surveys.

The AnaBat surveys confirmed the presence of seven bat species within the project boundary:

- White-striped Free tail-bat (*Austronomus australis*);
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Chocolate Wattled Bat (*Chalinolobus morio*);
- Southern Free tail-bat (*Mormopterus species 4 "big dick")*;
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*);
- Large Forest Bat (*Vespadelus darlingtoni*); and
- Southern Forest Bat (*Vespadelus regulus*).

The bat species detected onsite are thought to be common throughout the region with the majority of bats recorded, being within the vicinity of habitat features such as woodlands and open water. None of the recorded bat species have a conservation rating.

Two nationally threatened ecological communities, listed under the EPBC Act 1999 were investigated and assessed for qualification within the project boundary. The listed ecological communities being:

- Iron-grass (*Lomandra* spp). Natural Temperate Grassland of South Australia and
- Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

There were 21 sites assessed within the *Lomandra* Grasslands across the project site in 2015; these were assessed to confirm whether they qualified as a nationally listed threatened ecological community. One of the sites assessed for the terminal substation (18), qualified as EPBC listed and another two sites (19 and 21) are considered likely to qualify if surveyed when more plants are in their visible life phase (early/mid spring), as they were only a few species short of qualifying. Site 20 may also possibly qualify. None of the other sites met criteria qualified as either condition A or B, and therefore, do not qualify as a threatened ecological community. Of the 21 *Lomandra* sites, 13 come under Condition class C, which are considered degraded patches amenable to rehabilitation. Five of the sites (*Lomandra* Site 2, 14, 15, 19 and 21) were within 1-3 native species of meeting the condition class B threshold. Based on survey findings, the design for the Terminal Substation was refined to avoid high value *Lomandra* Grassland and an EPBC referral should not be required for the Terminal Substation based on this design. A spring survey of the transmission line is recommended as part of the final design, in particular if any Lomandra areas (mapped by EBS) will be impacted upon by the final design.

The project boundary was assessed for any Peppermint Box that may qualify against the criteria outlined in *EPBC Act Policy Statement 3.7, Nationally Threatened Species and Ecological Communities, Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia.* A patch of Peppermint Box was identified within the principle wind farm infrastructure area, during the 2015 survey. It wasn't dominated by *Eucalyptus odorata*; it was

a large mix of *E. odorata*, *E. porosa* and *E. gracilis*, and therefore did not qualify. Patches of woodland dominated by Peppermint Box were observed during late spring/early summer 2016 survey, whilst surveying additional areas including the proposed transmission line. An assessment against the criteria found them to be Class C which is not listed under the EPBC Act but is 'amenable to rehabilitation'. However, one of the sites north of Dutton Road was only two species short of qualifying as listed under the EPBC Act. This patch may qualify if surveyed earlier in spring when more plants are in their visible life phase.

An additional survey was undertaken on 5 April 2017 to assess Peppermint Box as part of the finalisation of the transmission line, including the route ong Biele Road. From observations made, it appeared degraded and may not qualify for the EPBC listed TEC. This statement cannot be certain without adequate access and additional surveying in spring. It did not appear planted. EBS's recommends positioning the transmission line through the cropping land where possible, rather than Peppermint Box Woodland areas. Amendments have been made to infrastructure design to avoid Site 1 (likely to qualify) and minimise impact on Site 2 (possibly qualifying). Based on the current proposal the final clearance impact in Peppermint Box Woodland is expected to be small (insignificant), fitting with minimum requirements under powerlines and should not require an EPBC referral (subject to spring survey and final design).

A total of 86 native flora species and 74 exotic flora species were recorded within the project boundary. There was no conservation rated flora species identified within vegetation assessments completed during the September 2015 and November 2016 surveys within the proposed Twin Creek Wind Farm project boundary.

The habitats present within the project boundary were assessed for the nationally endangered Pygmy Blue-tongue Lizard (PBTL) (*Tiliqua adelaidensis*) and nationally vulnerable Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*). Other than these two species, none of the reptile species recorded within the project boundary have a conservation rating and can be classed as common in suitable habitats.

The Flinders Worm-lizard is endemic to South Australia but were not detected during the September spring 2015 survey.

EBS undertook targeted Pygmy Blue-tongue Lizard (PBTL) surveys during the 22 February – 4 March 2016 survey and again in April 2016 (5th, 8th and 14th April). Surveys in summer 2016/2017 were undertaken in relation to the proposed transmission line corridor. These surveys followed the spring 2015 survey which categorised habitat for the entire project boundary. The habitat and potential presence of PBTL was assessed during the initial flora and fauna assessment 8-11 September 2015, and categorised as: likely, possible or not likely. A large proportion of the project boundary is considered possible or likely habitat for the PBTL due to the open grasslands, slopes and spider holes observed across the site. Areas considered unlikely to contain PBTLs are cropping, very steep, very rocky or areas with no evidence of spider holes. The southern area of the wind farm development area has optimal habitat for the species, gentle sloping rolling hills with plenty of spider holes. The northern section of the infrastructure area still has PBTLs present; however, they are typically in lower densities of numbers where infrastructure is proposed.

Measures which EBS Ecology recommend to mitigate the impact of the proposed development on the PBTL include:

- Areas which are suitable to PBTL, should be avoided. All known locations within possible habitat will need to micro-sited prior to construction to mitigate impact;
- Utilising cropping areas as much as possible for wind turbine generators, infrastructure areas and access tracks;
- Micro-site where possible around proposed infrastructure including the transmission line;
- An EPBC referral will be submitted as part of this proposed development. A translocation of PBTL from areas of less suitability is being recommended to increase the number of turbines being installed and reduce potential impacts on PBTL; and
- Ongoing monitoring of PBTL populations within the project boundary is recommended to detect future impacts on the species.

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1 INTRODUCTION

RES Australia Pty Ltd (RES) is undertaking feasibility studies for a wind farm development proposed to be located near Kapunda, approximately 80 km north east of Adelaide. The proposal is for up to 51 wind turbine generators (herein referred to as WTGs or turbines) along with associated infrastructure including access tracks, transmission lines, overhead and underground electrical cabling and an overhead transmission line.

During 2015-2017, EBS Ecology was engaged by RES to undertake a series of detailed assessments of the potential ecological impacts of the proposed Twin Creek Wind Farm, and where potential impacts were identified, to propose options and recommendations for mitigation. The ecological assessments are intended to support State and Federal project approval documents such as the Development Application, EPBC Referral, Native Vegetation Clearance Application and comply with Auswind Best Practise Guidelines.

Whilst the SEB calculation is not summarised as part of this report, the breakdown of SEB calculations for the infrastructure components of the Twin Creek Wind Farm, will be provided in a separate report to the Native Vegetation Council. This will be required by RES to make an appropriate SEB either through on-ground works (an Offset Management Plan will be developed) or payment into the Native Vegetation Fund.

1.1 Objectives

The specific objectives of the assessment were to:

- Identify and map vegetation communities;
- Identify and map the extent and significance of fauna habitat, including targeted specific surveys for bird and bat species;
- Identify species of national, state or local conservation significance known or likely to occur in the area and details on possible impacts;
- Identify areas of conservation value, including areas of high biodiversity value;
- Identify pest plants and animals;
- Assess the likely level of impact from an ecological perspective;
- Identify sensitive/exclusion areas;
- Recommend measures to mitigate potential ecological impacts, including avoidance and management of sensitive areas; and
- Calculate SEB offset requirements (for the Native Vegetation Clearance application).

There were some specific objectives of the assessment relating to Pygmy Blue-tongue Lizard (PBTL) (*Tiliqua adelaidensis*):

- Inspect proposed turbine locations for PBTL:

- Identify and categorise all potential PBTL habitat within the turbine locations and within likely locations of access tracks and infrastructure routes, including an assessment of likely PBTL density;
- Provide recommendations to minimise potential project impacts on PBTL's and their habitat; and
- Recommend measures to mitigate potential ecological impacts, including avoidance and management of sensitive areas.

1.2 Project area

The proposed Twin Creek Wind Farm is located approximately 80 km north east of Adelaide and is situated within the northern hills of the Mount Lofty Ranges (Figure 1). The project site is dominated by ridgelines in the north and plains or undulating hills in the south. The area of the development site surveyed included the wind farm development area and transmission route. This extended 6-7km north south and 5km east west.

Land use within the area is predominantly agricultural (e.g. grazing for sheep and cattle). Native vegetation has been extensively cleared, with most of the footprint containing grasslands. Woodland vegetation is generally restricted to creek lines and within small patches. The general region is open, low hills with occasional rocky outcrops that fall away to low foot slopes and drainage channels at regular intervals. Vegetation cover is dominated by grasses and perennial herbaceous forbs, with sparse incidents of remnant woodland primarily comprised of *Eucalyptus leucoxylon* subsp. *pruinosa* (South Australian Blue-gum) and *Eucalyptus porosa* (Mallee Box). Patches of *Eucalyptus odorata* (Peppermint Box) also occur in the transmission line and the species was also found scattered across the site.

1.3 Proposed wind farm specifications

The candidate turbine considered in our assessment has a maximum tip of blade height of 180 m, 112 m for the tower height and 67 m for the blade lengths. The risk assessment in this report has been based on the lowest extent of a rotating blade tip being 45 m from the ground. If the tower height and/or blade length (and ultimately the lowest extent of the rotating tip and the rotor swept area) substantially alter through the detail design of the project, the risk assessment may need to be reassessed.

The turbine foundations will be approximately 5 m in diameter at the surface, 20 m at the sub-surface and 3.5 m deep. Turbines will be connected to the on-site substation by underground cabling and to the terminal substation by overhead transmission lines. New access tracks will be required however existing roads and tracks will be utilized and upgraded where possible to minimise the overall impact. Project specifications are provided in Table 1. Overhead Transmission Line pole foundations will have a foundation of 1.5m in diameter and footprint of approximately 3m.

The design considered alternate access routes. An assessment has been made of the entire access route, although this is outside of the site of the development. Upon selection of the final access route, road reserves within the locality will be ground-truthed prior to clearance. Possible clearance is restricted to small degraded roadsides, which are expected to have minimal impact.

Table 1. Project specifications.

Component	Description
Project Layout	Up to 51 turbines and associated infrastructure. Approximate generation capacity of up to 1854MW with each WTG up to 3.6MW.
Wind Turbines	Maximum height (to blade tip) – 180 m. Blade Length – 67 m Tower Height – 112 m Foundations - approximately 5 m diameter at surface and 20 m sub-surface and up to 3.5 m deep.
WTG laydown and Hardstand area	An average area of approximately 90m x 45m for foundation, laydown and crane hardstand areas - plus two smaller 15m x 15m cranes hardstand areas (to erect the main crane jib) Hardstand areas will be required adjacent to the base of each turbine to enable the assembly and erection of the WTG components. The shape and area will vary depending on the construction approach and the site conditions at each WTG location.
External Electrical Transformers	A pad mounted enclosed transformer (kiosk) located at the base of each turbine. Approximate dimensions (2m long x 2m wide x 1.5m high).
Site Access	On-site access tracks up to 5.5 – 7 m wide to accommodate construction activities and cranes. The main access tracks will provide access the WTG sites and will be designed to take the weight of WTG transport and construction vehicles and the crane used to erect the turbines. These will be located to align with existing property access tracks where possible. Some sections of the access tracks may be wider to accommodate overtaking areas and turning circles.
Overhead electrical cabling	Approximate total length 15.5 km.
Underground electrical cabling	Approximate total length 49km. Trench width approximately 0.3m per circuit and depth of approximately 1m (minimum of 1m coverage over top of cable). Trench impact area of 5 m width for a single cable alignment + 0.5m for each additional cable. To be located adjacent the access tracks where possible (within approximately 5m of the shoulder of the track). The exact dimensions will depend on the installation method used by the contractor.
Overhead 275kV transmission line	Approximate length 15.5 km. The transmission would be constructed with steel or spun concrete poles of 35m high and spaced approximately 275 – 375 metres apart (or wider should terrain enable). At the terminal substation the 275kV transmission towers will comprise lattice towers up to 45 metres high to tee into the existing transmission line The impact areas will be approx. 3m x 3m for the monopole tower locations.
Substation and Operations and Maintenance Facilities	One 33kV/275kV substation, one Operations/Maintenance Facility and one Battery Energy Storage Facility all within a permanent hardstand measuring approximately 200m X 300m.
Meteorological masts	1 existing mast. An additional 2 to be installed. Approximate area of 14m2 (allowing for guyed wires).
Temporary Construction Compounds	One main temporary construction compound of up to 115m x 115m in area. The size will depend on the facilities required which may include:

Component	Description
	• site office and staff facilities • amenities • workshops • car park • skip bins • material storage areas • laydown area.
Concrete Batching Plants	One temporary concrete batching plant (if not sourced offsite). This will be located within a compound of approximately 115m X 115m.
Public Road Improvements	Access routes for all over-dimensional vehicles will be limited to those specified in the Traffic Management Plan. Roads and intersections will be up-graded to meet load and safety standards as agreed in the management plan. Public road access will require road upgrades to a width of 5.5m and a 1m shoulder either side. Localised widening in excess of up to 12m may be required to support transport and construction activity such as passing bays. All public roads will be left in good repair following construction as agreed in the management plan. All access routes will be subject to DPTI and Council agreement.

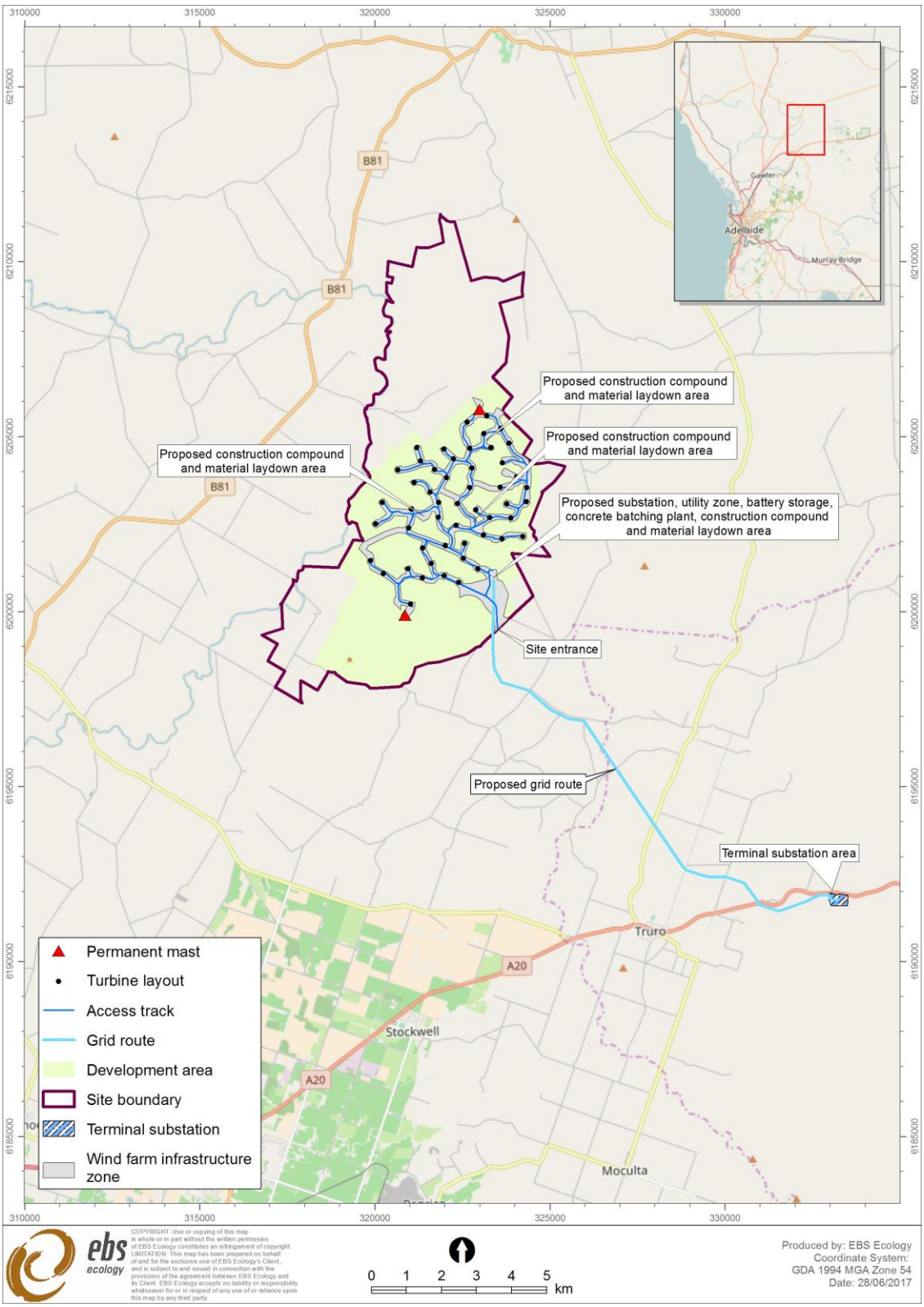


Figure 1. Twin Creek Wind Farm project area.

2 COMPLIANCE AND LEGISLATIVE SUMMARY

A summary of relevant Commonwealth and State environment legislation is provided below, with further detail in Table 2.

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as 'matters of national environmental significance'.

There are nine matters of national environmental significance protected under the EPBC Act, one of which is of relevance to the Twin Creek Wind Farm project:

- listed threatened species and ecological communities.

Any action that has, will have, or is likely to have a significant impact on matters of national environmental significance requires referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have, or is likely to have significant impact on a matter of national environmental significance without approval.

2.2 Native Vegetation Act 1991

Native vegetation within the project area is protected under the *Native Vegetation Act 1991* and *Regulations 2003*. Any proposed clearance of native vegetation in South Australia (unless exempt under the regulations) is to be assessed against the Principles of Clearance under the Act, and requires approval from the Native Vegetation Council (NVC). A net environmental benefit is generally conditional on an approval being granted.

An assessment against the Native Vegetation Clearance Principles may not be required if the clearance is considered to comply with **Exemption 5(1)(d) Building or provision of infrastructure including infrastructure in the public interest** (see below). Even if this is the case, an application is still required to the NVC.

Regulation 5(1) (d) Building or provision of infrastructure, including infrastructure in the Public Interest

Pursuant to Section 27(1) (b) of the Act, native vegetation may, subject to any other Act or law to the contrary, be cleared if-

(i)

(A) the clearance is incidental to the construction or expansion of a building or infrastructure, and the Minister has, by instrument in writing, declared that he or she is satisfied that the clearance is in the public interest; or

(B) the clearance is required in connection with the provision of infrastructure or services to a building or proposed building, or to any place; and

(ii) any development authorisation required by or under the *Development Act 1993* has been obtained; and

(iii) the Council is satisfied (on the basis of information provided to the Council by the person seeking the benefit of this paragraph and such other information as the Council thinks fit) that, after taking into account the need to preserve biological diversity and the nature and purposes of any proposed building or infrastructure that is yet to be constructed, the proposed site of the building or infrastructure is the most suitable that is available; and

(iv) the Council is satisfied (on the basis of information provided to the Council by the person seeking the benefit of this paragraph and such other information as the Council thinks fit) that there is no other practicable alternative that would involve no clearance or the clearance of less vegetation or the clearance of vegetation that is less significant or (if relevant) the clearance of vegetation that has been degraded to a greater extent than the vegetation proposed to be cleared; and

(v) the clearance is undertaken in accordance with a standard operating procedure determined or approved by the Council for the purposes of this provision or a management plan that has been approved by the Council, and either -

(A) there will be a significant environmental benefit on the property where the clearance is being undertaken or within the same region of the State; or

(B) either -the owner of the land (or a person acting on his or her behalf); or person connected with the construction or expansion of the building or infrastructure, or the provision of the infrastructure or services (as the case requires), has, an application to the Council to proceed with clearing the vegetation in accordance with this provision, made a payment into the Fund of an amount considered by the Council to be sufficient to achieve a significant environmental benefit in the manner contemplated by section 21(6) of the Act.

2.3 National Parks and Wildlife Act 1972

Native plants and animals in South Australia are protected under the *National Parks and Wildlife Act 1972* (NPW Act). It is an offence to take a native plant or protected animal without approval. Conservation rated flora and fauna species listed on Schedules 7, 8, or 9 of the NPW Act are known to or may occur within the project area.

2.4 Natural Resources Management Act 2004

Under the *Natural Resources Management Act 2004* (NRM Act) landholders have a legal responsibility to manage declared pest plants and animals and prevent land and water degradation.

Key components under the Act include the establishment of regional Natural Resource Management (NRM) Boards and development of regional NRM Plans; the ability to control water use through prescription, allocations and restrictions; requirement to control pest plants and animals and activities that might result in land degradation.

A ‘duty of care’ is a fundamental component of this Act i.e. ensuring one’s environmental and civil obligation by taking reasonable steps to prevent land and water degradation. Persons can be prosecuted if they are considered negligent in meeting their obligations.

Table 2. Summary of relevant Commonwealth and State legislation.

Legislation	Summary	Relevance
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999	To protect 'matters of national environmental significance': Any action that has, will have or is likely to have a significant impact on a matter of national environmental significance requires referral and approval under the EPBC Act. To determine whether an action is likely to have a significant impact on a matter of national environmental significance, refer to the Significant Impact Guidelines (Commonwealth of Australia 2013).	Where an activity may trigger requirements of the EPBC Act, this legislation must be taken into account. Significant penalties apply. The EPBC Act Significant Impact Guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a matter of national environmental significance. In terms of nationally threatened species, the guidelines define an action as likely to have a significant impact if there is a real chance or possibility that it will: • lead to a long term decrease in the population • reduce the area of occupancy of the species • fragment an existing population • adversely affect critical habitat • disrupt breeding cycles • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline • result in the establishment of invasive species that are harmful to the species • introduce disease that may cause the species to decline interfere with the recovery of the species.
State		
National Parks and Wildlife Act 1972	Allows for the protection of habitat and wildlife through the establishment of parks and reserves (both on land and in State waters); provides for the protection of native flora and fauna; identifies flora and fauna species considered to be of conservation significance (under Schedules 7, 8, and 9 of the Act); and provides for the use of approved wildlife through a system of permits allowing certain actions, i.e. keeping and selling (s.58), harvesting (s.60G), farming (s.60C), hunting (s.68A), releasing (s.55) and undertaking scientific research (s.53) on/of native fauna species, and for the taking of plants (s.49).	A person must not "take" a native plant, protected animal or the eggs of a protected animal without approval (s.48A). To take a protected animal means to remove, hunt, catch, restrain, kill or injure an animal, or attempt to do so. Taking a native plant or protected animal, or the eggs of an animal carries a maximum penalty of $10 000. Potential impacts on native plants and animals should be avoided where possible, particularly conservation significant flora and fauna species listed in Schedules 7. 8 or 9 of the Act.
Native Vegetation Act 1991	An Act to preserve, enhance and manage the State's native vegetation; provide a regulatory framework to control clearance of vegetation; and provide incentives and assistance to landowners to encourage them to preserve and enhance native vegetation. The Act protects all native vegetation that naturally occurs, i.e. vegetation which has not been planted. This includes all naturally occurring local native plants, from small ground covers and native grasses to mallee scrub and tall trees. It does not cover planted trees.	Any clearance of native vegetation in South Australia (unless under exemption) needs approval from the Native Vegetation Council (NVC). The NVC considers applications to clear native vegetation under ten principles. Native vegetation should not be cleared if it is significantly at odds with these principles: • it contains a high level of diversity of plant species • it is an important wildlife habitat • it includes rare, vulnerable or endangered plant species • the vegetation comprises a plant community that is rare, vulnerable or endangered • it is a remnant of vegetation in an area which has been extensively cleared

Legislation	Summary	Relevance
	Under the Act, clearance is defined as: • the killing or destruction of native vegetation • the removal of native vegetation • the severing of branches, limbs, stems or trunks of native vegetation • the burning, poisoning and slashing of native vegetation • any other substantial damage to native vegetation including activities such as the draining for the reclamation of wetlands or flooding of land • grazing land where stock has been excluded for more than ten years. The Act also provides the opportunity for landholders to enter into voluntary "Heritage Agreement(s)" to ensure vegetation on private land is protected for perpetuity (s.23).	• it is growing in, or association with, a wetland environment • it contributes to the amenity of the area • the clearance of vegetation is likely to contribute to soil erosion, salinity, or flooding • the clearance of vegetation is likely to cause deterioration in the quality of surface or underground water • after clearance, the land is to be used for a purpose which is unsustainable. The NVC will take into account the impacts of the proposed clearance and may grant consent, refuse consent or grant consent subject to certain conditions (s.29). A net environment benefit is generally conditional on an approval being granted. Significant penalties apply if a person clears native vegetation without the permission of the NVC (s.26). The NVC can also take civil enforcement proceedings in the District Court for an order that the native vegetation be re-instated (s.31).
Natural Resources Management Act 2004	To promote and facilitate integrated and sustainable management of all natural resources (water, soil, biodiversity etc.); and to provide for arrangements to involve the community in the development and implementation of regional initiatives to improve the management of the natural resources. Key components include the establishment of regional Natural Resource Management (NRM) Boards and development of regional NRM Plans; the ability to control water use through prescription, allocations and restrictions; requirement to control pest plants and animals, and activities that might result in land degradation. A 'duty of care' is a fundamental element of this Act, i.e. ensuring one's environmental and civil obligation by taking reasonable steps to prevent land and water degradation. Persons can be prosecuted if they are considered negligent in meeting their obligations. The project area falls within the South Australian Murray-Darling Basin Natural Resources Management Board. Section 188(5) of the Act requires that the NRM Board must take into account any relevant provision of the regional NRM plan.	The NRM Board may appoint authorised officers to administer and enforce the Act. Authorised officers possess powers of entry, powers to give directions, powers to collect evidence and seize and remove animals and plants. An authorised officer may issue a protection order for the purpose of securing compliance with specified provisions of the Act: • breach of the general statutory duty; • breach of the duty not to damage watercourses or lakes; • failure to take action to destroy or control certain animals or plants; • failure to comply with the terms of a management agreement entered into under the Act; and • any other requirement imposed by the NRM Act or a repealed Act and which has been specified in the NRM Regulations. An owner of land who is, or is likely to be, in breach of the general statutory duty under the Act resulting or likely to result in land degradation may be required to prepare an action plan. Failure to comply with a notice requiring preparation of an action plan is an offence. An NRM authority or a State authorised officer may issue a reparation order in certain circumstances where a person has caused harm to a natural resource and repair is necessary. Enforcement action in the ERD Court can be taken if necessary.

Note: this summary is not intended to be a substitute for particular legal advice.

3 BACKGROUND INFORMATION

3.1 Administrative boundaries

The site is within three local government areas: the Regional Council of Goyder, the Light Regional Council and the Mid Murray Council. The site also falls within two Natural Resources Management Board regions: the Adelaide and Mount Lofty Ranges and the Northern and Yorke.

3.2 Environmental setting

The project is located in northern Mount Lofty Ranges Botanical Region. Interim Biogeographical Regionalisation of Australia (IBRA) is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity (DoE 2013a). The majority of the project area falls within the Flinders Lofty Block IBRA bioregion, Broughton subregion and Mopami and Rufus environmental associations. Less than 10% of the remnant native vegetation within the Mopami and Rufus environmental associations is remaining, which highlights its importance. Most of the native vegetation is located on private land and is subject to grazing. A small area of the proposed terminal substation falls within the Kanmantoo IBRA Bioregion, Fleurieu Sub-region and Scotts Hill environmental association. The Fleurieu IBRA subregion has only 12% native vegetation mapped and high quality native grasslands were observed in this area during EBS surveys. Landscape and remnancy descriptions are summarised in Table 3.

Table 3. IBRA bioregion, subregion, and environmental association environmental landscape summary.

Environmental setting (excluding portion of terminal substation)	
Flinders Lofty Block IBRA bioregion	
Temperate to arid Proterozoic ranges, alluvial fans and plains, and some outcropping volcanics. The semi-arid to arid north supports native cypress, black oak (belah) and mallee open woodlands, *Eremophila* and *Acacia* shrublands and bluebush/saltbush chenopod shrublands on shallow, well-drained loams and moderately-deep, well-drained red duplex soils. The increase in rainfall to the south corresponds with an increase in low open woodlands of *Eucalyptus obliqua* and *E. baxteri* on deep lateritic soils, and *E. fasciculosa* and *E. cosmophylla* on shallower or sandy soils.	
Broughton IBRA subregion	
This subregion is characterised by a series of wide undulating intramontane basins with red duplex soils, separated by low but distinct northerly trending strike ridges. In the north the region leads into the Southern Flinders Ranges with no sharply defined landform boundary, but a land use boundary marking the northern extremity of wheat cultivation. Due to widespread clearing for farming the only significant remnant of native vegetation is found in the Mt Remarkable area, where an open forest dominated by *Eucalyptus cladocalyx* or by *E. goniocalyx* and *E. leucoxylon* on reddish dense loams remains. Degraded remnants of *E. leucoxylon* and *E. odorata* woodlands can still be found on stony crests and steep slopes.	
Remnant vegetation	Approximately 10 % (106330 ha) of the subregion is mapped as remnant native vegetation, of which 3 % (3064 ha) is formally conserved
Landform	Hills and valleys; alternating subparallel hilly ridges and valleys with a general N-S trend in north. In south, there is hilly dissected tableland
Geology	Dissected lateralized surface in south

Soil	Hard setting loams with red clayey subsoils, highly calcareous loamy earths, hard setting loams with mottled yellow clayey subsoil, coherent sandy soils, cracking clays
Vegetation	Assumed native vegetation cover
Conservation significance	55 species of threatened fauna, 113 species of threatened flora. 0 wetlands of national significance.
Mopami IBRA environmental association	
Remnant vegetation	Approximately 6 % (4257 ha) of the association is mapped as remnant native vegetation, of which 2 % (85 ha) is formally conserved
Landform	Undulating plain on metasediments with low ridges and hills rising above it.
Geology	Metasediments and alluvium.
Soil	Hard pedal red duplex soils, reddish powdery calcareous loams and brown self-mulching cracking clays.
Vegetation	Grasslands and open parkland.
Conservation significance	25 species of threatened fauna, 39 species of threatened flora. 0 wetlands of national significance.
Rufus IBRA environmental association	
Remnant vegetation	Approximately 9 % (1639 ha) of the association is mapped as remnant native vegetation, of which 0 % (3 ha) is formally conserved
Landform	Northerly trending strike ridges with dissected footslopes on metasediments.
Geology	Quartzite and metasediments.
Soil	Reddish dense loams and hard pedal red duplex soils.
Vegetation	Grasslands and open parkland.
Conservation significance	18 species of threatened fauna, 14 species of threatened flora. 0 wetlands of national significance.
Environmental setting (portion of terminal substation)	
Kanmantoo IBRA bioregion	
Temperate, well defined uplands of Cambrian and Late Proterozoic marine sediments, and a lateritized surface becoming increasingly dissected northwards, with eucalypt open forests and woodlands and heaths on mottled yellow and ironstone gravelly duplex soils in the wetter areas, and Eucalyptus odorata and drooping sheoak on shallow rocky soils in drier areas. Extensively cleared for agriculture.	
Fleurieu IBRA subregion	
This subregion is predominantly an undulating to low hilly upland with steeper marginal ranges and hills. A lateritized surface occurs on the Fleurieu Peninsula and becomes increasingly dissected northward to where only a few remnants survive as rounded crests and summits with mottled -yellow duplex soils. The lowest lying areas are within the Inman Valley where soft glacial and fluvio-glacial deposits have been lowered more quickly than the surrounding sedimentary rocks. Much of the native vegetation has been cleared, however some remains in reserves and small isolated inaccessible areas. Low open woodland commonly dominated by Eucalyptus obliqua and E. baxteri are found in higher rainfall areas on deep, lateritic soils. Shallower or sandy soils support E. fasciculosa, E cosmophylla and in the northern part of the region E. goniocalyx. E leucoxylon dominates the woodlands on podzolised soils in the lower rainfall areas, E. viminalis ssp. cygnetensis dominates the wetter and cooler woodlands and E. odorata characterises drier sites. Eucalypts give way to drooping sheoak (Allocasuarina verticillata) in the most arid woodlands and in coastal situations on shallow rocky soils.	
Remnant vegetation	Approximately 12% (45372 ha) of the subregion is mapped as remnant native vegetation, of which 24% (10865ha) is formally conserved

Landform	Hills and valleys; alternating subparallel hilly ridges and valleys with a general N-S trend in north. In south, hilly dissected tableland
Geology	Dissected lateritized surface in south
Soil	Hard setting loams with red clayey subsoils, Highly calcareous loamy earths, Hard setting loams with mottled yellow clayey subsoil, Coherent sandy soils, Cracking clays
Vegetation	Eucalyptus woodlands with a shrubby understorey
Conservation significance	117 species of threatened fauna, 268 species of threatened flora. 9 wetlands of national significance.
Scotts Hill IBRA environmental association	
Remnant vegetation	Approximately 10% (9673 ha) of the association is mapped as remnant native vegetation, of which 5% (464ha) is formally conserved
Landform	Structurally controlled ridges with steep slopes.
Geology	Metasediments.
Soil	Grey-brown weakly structured sandy soils, hard pedal mottled-yellow duplex soils and reddish siliceous loams.
Vegetation	Low woodland of drooping sheoak and peppermint box and low open scrub of scarlet mintbush and mallee correa.
Conservation significance	41 species of threatened fauna, 59 species of threatened flora. 0 wetlands of national significance.

3.2.1 Climate

Nearest long term climate data comes from Kapunda weather station (BOM 2015), which shows trends of a typical Mediterranean climate (Figure 2). Most rainfall occurs in the mild winter months with low rainfall and average maximum temperatures nearing 30°C in the summer months. This area has an average annual rainfall of 494 mm, which supports cropping and improved pasture activities.

3.2.2 Vegetation

Remnant vegetation has been mapped by the Department of Environment, Water and Natural Resources (DEWNR) as part of the Native Vegetation Information System (NVIS) floristic analysis and mapping project. The NVIS mapping is based on interpretation of aerial photography or Landsat imagery and floristic data derived from Biological Survey of SA vegetation sites or field trips. Given the NVIS mapping is largely derived from remote assessment, it can be inaccurate and hence was ground-truthed by EBS. The following native vegetation communities have been previously mapped by DEWNR (within the proposed Twin Creek Wind Farm project area) and are shown in Figure 3.

- *Acacia paradoxa* shrubland;
- *Allocasuarina verticillata* woodland;
- *Austrostipa* sp. grassland;
- *Eucalyptus gracilis* mallee woodland;
- *Eucalyptus leucoxylon* ssp. woodland;

- *Eucalyptus odorata* woodland;
- *Lomandra effusa* (mixed) grassland;
- *Lomandra* sp. sedgeland; and
- *Phragmites australis*, *Typha domingensis* grassland.

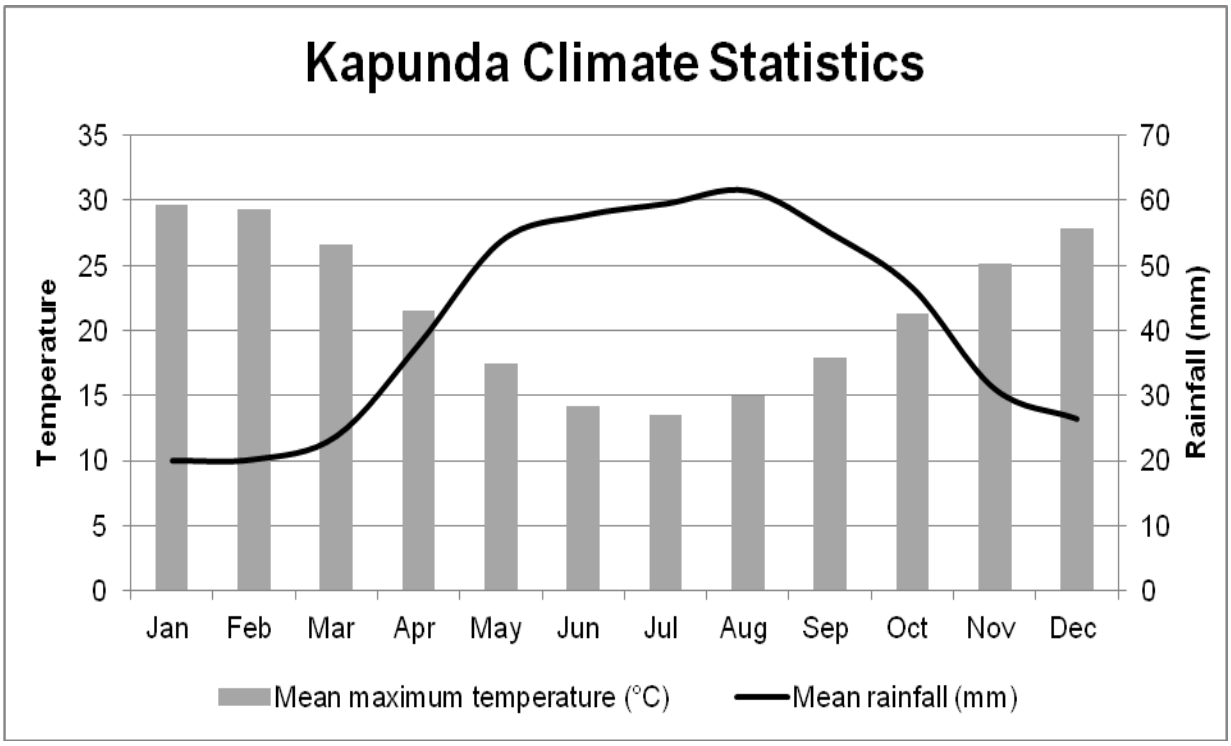


Figure 2. Average monthly rainfall and temperature data for Kapunda weather station.

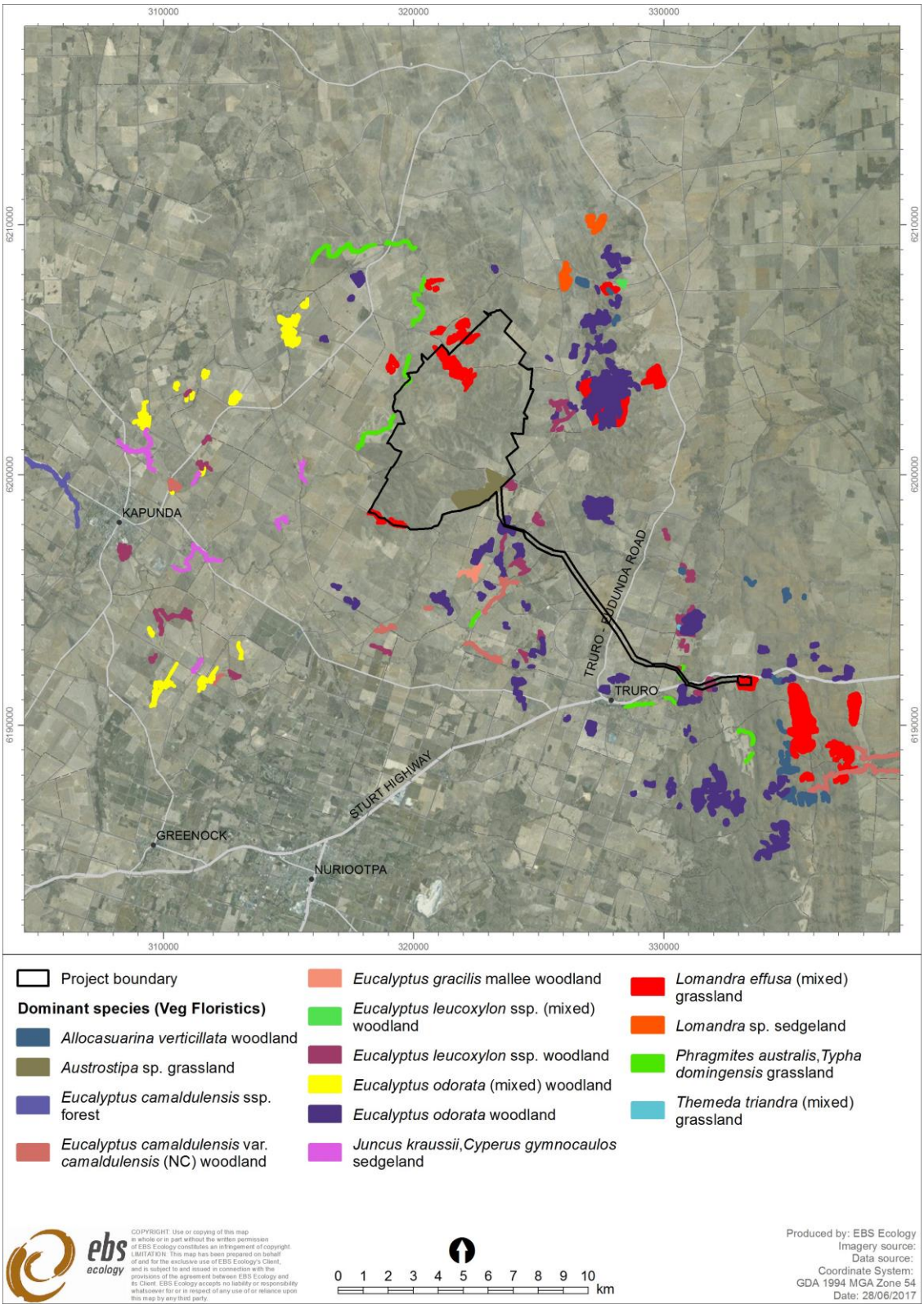


Figure 3. DEWNR native vegetation floristic mapping within the current infrastructure zone.

3.2.3 Protected areas

The closest DEWNR reserves to the proposed Twin Creek Wind Farm footprint are Kaiserstuhl Conservation Park (approximately 25 km south) and Brookfield Conservation Park (approximately 32 km east). Three existing Heritage Agreements under the *Native Vegetation Act 1991* are situated 4 km south (Heritage Agreement No.287) and 6 km east of the project area (Heritage Agreement numbers 677 and 1314) (Figure 4).

3.2.4 Previous surveys conducted

EBS undertook a vegetation assessment (on behalf of DP Energy in 2012) for the placement of the meteorological mast where it currently resides. EBS is aware of a series of targeted Pygmy Blue-tongue Lizard (PBTL) (*Tiliqua adelaidensis*) surveys that have been conducted, by others on the southern landholder's property (K. Mosey, pers.comm. 2015). Several surveys for PBTLs have been conducted by others within the Twin Creek project area (BDBSA 2010, 2011, 2012). The PBTL location data from these surveys has been included in Section 5.3.3 of this report.

The Government of South Australia (Naturemaps) detected six DEWNR flora survey sites located in and around the project area; two out of the six sites were situated within the wind farm footprint (Patch ID 15595 and 292471, which were described as vegetation and vegetation/vertebrates surveys respectively) (Table 4).

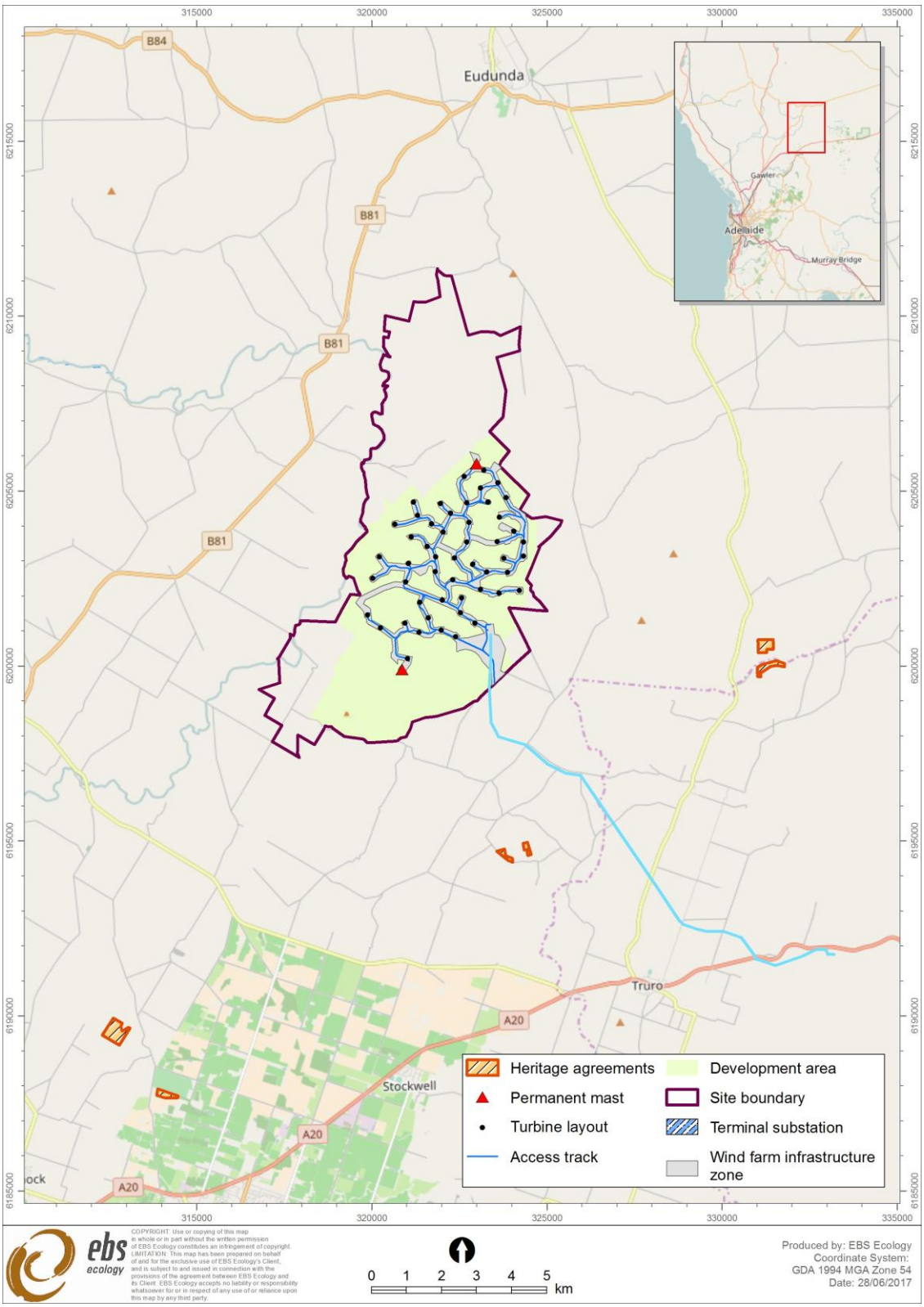


Figure 4. Heritage Agreements relevant to the proposed Twin Creek Wind Farm project area.

Table 4. Summary of previous DEWNR surveys.

Patch ID	Survey No.	Site ID	Survey name	Visit date	Survey type	Abstract	Data Custodian
15594	83	LBGTRU03	Lofty Block Grasslands	4/12/1996	vegetation only	A 1995 to 1996 vegetation survey to document grassland and grassy woodland remnants in the Lofty Block Bioregion	DEH - Biological Survey and Monitoring
15595	83	LBGTRU04	Lofty Block Grasslands	5/12/1996	vegetation only	A 1995 to 1996 vegetation survey to document grassland and grassy woodland remnants in the Lofty Block Bioregion	DEH - Biological Survey and Monitoring
9925	45	TRU0101	Western Murray Flats	29/04/1992	vegetation only	Survey aimed to classify and map the floristic composition and structure of vegetation within the Western Murray Flats	DEH - Biological Survey and Monitoring
9931	45	TRU0401	Western Murray Flats	27/04/1992	vegetation only	Survey aimed to classify and map the floristic composition and structure of vegetation within the Western Murray Flats	DEH - Biological Survey and Monitoring
292473	836	KAPDUF01	Grasslands - Lower North	19/10/2012	vegetation and vertebrates	Produce flora, reptile and bird data from grassland and grassy woodland sites on the Adelaide Plains and foothill areas of the AML NRM Board Region	AML NRM Board
292471	836	KAPFLA01	Grasslands - Lower North	21/10/2012	vegetation and vertebrates	Produce flora, reptile and bird data from grassland and grassy woodland sites on the Adelaide Plains and foothill areas of the AML NRM Board Region	AML NRM Board

4 METHODS

4.1 Desktop assessment

4.1.1 Database searches

The online Protected Matters Search Tool was used to identify any species or ecological communities of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur or may have suitable habitat within the project area. A 20 km buffer was applied to the search to incorporate the current infrastructure zone (which includes wind turbines, battery storage, substation, transmission line, access tracks and associated infrastructure, as of March 2017).

A search of the Biological Database of South Australia (BDBSA) maintained by the Department of Environment, Water and Natural Resources (DEWNR), was obtained to identify flora and fauna species previously recorded within 20 km of the project area (DEWNR 2015).

The BDBSA is comprised of an integrated collection of corporate databases which meet DEWNR standards for data quality, integrity and maintenance. In addition to DEWNR biological data, the BDBSA also includes data from partner organisations (Birds Australia, Birds SA, Australasian Wader Study Group, SA Museum, and other State Government Agencies). This data is included under agreement with the partner organisation for ease of distribution but they retain ownership of the data and should be contacted directly for further information.

4.1.2 Background research

Existing information relevant to the project site was referred to:

- Aerial imagery.
- GIS spatial datasets including DEWNR biological survey sites, vegetation cover, protected areas, IBRA, NVIS floristic mapping and TSA roadside vegetation survey.
- DotEE website for Species Profiles and Threats (SPRATs), conservation advices and policy statements for nationally listed species and ecological communities.
- Reports and plans, key references being:
    - Biodiversity Plan for the Northern Agricultural Districts (Graham *et al.* 2001);
    - A Regional Species Conservation Assessment Process for South Australia - Phase 2: Species Prioritisation, Northern & Yorke (Gillam 2009);
    - Northern and Yorke Regional Natural Resources Management Plan (NYNRMB 2008);
    - Native Vegetation of the Northern and Yorke Region (Berkinshaw 2006);
    - Adelaide and Mount Lofty Ranges Natural Resources Management Plan (AMLR NRMB 2013).
- Documents relating to threatened species and communities within the region, such as the Recovery Plan for the Pygmy Blue-tongue (*Tiliqua adelaidensis*).

This information was used to build a picture of:

- native vegetation cover within the project area and immediate surrounds;
- previous survey effort in the area;
- vegetation associations present (including associations of significance);
- flora and fauna species (including species of national, state or local conservation significance) known or likely to occur in the area;
- potential ecological constraints for the project; and
- key threatening processes (e.g. weeds, pest animals) that may require specific management.

4.2 Assessment of the likelihood of threatened species occurring

A likelihood of occurrence rating (i.e. likelihood of that species occurring on or near the project area) was assigned to each threatened species identified in the Protected Matters Search and BDBSA database search. This likelihood of occurrence rating, 'Highly Likely', 'Likely', 'Possible' and 'Unlikely' take the following criteria into consideration:

- proximity of the records (distance to the project area);
- date of the records;
- landscape features, vegetation remnancy and vegetation type at the location of the record (taking into consideration similarities within the project area); and
- knowledge of species' habitat preferences, causes of decline and local population trends.

4.3 Field survey

4.3.1 Survey area and dates

EBS Ecology have undertaken a series of assessment's at the Twin Creek Wind Farm site, as new infrastructure areas were added over the course of the wind farm design and to determine if there were any seasonal variations in fauna (largely in bird assemblages) across the site. Targeted surveys for the Pygmy Blue-tongue Lizard were also conducted across the site, again as new infrastructure areas were proposed as well as micro sighting around wind turbines and access tracks within the main wind farm boundary. Table 5 is a summary of all surveys completed within the Twin Creek Wind Farm project area (as of March 2017).

Table 5. Consolidated list of surveys completed for Twin Creek Wind Farm.

Survey type	Date	Season	Description
Flora and fauna assessment	8-11 September 2015	Spring	General assessment and condition rating of vegetation, bird, bat and PBTL assessment
Targeted Lomandra assessment	8 October 2015	Spring	Assess whether Lomandra Grasslands qualified as a TEC

Survey type	Date	Season	Description
Bird survey	3-5 February 2016	Summer	Revisit bird count surveys established in spring 2015
Bird survey	18-20 April 2016	Autumn	Revisit bird count surveys established in spring 2015
Bird survey	26-28 August 2016	Winter	Revisit bird count surveys established in spring 2015 and undertake nest checks
Targeted PBTL survey and Bat survey	22 Feb – 4 March 2016	Summer/Autumn	Detailed assessment of PBTL habitat and occupation across the site. Anabat survey repeated from September 2015 survey due to poor weather conditions
Additional PBTL survey	5, 8 and 14 April 2016	Autumn	Investigate additional routes within areas of likely habitat
Additional PBTL survey	31 Oct – 11 Nov 2016	Spring	Targeted areas and additional infrastructure
Additional PBTL survey	22 Nov – 25 Nov 2016	Spring	Targeted areas and additional infrastructure
Vegetation Assessment	23, 24, 29, 30 Nov and 1 Dec 2016	Summer	Vegetation assessment of additional turbine, substation and transmission line
Additional PBTL survey	6-9 December 2016	Summer	Targeted areas and additional infrastructure
Additional PBTL survey	9 Jan – 13 Jan 2017	Summer	Targeted areas and additional infrastructure
Vegetation Assessment	5 April 2017	Autumn	Vegetation assessment of 2nd substation and potential shift of transmission line easement

4.3.2 Vegetation survey

Vegetation across the site was mapped into vegetation communities and described. All native and exotic flora species observed within the 11 vegetation associations, were recorded (Appendix 1). Species nomenclature used in this report follows that used in the Biological Database of South Australia (BDBSA).

Pre-prepared aerial maps were used to guide the field assessment. The survey was undertaken on foot and by vehicle, using the network of existing vehicle tracks and traversing across cleared paddocks where required. The entire development footprint is referred to hereon in as the project boundary. Field surveys initially covered a broad area; the development footprint was refined during the course of the assessment process, in response to findings by EBS Ecology and other consultants. An assessment has been made of the access route, however impact areas will be ground-truthed prior to clearance. Impact footprints restricted to roadsides and are minimal in size. Ground survey will be conducted prior clearance. There is another area of the Transmission Line (just north of the Sturt Highway) (Figure 32 and Figure 33) classified using aerial photography and based on surveyed vegetation in the adjacent paddock. This area will require follow up ground survey.

The general vegetation survey focused on validating and building on from the broad DEWNR floristic mapping, to obtain a greater understanding of the vegetation communities and vegetation condition within the area. This involved surveying all areas of native vegetation and recording the following:

- Location of vegetation associations;
- Species list for each vegetation association;

- Vegetation condition, determined using criteria adopted by the Native Vegetation Council (NVC) to calculate significant environmental benefit (SEB) offset requirements for native vegetation clearance (Table 6). Using these criteria, vegetation was assigned an SEB condition ratio based on the percentage of native and exotic species in the understorey, disturbance, and intactness of vegetation stratum;
- Isolated trees or small clumps of trees with a very low percentage of native understorey are considered scattered trees by definition of the NVC. These include trees in crops and exotic grasslands, or on degraded roadsides and was particularly relevant when assessing the transmission line and access roads. Such trees were assessed using the appropriate methodology which includes recording tree attributes such as species, height, girth, health and habitat value and using them to calculate a tree score using the NVC point scoring system. These trees have not been described or presented on maps in this report. However, SEB calculations will be undertaken for trees affected once the final works footprint and clearance required is known. This was particularly relevant when assessing the proposed transmission line for native vegetation;
- Location and extent of declared and serious environmental weed species;
- Flora species and ecological communities of conservation significance; and
- Habitat value.

The SEB Condition Ratios (Table 6) and Tree Scores in addition to other policies are used to calculate appropriate offset area or offset cost requirements. High quality vegetation or vegetation that provides important habitat such as for state or nationally threatened species is subject to additional policies that increase the required offset area or value.

In addition, the Native Vegetation Council (NVC) has advised that in the event of native vegetation clearance applications, woodland associations may warrant a higher SEB rating depending on the condition of the overstorey.

A Native Vegetation Clearance Report will be prepared and submitted to the NVC, which will discuss and determine the required Significant Environmental Benefit (SEB) as part of the proposed native vegetation clearance for this proposed development.

Table 6. Assessment criteria for the condition of vegetation communities.

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Very Poor	**0:1**	<10%	No overstorey stratum remaining.	Complete destruction of indigenous understorey* (by grazing &/or introduced plants).	Vegetation structure no longer intact (e.g. removal of one or more vegetation strata). Scope for regeneration, but not to a state approaching good condition without intensive management. Dominated by very aggressive weeds. Partial or extensive clearing (> 50% of area). Evidence of heavy grazing (tracks, browse lines, species changes, complete depletion of soil surface crust).	Where proposed clearance is considered to be minor and of limited biodiversity impact, e.g. lopping of overhanging limbs only or minor clearance of shrubs in areas otherwise considered as highly disturbed.
	1:1	10-19%	Scattered trees in poor health and/or representing an immature stand.	Almost complete destruction of indigenous understorey* (by grazing &/or introduced plants) - reduced to scattered clumps and individual plants.		Where proposed clearance is in areas dominated by introduced species, the area of native vegetation is largely reduced to scattered trees, indigenous understorey reduced to scattered clumps and individual plants.
	2:1	20-29%	Scattered trees either immature in good health or mature in poor/moderate health. Alternatively, the dominant overstorey stratum is largely intact and is an immature stand (or regrowth), and is generally in poor health.			
Poor	**3:1**	30-39%	Dominant overstorey stratum is largely intact and is a moderately healthy mature stand.	Heavy loss of native plant species (by grazing &/or introduced plants). The understorey* consists predominately of alien species, although a small number of natives persist.	Vegetation structure substantially altered (e.g. one or more vegetation strata depleted). Retains basic vegetation structure or the ability to regenerate it. Very obvious signs of long-term or severe disturbance. Weed dominated with some very aggressive weeds. Partial clearing (10 – 50% of area). Evidence of moderate grazing (tracks, browse lines, soil surface crust extensively broken).	Where the proposed clearance is of mostly intact overstorey vegetation but there is still considerable weed infestation amongst the understorey flora.
	4:1	40-49%	Dominant overstorey stratum is largely intact and is a healthy mature stand with high wildlife habitat value (e.g. hollows).			

Condition	SEB ratio	% indigenous cover	Overstorey condition description	Understorey condition description	Indicators	NVC Interim Policy (1.2.11)
Moderate	**5:1**	50-59%	Dominant overstorey stratum is largely intact – any condition+	Moderate loss of native understorey diversity. Weed-free areas small. Substantial invasion of aliens resulting in significant competition, but native understorey* persists; for example, may be a low proportion of native species and a high native cover, or a high proportion of native species and low native cover.	Vegetation structure altered (e.g. one or more vegetation strata depleted). Most seed sources available to regenerate original structure. Obvious signs of disturbance (e.g. tracks, bare ground). Minor clearing (<10% of area). Considerable weed infestation with some aggressive weeds. Evidence of some grazing (tracks, soil surface crust patchy).	Where the proposed clearance is of mostly intact overstorey vegetation with moderate but not severe weed infestation amongst the understorey flora. Clearance is not seriously at variance with the Principles.
	6:1	60-69%	Dominant overstorey stratum is largely intact – any condition+	Moderate but not severe weed infestation amongst the understorey flora.		
Good	**7:1**	70-79%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.	Vegetation structure intact (e.g. all strata intact). Disturbance minor, only affecting individual species. Only non-aggressive weeds present. Some litter build-up.	Where the proposed clearance is of mostly intact overstorey and understorey vegetation, weed infestation is moderate to low, but the original vegetation is still dominant. Clearance is assessed by the NVC to be at variance with the Principles.
	8:1	80-89%	Original overstorey stratum is still dominant and intact – any condition+	Understorey only slightly modified. High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.		
Excellent	**9:1**	> 89%	Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand.	Diverse vegetation with very little weed infestation.Understorey largely undisturbed, minimal loss of plant species diversity. Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.	All strata intact and botanical composition close to original. Little or no signs of disturbance. Little or no weed infestation. Soil surface crust intact. Substantial litter cover.	Where the proposed clearance is of diverse vegetation with very little weed infestation. Clearance is assessed by the NVC to be seriously at variance with the Principles.
	10:1		Original vegetation is still dominant and intact. Overstorey individuals in good condition and represent a mature stand, with high habitat value (e.g. hollows).			

* Or all strata if the upper and lower strata are difficult to distinguish. + Ratio assessment will largely depend upon condition of understorey associated with an intact overstorey stratum.
Adapted from *Guide to Roadside Vegetation Survey Methodology for South Australia* (Stokes et al. 1998) and *Guidelines for a Native Vegetation Significant Environmental Benefit Policy* (DWLBC 2005).

4.3.3 Threatened ecological communities

Targeted surveys were undertaken in areas of *Eucalyptus odorata* (Peppermint Box) woodlands and *Lomandra* spp. (Iron-grass) grasslands to determine if the areas qualified as threatened ecological communities under the EPBC Act.

Baseline surveys for *Lomandra* Grasslands in the turbine area were undertaken in September 2015. An additional one day survey was undertaken on 8 October 2015 to assess whether the *Lomandra* Grasslands in the turbine area qualified as the threatened ecological community. Additional areas of *Lomandra* grassland were located during vegetation surveying for the transmission line in late 2016 and assessed at the time (early summer) or during a follow up survey on 5th April 2017.

Areas of *Eucalyptus odorata* woodland mapped in the proposed transmission line (Biele Road) during the late 2016 survey were assessed at the time. An additional area was visited during the 5th April 2017 survey (Biele Road), due to a proposed shift in the transmission line. A further detailed survey is required to determine whether this patch of *Eucalyptus odorata* woodland qualifies as a TEC.

Surveys with appropriate access followed the criteria outlined in the *EPBC Act Policy Statement 3.7: Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia* (DEWR 2007).

The extent of *Lomandra* grassland patches and Peppermint Box woodland were recorded using hand held Garmin GPS (accuracy +/- 10 m). Species diversity totals were obtained from a 50 x 50 m quadrat for each representative area. All species observed within the quadrats were recorded with totals compared against the benchmark criteria outlined in DEWNR (2007). Table 7 details the minimum criteria used for listing the Iron-grass Natural Temperate Grassland of South Australia. The flowchart in Figure 5 highlights the steps necessary to assess an area against the EPBC criteria for *Iron-grass Natural Temperate Grasslands of South Australia*.

Note: To meet the criteria an area must have either one, or both, of the Iron-grass species present out of *Lomandra multiflora* ssp. *dura* (Hard Mat-rush) or *Lomandra effusa* (Scented Mat-rush).

Table 8 details the minimum criteria used for listing the Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

Areas of Condition Class A are considered the highest quality representation of the community. Condition Class B areas are also of high quality, but do not have the native species diversity of Condition Class A. Classes A and B are indicative of the listed ecological community. Condition Class C areas, which are typically significantly degraded (low condition), are not included as the listed ecological community, and therefore, do not trigger the 'significant test' of the EPBC Act. Condition Class C areas are still considered to be amenable to rehabilitation through measures such as weed control, natural regeneration and protection from grazing.

Table 7. Condition classes for Iron-grass Natural Temperate Grassland of South Australia.

Condition Class	Minimum Size	Diversity of Native Species[1]	No. of Broad-leaved Herbaceous Species[1] in addition to identified disturbance resistant species[2]	No. of Perennial Grass Species[1]	Tussock Count[3]
Listed ecological community					
A	0.1 ha	> 30	+10	≥5	1/m
B	0.25 ha	> 15	+3	>4	1/m
Degraded patches amenable to rehabilitation					
C		> 5	No minimum	≥1	No minimum

[1] As measured in a 50 m X 50 m quadrat;

[2] The following species are identified as disturbance resistant species: *Ptilotus spathulatus* forma *spathulatus; Sida corrugata; Oxalis perennans; Convolvulus erubescens; Euphorbia drummondii;* and, *Maireana enchylaenoides;* and,

[3] As measured along a 50 m transect.

Table 8. Condition classes for Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

Condition Class	Minimum Size	Diversity of Native Species[1]	No. of Broad-leaved Herbaceous Species[1] in addition to identified disturbance resistant species[2]	No. of Perennial Grass Species[1]
Listed ecological community				
A	0.1 ha	> 30	+10	≥5
B	1 ha	> 15	+3	≥2
Degraded patches amenable to rehabilitation				
C		> 5	No minimum	≥1

[1] As measured in a 50 m X 50 m quadrat;

[2] The following species are identified as disturbance resistant species: *Ptilotus spathulatus* forma *spathulatus; Sida corrugata; Oxalis perennans; Convolvulus erubescens; Euphorbia drummondii;* and, *Maireana enchylaenoides.*

4.3.4 Fauna

Fauna surveys were undertaken across all seasons in an attempt to detect seasonal variations, including possible migratory birds moving into the area and assessing the breeding success of raptors at identified nesting locations.

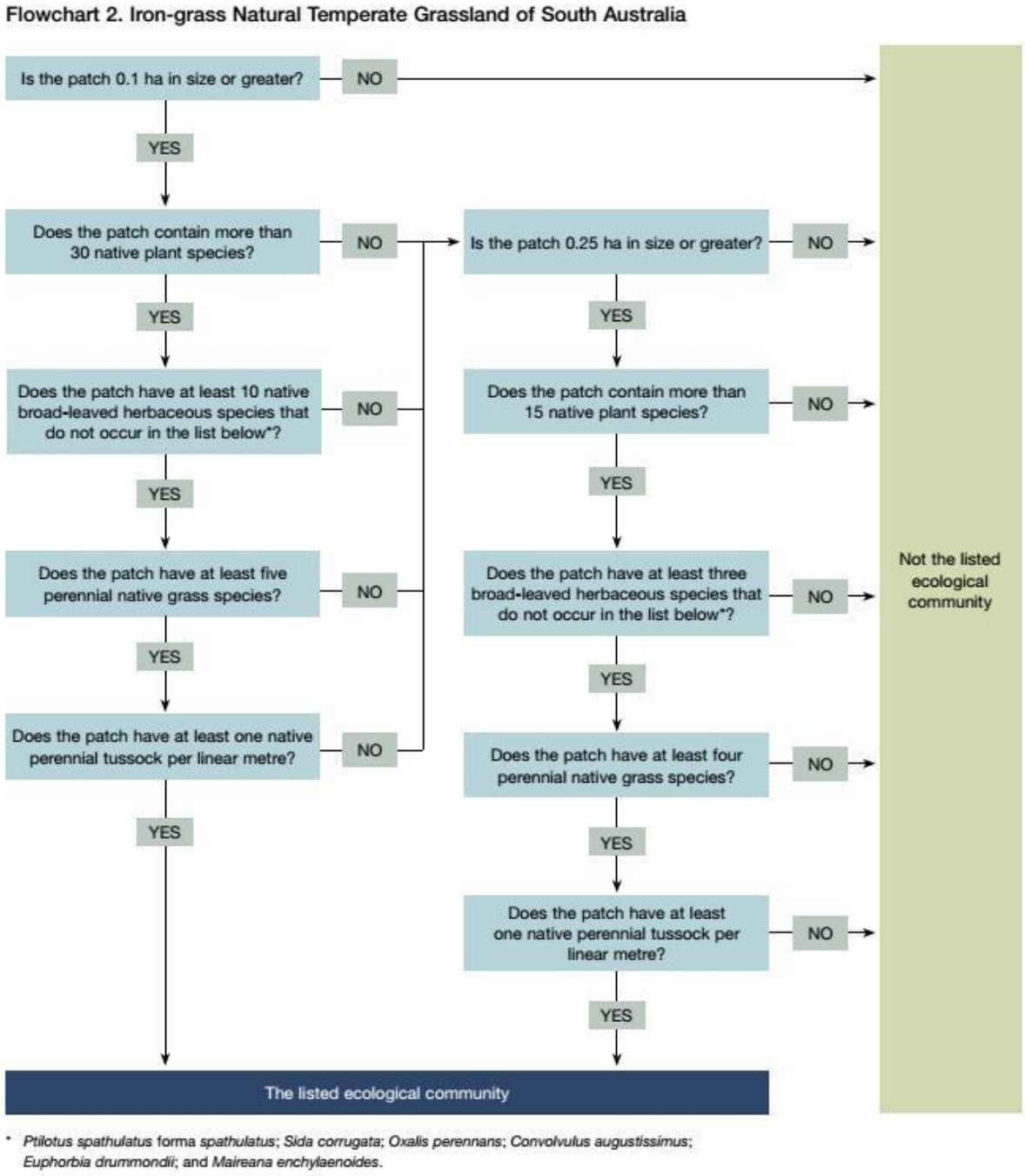


Figure 5. Flowchart to assess an area against EPBC criteria for *Lomandra* Grassland.

Targeted fauna surveys were undertaken for birds and bats as these fauna groups are considered particularly at risk in regard to wind farm developments. Bird and bat surveys were performed in line with the following guidelines:

- Best Practice Guidelines for implementation of wind energy projects in Australia (Clean Energy Council 2013, with reference to additional detail on birds and bats in AusWind 2006) and
- National guidelines for detecting bats listed as threatened under the EPBC Act (AGDEWHA 2010).

The Best Practice Guidelines for implementation of wind energy projects in Australia outline three tiers of surveys for birds and bats (Table 9). The guidelines for Australia's threatened bats (AGDEWHA 2010) outline field survey expectations and survey techniques to detect nationally listed bat species. The guidelines are not mandatory and should be read in conjunction with the EPBC Act Significant Impact Guidelines (Commonwealth of Australia 2013).

The assessment of fauna habitat on site occurred to determine its suitability for threatened species that are known to occur in the broader area. The determination of species that were to be targeted during the field survey was made based on the desktop assessment, existing records and habitat suitability. All fauna species observed (e.g. via sightings, scats, diggings, tracks, burrows) during the spring 2015 survey were recorded. Any opportunistic sightings during the summer, autumn and winter bird surveys, as well as during the PBTL and bats surveys, were also recorded.

Survey methodology for these fauna groups is further described below.

Table 9. Auswind (2006) survey level requirements.

Survey Level	Bat	Bird
Level One – Initial surveys	Minimum requirement for assessing potential bat impacts at wind farms • Determine the bat species present on or near the site; • Identify if there are any priority species on or near the site; • Identify bat habitat (which may include habitat used for foraging, breeding, roosting, etc) of priority species on or near the wind farm; Level One investigation can act as pilot studies for higher level investigations, should these be required.	Minimum requirement for assessing potential bird impacts at wind farms • Determine the avian species present on or near the site; • Identify any priority species on or near the site; • Identify avian habitat (which may include habitat used for foraging, breeding, roosting, etc) of priority species on or near the site; Level One investigations may involve desk top surveys, but a site visit is usually required to verify desktop data (which are sometimes coarse in their resolution or incomplete). These surveys can also act as pilot studies for higher level investigations. For example, roaming surveys are a good way of identifying avian habitats and areas of avian use within a site, which will assist with the design of higher level investigations
Level Two – detailed surveys	Allow more detailed quantification for assessing potential impacts than is possible through Level One investigations. Investigations may involve (but not be limited to): • More detailed bat surveys, which quantify which species are present and relative activity levels, the numbers and how they use the site • Gradient studies may be a suitable method in some circumstances	Designed to obtain more detailed data on birds necessary for a risk assessment than was achieved from through Level One investigations. Studies may involve (but are not limited to): • Bird utilisation surveys, which quantify which species are present, their numbers and how they use the site. Data from these surveys can be input to collision risk models to estimate the potential collision risk of species; • Collision risk modelling. The advantage of using a model is that it is a more objective quantification of the risk than can be derived from a subjective assessment. Further, inputs can be modified based on advice from experts and Regulators. In the absence of empirical bird utilisation data, scenario modelling can be conducted, where a series of assumptions are input into the model to

Survey Level	Bat	Bird
		examine collision risk. Inputs can be varied to test an array of scenarios • Gradient studies may be a suitable method in some circumstances.
Level Three – targeted surveys	Investigate specific issues that level two investigations have been unable to adequately address. Studies may be (but are not limited to): • Population viability analysis for priority species (if one is available, or if there are sufficient data to undertake one); • Other modelling exercises; • Detailed studies examining a specific issue.	Investigate specific issues that Level Two investigations have been unable to adequately address. Studies may be (but are not limited to): • Population viability analysis for priority species (if a PVA is available, or if there are sufficient data to undertake one); • Other modelling exercises; • Detailed studies examining a specific issue.

4.3.5 Birds

An Auswind Level 2 bird survey was undertaken in September 2015 (spring), February 2016 (summer), April 2016 (autumn) and August 2016 (winter). Sixteen (16) monitoring point count sites were originally established in 2015 (Figure 6), with the aim being to sample a range of habitats and achieve a spread of sites within the project boundary. This was to ensure that site visits were timed to coincide with a range of seasons which would provide a better representation of both the resident and transient bird species, so that the entire bird community was identified.

Each point count was of a thirty minute duration, commencing after a five minute acclimatisation period. Point counts were conducted twice at each site, once in the morning and once in the afternoon. These were undertaken on two separate days to avoid temporal biasing of species present. Data collected for each point count observation were as follows:

- Species observed
- Number of individuals
- Height above ground (m) (minimum and maximum)
- Distance from observed (m)
- Behaviour:
    - Flying in a single direction – FLM
    - Flying (hovering or circling) over or around a single point – FLH
    - Foraging (feeding) on ground – FOG
    - Perching/resting/walking on ground – ROG
    - Perching/resting/climbing on trees or shrubs – ROT
- Direction of flight where possible.

Roaming surveys were undertaken through cleared cropping land to maximise the time spent conducting point count surveys within more suitable habitat areas, where bird abundance and diversity were expected to be greater. All opportunistic records of birds observed during the course of moving around the site were recorded. The gathered bird data was used to identify potential impacts of the proposed wind farm on bird

species. A call play-back survey technique was used where it was deemed appropriate. In addition, the bird survey focused on key habitats for any threatened bird species identified as potentially occurring in the area.

Flight height and movement details were specifically recorded for 'at-risk' bird species; meaning those species with the potential to fly at heights within the rotor-swept area, making them at risk of turbine strike. Flight height and movement details were used to help assess the potential collision risk of bird's species (refer to Section 4.4 for risk assessment methodology).

The maximum turbine height proposed for the Twin Creek Wind Farm is 180 m (at the blade tip). At these dimensions, the lowest extent of a rotating blade tip is approximately 45 m. For the purposes of this report, flights that are performed above 45 m over the top of the ridge are considered at-risk movements, as this air-space corresponds with the rotor-swept area of turbines. Refer to the Discussion (Section 5.3.8) for further details on the concept of at-risk and rotor swept area.

4.3.6 Targeted Wedge-tailed Eagle nest searches

The Wedge-tailed Eagle (*Aquila audax*) is often referred to as a flagship raptor species; although not a species of state or national conservation significance, it is iconic and readily identifiable to many people. The Wedge-tailed Eagle is an at-risk bird species in relation to wind farm developments due to its flight heights and flight behaviours.

All Wedge-tailed Eagle sightings and behaviours were recorded across the four seasonal surveys (spring 2015, summer 2016, autumn 2016 and winter 2016). Any eagles flying to and from the recorded nests, were recorded during the spring 2015 and winter 2016 surveys, when the nest checks were undertaken.

Spring 2015

Searches were conducted on foot through all woodland habitat across the site to locate Wedge-tailed Eagle nests and determine the breeding success (if any) of birds present. For each nest, the location, dimensions and signs of activity were recorded. Photographs of each of the nesting sites were taken and the occupancy of a nest site was assessed as well as its status. The presence of chick, fledgling or adult Wedge-tailed Eagles, in or near the nest, was recorded. Any Wedge-tailed Eagles flying from the area upon arrival were also recorded. Other parameters were also used as an indication of nest occupancy, such as fresh whitewash (bird excrement), prey remains on the ground beneath or within the nest and the presence of green leaves in the nest bowl (when views were available).

Winter 2016

Nests that were originally found during the spring 2015 survey, were again rechecked for breeding status during the winter (August) 2016 survey. This was undertaken at an optimal time of the year, when potential breeding pairs of eagles would have mated and should be sitting on nest (incubating an egg).

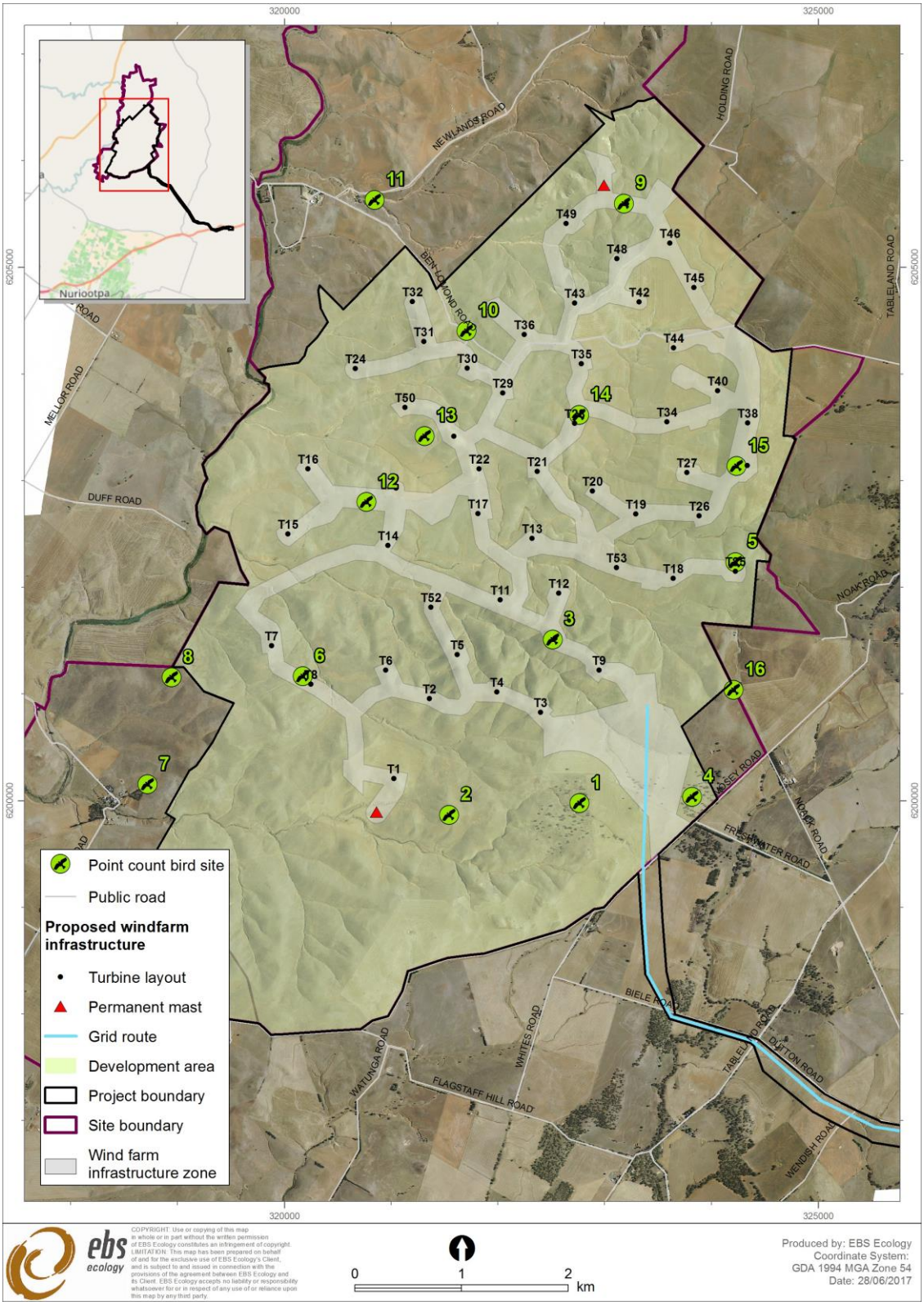


Figure 6. Bird survey locations across the Twin Creek Wind Farm site.

4.3.7 Targeted Peregrine Falcon nest searches

Along with the Wedge-tailed Eagle, the Peregrine Falcon (*Falco peregrinus*) was also targeted during the spring 2015 surveys, with potential nest locations and breeding status investigated. Suitable breeding habitat for Peregrines Falcons include rocky crevices and ledges, however, the species has also been known to utilise abandoned nests of other species e.g. Wedge-tailed Eagles. Rocky crevices and ledges were not typically present within the project boundary.

4.3.8 Bats

An Auswind Level 1 (Table 9) bat survey was performed in spring 2015. The spring survey encountered poor weather and a malfunction of one of the Anabat detectors, and therefore a subsequent survey was conducted in summer/early autumn 2016 (22 February - 4 March 2016). AnaBat detectors were set up at three locations across the site (Figure 7), and recorded bat calls from late afternoon until early the following morning. Anabat detectors were strategically placed within areas thought to be suitable habitat for bats to roost or forage within, and therefore, woodland areas which contained hollows for roosting and 'fly-ways' through the canopy were targeted for bat call activity (Figure 8).

Bat calls recorded on the AnaBat detectors were analysed and interpreted by Dennis Matthews in line with the reporting standards for echolocation call analysis developed by the Australasian Bat Society. The bat identifications made were based on a combination of manual and automated methods using either reference calls from the region or from species calls recorded outside the region, that are likely to represent the calls from species in the survey region. A species inventory was tabulated for each detector night and the number of calls for each species was recorded. Species identifications were only made if call identification was certain.

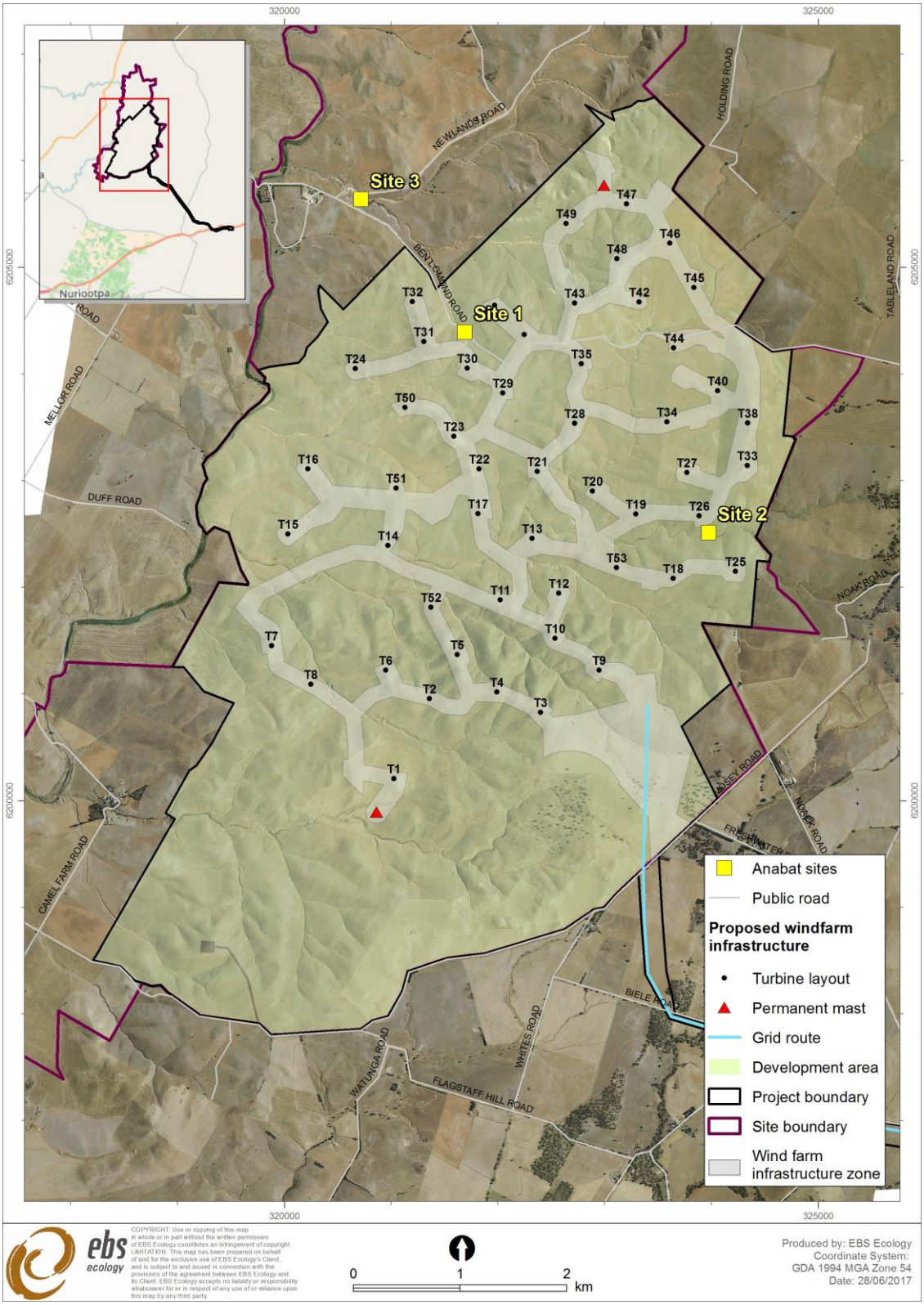


Figure 7. Bat survey locations across the proposed Twin Creek site.

Figure 8. Bird survey location typically set up within wooded areas across the proposed Twin Creek site.

4.3.9 Pygmy Blue-tongue Lizards

The habitats present within the project boundary were assessed for their suitability for the nationally endangered Pygmy Blue-tongue Lizard (PBTL) (*Tiliqua adelaidensis*) during the initial flora and fauna assessment of the project site (8-11 September 2015).

A search for spider holes was undertaken within potential PBTL habitat, as well as opportune searches in other areas of potential habitat throughout the project boundary. The habitat was categorised for the PBTL as likely, possible and unlikely habitat. The habitat assessment was based on the habitat attributes provided in Table 10. A further categorisation was made based on the likely density of PBTL in an area (no lizards, low density, high density), using information gathered from each area within the project boundary. Known suitable Pygmy Blue-tongue Lizard habitat attributes versus unsuitable habitat attributes are summarised in Table 10.

Table 10. Categorisation of habitat suitability.

Attributes considered suitable habitat	Spider burrows within native or exotic grasslands; PBTLs have also been detected in highly modified treeless grasslands
	• Soil of heavy sandy loam (red-brown earth)
	• Foot slopes of hills
	• Sheltered areas of foot slopes
Attributes considered unsuitable habitat	Areas that have been previously cropped
	Areas lacking spider burrows
	Areas containing dense ground cover vegetation
	Steep terrain and exposed rocky ridgelines
	Overly rocky areas

Targeted Survey

Targeted searches for PBTL were undertaken by EBS. The survey effort for target areas was based on the experience of the EBS team and experience of researchers who have undertaken PBTL surveys for many years (J. Clayton pers. comm 2017 and M. Hutchinson pers comm 2016). The targeted PBTL survey was conducted over a two-week period (22 February – 4 March 2016) to cover as much of the survey area as possible focusing on the proposed infrastructure areas and at proposed turbine locations. An additional three-day survey was also conducted (5, 8 and 14 April 2016) to investigate areas of likely habitat for the presence of PBTL, which was to assist with turbine placement and associated infrastructure design. Extensive surveys were then undertaken in potential PBTL habitat across the entire project site over a five week period, between November 2016 and January 2017 (31/11/16 – 11/11/16; 22/11/16 – 25/11/16; 09/01/17 – 13/01/17) (Table 5). These surveys included any additional project areas, including the transmission corridors and varied turbine layout.

Suitable spider holes within infrastructure and turbine locations were inspected using a burrowscope during all targeted PBTL surveys. The presence or absence of a spider or PBTL within each hole was recorded. A GPS location was obtained for each general area within which spider holes were inspected. A typical PBTL burrow is shown in Figure 9.

Turbine locations

Each of the 51 turbine locations and transmission corridors were surveyed by one or two ecologists. The summer/autumn 2016 turbine surveys included the following steps:

1. The proposed turbine locations were predetermined by RES and coordinates provided. The location of proposed turbines was then marked using either the survey vehicle or a temporary survey peg.

2. A 100 x 100 m survey area was marked out using the turbine location as the centre point. Each of the four corners (north, east, south, west) of the survey area were temporarily marked using survey pegs. The use of the temporary survey markers provided a visual boundary of the survey area for the surveyors. A site photo was taken from the western corner looking towards the proposed turbine location. The surveyors started on opposite sides of the survey area and moved towards each other at 5 m intervals. All spider holes and/or PBTL burrows located were temporarily marked using a survey peg (a different colour to the boundary and turbine location survey pegs). Each surveyor carried a GPS and used the track log function which provided the 'real time' location of the surveyor which helped in aligning the 5 m transects.

3. Each of the temporarily marked holes and/or burrows were then checked with a fibre optic scope ('Burrowscope') to determine the presence of lizards. All locations of holes and/or burrows were recorded using a GPS. Data collected at each hole or burrow recorded hole/burrow occupancy (i.e. spider, debris, beetle, empty, PBTL). All holes not containing a PBTL have been described as being empty for the purpose in this report. Survey pegs were removed after inspecting each hole/burrow.

Figure 9. A Pygmy Blue-tongue Lizard burrow.

Subsequent surveys in the summer of 2016/2017 followed similar methods with the following amendments:

1. Turbine locations and transmission corridors were surveyed using marker pegs spaced out at 10m intervals to ensure surveyors covered all of the area. An interactive map on an iPad was used to ensure that areas within the boundaries of the project site were included in the search.

2. Burrows were inspected as the surveyors moved, removing the need to double-up on covering the same areas.

Track alignments

An extensive track network is required for the wind farm. Due to the large area requiring inspection for the proposed track alignments, a 40 m wide corridor was assessed (20 m either side of the midpoint of the access track). The surveys along the proposed track alignments were not as detailed as the 100 m x 100 m turbine surveys (undertaken during the initial flora and fauna assessment, 8-11 September 2015), due to the scale of the assessment.

PBTL surveys have not been conducted along the access routes outside of the development site. The access road clearance footprint is small (restricted to turn points); the final impact footprint will be subject to on ground survey prior clearance.

Transmission corridor

In the summer 2016/2017 surveys, corridors to proposed WTG were also inspected for PBTL. A 200m wide corridor was assessed. Surveys within corridors were not as extensive as within WTG infrastructure zones due to the large area that needed to be covered and the lower impact of the overhead line compared to WTG infrastructure zone. Targeted surveys were carried out in likely PBTL habitat and less time was spent in areas that consisted of possible PBTL habitat. All areas within the transmission corridors were, at a minimum, assessed for their likelihood of having PBTL occupants and potential density of lizards.

4.3.10 Flinders Ranges Worm-Lizard (Aprasia pseudopulchella)

As well as the nationally endangered PBTL, the habitats present within the project boundary were also assessed for their suitability for the nationally vulnerable Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*). This was also undertaken during the initial flora and fauna assessment of the project site (8-11 September 2015).

4.4 Risk assessment

A risk assessment matrix was used to qualitatively define the risk of the proposed Twin Creek Wind Farm on birds that performed at-risk movements within the project boundary. The assessment is an adaptation of the qualitative measures of likelihood and consequence used in the Australian Defence Risk Management Framework (DRMF) (Gaidow and Boey 2005).

The DRMF provided generic guidance on the introduction and ongoing implementation of a risk management process; it may be applied to different activities or operations of any corporate, community or public sector organisation (Gaidow and Boey 2005). This risk assessment matrix considered the risk consequences (impact or magnitude of effect) and likelihood (measured by frequency or probability) of risk occurrence to combine them into the level of risk.

The risk assessment methodology used within the DRMF was adapted to a science based situation to include likelihood and consequence of an event on a species or local population. EBS Ecology used the risk assessment matrix to qualitatively define the risk of a proposed wind monitoring mast on birds within numerous proposed wind farms located in the mid-north of South Australia. The risk matrix was accepted (when previously used by EBS Ecology) by the Environment, Resources and Development (ERD) Court. State threatened species, raptors and migratory species were targeted in the assessment. This was based on bird species that had been identified as potentially occurring on site (through database searches) and those species that had been previously recorded on site.

Likelihood was defined as how likely is mortality from collision to occur, and consequence was defined by significance of associated impact on species viability (Table 11). A category of A to E was used to define likelihood, ranging from chronic (the event is expected to occur in most circumstances) to rarely (where the event may occur only in exceptional circumstances). A category of one to five was used to define consequence, where one equated to nil/insignificant (individuals may be affected, but viability of local population was not impacted) and five equated to catastrophic disaster (potential to lead to collapse of a species) (Table 11). Table 12 outlines the qualitative risk analysis matrix, which summarises four levels of impact: low, medium, high and extreme.

If the level of risk was determined as high to extreme, then resulting impact on an individual species and local population would be unacceptable. If the level of risk was categorised as medium, then all efforts should be made to mitigate against potential impact on the species. If the level of risk was low, then impact would be restricted to an individual level and impact on a species would be unlikely to affect the viability of a local population.

Table 11. Qualitative measures of likelihood and consequence (adopted from AS/NZS 4360:1999).

Likelihood (How likely is mortality from collision to occur)	**Consequence (Significance of associated impact on species viability)**
Rating Definition	**Rating Definition**
A Chronic: The event is expected to occur in most circumstances	**5 Catastrophic Disaster:** potential to lead to collapse of species
B Frequent: The event probably will occur in most circumstances (e.g. weekly to monthly).	**4 Major**: Critical event, very likely to have significant impact on species
C Likely: The event should occur at some time i.e. once in a while	**3 Moderate**: likely to have impact on population, potential to impact on long term viability under some scenarios
D Unlikely: The event could occur at some time	**2 Minor**: may have impact on local population, no impact on species
E Rarely: The event may occur only in exceptional circumstances	**1 Insignificant**: individuals may be affected, but viability of local population not impacted

Table 12. Qualitative Risk Analysis Matrix – Level of Risk (adopted from AS/NZS 4360:1999 and HB 143:1999).

Likelihood	**Consequences**				
	Insignificant 1	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
A (chronic)	High	High	Extreme	Extreme	Extreme
B (frequent)	Medium	High	High	Extreme	Extreme
C (likely)	Low	Medium	High	Extreme	Extreme
D (unlikely)	Low	Low	Medium	High	Extreme
E (rarely)	Low	Low	Medium	High	High

4.5 Limitations

The findings and conclusions expressed by EBS Ecology are based solely upon information in existence at the time of the assessments. Field data collected during the spring, summer, autumn and winter surveys, combined with database records and background research, is part the way to providing an adequately detailed assessment of the flora and fauna that occurs, and is likely to occur, within the project boundary.

The 2015 surveys for the turbine area were undertaken in spring when plants are generally in their visible life phase and easy to identify. However, follow up surveys in 2016 and 2017 (covering additional infrastructure components such as the substation and proposed transmission line); were undertaken in early summer and early autumn when the site had dried off significantly when the site had largely dried off and some understorey species were more difficult to identify or in their dormant phase. This is particularly important for Peppermint Box woodlands and *Lomandra* grasslands located in the Transmission Line and Terminal substation, requiring assessment to determine if they qualified as listed communities under the EPBC Act. It could not be determined with certainty whether sites qualified, except in some cases. However, a likelihood of qualifying is provided.

Existing flora and fauna records were sourced from the Biological Database of South Australia (BDBSA). The BDBSA only includes verified flora and fauna records submitted to the Department of Environment, Water and Natural Resources (DEWNR) or partner organisations. Although much of the BDBSA data has been through a variety of validation processes, the lists may contain errors. It should be noted that the spatial precision of the BDBSA data ranges from 5 m to over 25 km. Hence the location of mapped BDBSA records may not reflect their exact location.

Unforeseen rainy conditions were experienced on the first two days of the spring 2015 survey (8-9 September 2015). Prevailing weather conditions can impact on survey results, with rainy weather possibly leading to fewer observations of birds and bats. This unforeseen bad weather resulted in an additional bat survey being undertaken and also provided weight to the decision to undertake bird surveys across all four seasons (to account for variability).

AnaBat detectors aid in the identification of bat species and levels of bat activity, however, the technology does have limitations. Certain bat species are readily identified via AnaBat recordings however, others cannot be distinguished to species level by a call recording alone. For example, multiple calls from a single bat can be indistinguishable from single calls from multiple bats (Law *et al.* 1998). AnaBats are not able to determine flight heights performed by bats. The AnaBat recording range varies with temperature and humidity, therefore, the range being sampled is not equal across the nights. Different species are active at different times during the night; this means that depending on weather conditions, not all species will be recorded equally (D. Matthews, pers. comm. 2013).

A range of bird survey locations were positioned within different habitat types within the project boundary. Naturally some of these bird sites were situated along ridgelines in order to observe birds utilising this part of the landscape. A bias toward the number of observations recorded along the ridgeline may have been a result of this site placement.

In the summer/autumn 2016 survey, the ground cover vegetation was at an optimal stage (reasonably dry and lacked growth) for conducting spider holes/PBTL burrow searches. The lack of vegetative growth assisted the surveyor(s) to detect spider holes/PBTL burrows. For the duration of the summer 2016/2017 survey, vegetation cover was high and dense, due to higher than average rainfall throughout the season. This meant that the probability of detecting spider holes/PBTL burrows was lower than usual.

The PBTL survey aimed at examining all spider holes within 100 x 100 m turbine survey areas, however, it is possible some spider holes were missed as they are difficult to detect. Broader PBTL population surveys were not conducted during the both the summer/autumn 2016 and summer 2016/2017 assessments. The location of each spider hole was recorded using a handheld global positioning system (GPS), accurate to +/- 10 m. Pygmy Blue-tongue Lizard habitat across the infrastructure boundaries was assessed, however, due to the large area to be assessed, detailed surveys were not undertaken to the full 200 m. Information gathered in extensively searched areas was used to inform decisions made on the likelihood of PBTL occupation in areas that were not able to be extensively searched.

5 RESULTS

5.1 Desktop assessment

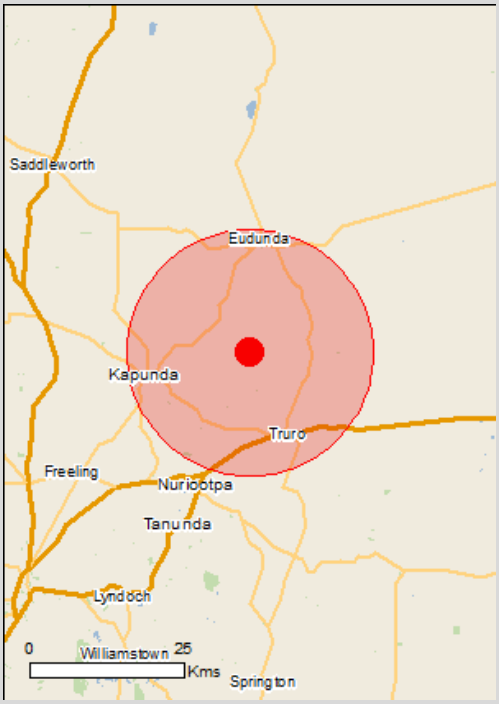
A Protected Matters database search was performed for the project boundary within a 20km buffer from a central point at the project site (Latitude 34.31, Longitude 139.07). The database search was used to identify flora and fauna species as well as threatened ecological communities of national environmental significance listed under the EPBC Act that may occur within the project boundary (DoE 2015).

A search of the Biological Database of South Australia (BDBSA) was undertaken to identify flora and fauna species previously recorded within the project boundary, also with a 20 km buffer (DEWNR 2015).

5.1.1 Matters of national environmental significance

The results from the EPBC Protected Matters Search is summarised below. The 20km search buffer identified 34 threatened species, ten migratory species and three ecological communities (Table 13).

Table 13. Summary of results from EPBC Protected Matters Search.

Search area	Matters of National Environmental Significance	20km
	World Heritage Properties	None
	National Heritage Places	None
	Wetlands of International Importance	None
	Great Barrier Reef Marine Park	None
	Commonwealth Marine Areas	None
	Listed Threatened Ecological Communities	3
	Listed Threatened Species	34
	Listed Migratory Species	10
	Listed Marine Species	15
	Whales and Other Cetaceans	None
	Other Matters Protected by the EPBC Act	
	Commonwealth Heritage Places	None
	Critical Habitats	None
	Commonwealth Land	None
	Commonwealth Reserves Terrestrial	None
	Commonwealth Reserves Marine	None
	Extra Information	
	State and Territory Reserves	6
	Regional Forest Agreements	None
	Invasive Species	33
	Nationally Important Wetlands	None
	Key Ecological Features (Marine)	None

5.1.2 Threatened ecological communities

Three threatened ecological communities were assessed as potentially occurring within the project boundary:

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions;
- Iron-grass Natural Temperate Grassland of South Australia; and
- Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

Buloke woodlands do not occur in the project area.

The Iron-grass Natural Temperate Grassland of South Australia is listed as Critically Endangered under the EPBC Act. It comprises a grassland dominated by Iron-grasses (*Lomandra multiflora* ssp. *dura* and/or *Lomandra effusa*), with tussock-forming (clumping) grasses, low shrubs and a range of other native plants in the ground layer. Trees and tall shrubs are generally absent or very sparse (less than 10 % cover). To qualify as the EPBC listed community, patches have to be at least 0.1 ha in size and meet native species diversity and density criteria (DEWR 2007).

Iron-grass Grasslands are unique to South Australia, and are predominantly distributed on the slopes and hills of the Mount Lofty Ranges, west of the River Murray and throughout the Mid North. Iron-grass Grasslands typically grow within loam to clay loam soil, with an estimated clay content of 30-35%. Geologically, Iron-grass Grasslands are often associated with surface pebbles and shale or sandstone rocky outcrops. Major threats to Iron-grass Grasslands include clearance and fragmentation, inappropriate grazing regimes, and weed invasion (DEWR 2007).

Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia was listed as critically endangered under the EPBC Act in 2007, due to a severe decline in distribution and an ongoing loss of integrity. The dominant tree species is *Eucalyptus odorata*, however, other species of Eucalypt commonly co-occur. A grassy understorey is most often present, although some shrubs may exist such as *Bursaria spinosa* (Sweet Bursaria) and *Acacia pycnantha* (Golden Wattle). The majority of remnants occur between Victor Harbor and Port Augusta, encompassing the mid-north region, as well as the Adelaide region, Mount Lofty Ranges and part of Yorke Peninsula. The key threats to this community are clearing, grazing and invasion by weeds (DEWR 2007).

5.1.3 Threatened flora

The 20km EPBC and BDBSA database searches identified 20 nationally listed flora species under the EPBC Act as potentially occurring or having suitable habitat potentially occurring within the project boundary. The 20 species consisted of:

- 1 species listed as Critically Endangered;
- 11 species listed as nationally endangered; and
- 8 species listed as nationally vulnerable.

Their likelihood of occurrence within the project boundary is provided in Table 14. Seven out of the 20 species, identified by the EPBC database search, have been determined as possibly occurring within the project boundary. Peep Hill Hop-bush (*Dodonaea subglandulifera*), which is listed as nationally and State endangered, has a record north of the project site, just south of Eudunda (Figure 10).

Table 14. Nationally threatened flora species potentially occurring within the project boundary.

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Acacia glandulicarpa	Hairy-pod Wattle	VU	E	1		Possible
Acacia menzelii	Menzel's Wattle	VU	V	1		Unlikely
Acacia spilleriana	Spiller's Wattle	EN	E	2	11/5/1982	Possible
Caladenia argocalla	White-beauty Spider-orchid	EN	E	1	1/5/1995	Unlikely
Caladenia behrii	Pink-lipped Spider Orchid	EN	E	1		Unlikely
Caladenia colorata	Coloured Spider-orchid	EN	E	2	1/09/1979	Unlikely
Caladenia gladiolata	Bayonet Spider-orchid	EN	E	1		Unlikely
Caladenia macroclavia	Large-club Spider-orchid	EN	E	1		Unlikely
Caladenia tensa	Greencomb Spider-orchid	EN		1		Possible (southern extent))
Caladenia woolcockiorum	Woolcock's Spider-orchid	VU	E	1		Unlikely
Caladenia xantholeuca	Flinders Ranges White Caladenia	EN	E	1		Unlikely
Dodonaea procumbens	Trailing Hop-bush	VU	V	1		Possible
Dodonaea subglandulifera	Peep Hill Hop-bush	EN	E	1	13/9/1987	Possible
Euphrasia collina ssp. osbornii	Osborn’s Eyebright	EN	E	1		Possible (southern extent
Hibbertia tenuis		CE	E	1		Unlikely
Olearia pannosa subsp. pannosa	Silver Daisy-bush	VU	V	1	26/11/1986	Possible (record near Truro)
Prasophyllum pallidum	Pale Leek-orchid	VU	R	1	11/11/1976	Unlikely
Prasophyllum pruinosum	Plum Leek-orchid	EN	V	1		Unlikely
Swainsona pyrophila	Yellow Swainson-pea	VU	R	1		Unlikely
Thelymitra matthewsii	Spiral Sun-orchid	VU	E	1		Unlikely

Conservation status

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. ssp.: the conservation status applies at the sub-species level.

Source of Information

1. **EPBC Act Protected Matters Report (data extraction 13/8/2015) – 20 km buffer applied to project site.**
2. **Biological Database of South Australia data extract (data extraction 5/8/2015) - 20 km buffer applied to project site.**

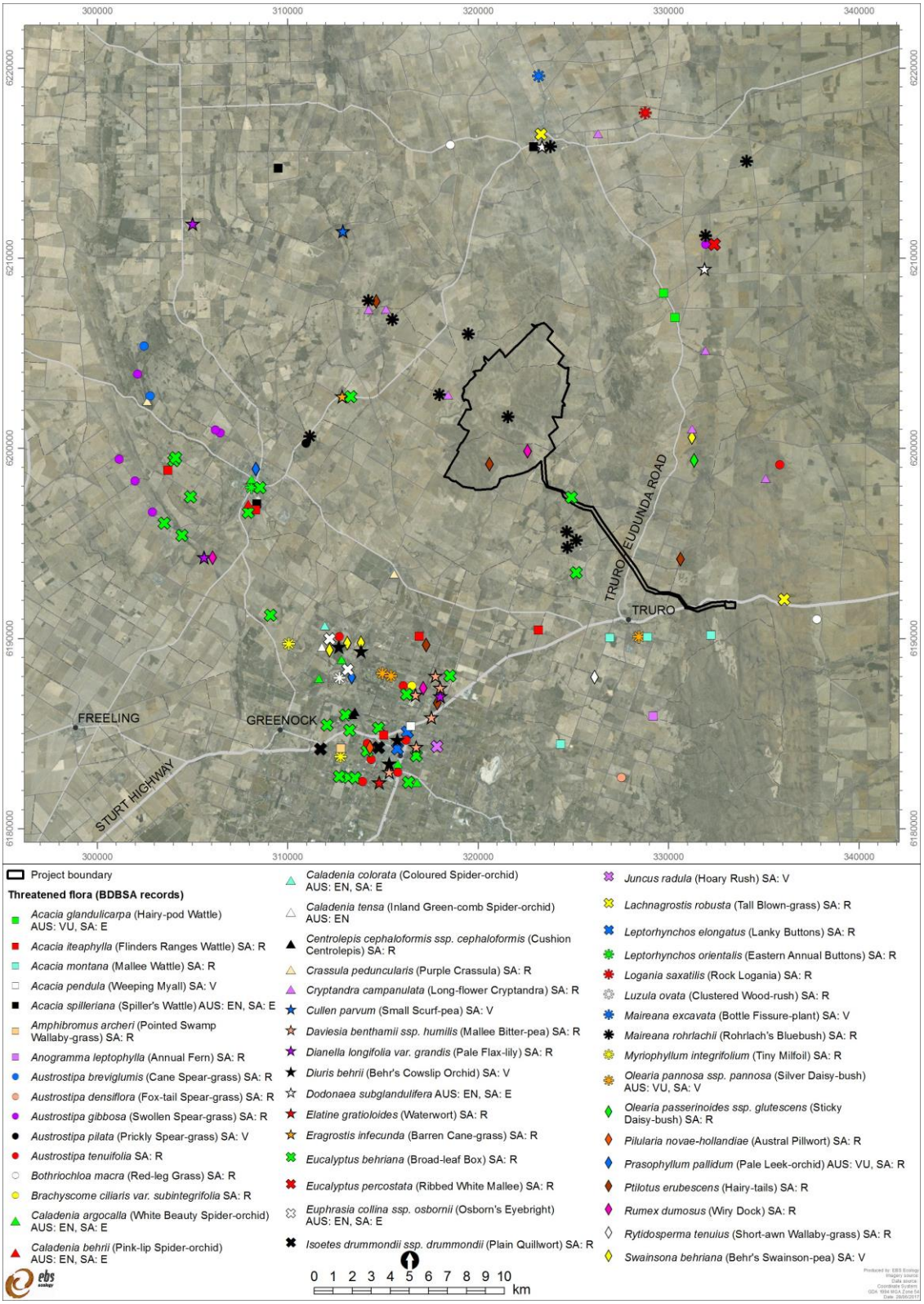


Figure 10. Threatened flora (BDBSA) clipped to a 20km search.

The BDBSA search identified 39 state listed flora species listed under the NPW Act, as having previous records within 20 km of the centre of the project site, (in addition to the 19 nationally threatened plants). Of these 39 species, seven were State vulnerable and 32 were State rare. Their likelihood of occurrence within the project boundary is provided in Table 15. Four species are known to the project site and one has been determined as likely to occur within the project boundary (Table 15). Those species known to occur and determined as likely to occur are discussed in further detail in Section 6.1. See Appendix 5 for all BDBSDA flora records within 20km of the site.

Table 15. Threatened flora species potentially occurring within the project boundary (BDBSA search – 20km buffer).

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Acacia iteaphylla	Flinders Ranges Wattle		R	2	11/07/2002	Possible (records close to site at Truro)
Acacia montana	Mallee Wattle		R	2	24/11/1975	Possible (records close to site at Truro)
Acacia pendula	Weeping Myall		V	2	21/03/2001	Unlikely
Amphibromus archeri	Pointed Swamp Wallaby-grass		R	2	24/11/1992	Unlikely
Anogramma leptophylla	Annual Fern		R	2	18961101	Unlikely
Austrostipa breviglumis	Cane Spear-grass		R	2	12/04/2002	Possible
Austrostipa densiflora	Fox-tail Spear-grass		R	2	20/10/1993	Possible
Austrostipa gibbosa	Swollen Spear-grass		R	2	10/12/2013	Possible
Austrostipa pilata	Prickly Spear-grass		V	2	19/10/2012	Possible
Austrostipa tenuifolia			R	2	30/11/2005	Possible
Bothriochloa macra	Red-leg Grass		R	2	4/04/2000	Possible (records close to term substation)
Brachyscome ciliaris var. *subintegrifolia*			R	2	1/08/2004	Possible
Centrolepis cephaloformis ssp. *cephaloformis*	Cushion Centrolepis		R	2	14/11/1996	Unlikely
Crassula peduncularis	Purple Crassula		R	2	30/09/1993	Possible
Cryptandra campanulata	Long-flower Cryptandra		R	2	13/05/2015	Likely
Cullen parvum	Small Scurf-pea		V	2	1/10/1912	Possible
Daviesia benthamii ssp. *humilis*	Mallee Bitter-pea		R	2		Unlikely
Dianella longifolia var. grandis	Pale Flax-lily		R	2	21/10/2012	Possible
Diuris behrii	Behr's Cowslip Orchid		V	2	28/09/2010	Possible

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Elatine gratioloides	Waterwort		R	2	25/10/1992	Unlikely
Eragrostis infecunda	Barren Cane-grass		R	2	12/02/2000	Possible
Eucalyptus behriana	Broad-leaf Box		R	2	8/05/2015	Known
Eucalyptus percostata	Ribbed White Mallee		R	2	10/12/2013	Unlikely
Isoetes drummondii ssp. *drummondii*	Plain Quillwort		R	2	9/10/1996	Possible
Juncus radula	Hoary Rush		V	2	25/10/1992	Possible
Lachnagrostis robusta	Tall Blown-grass		R	2	12/02/2000	Possible
Leptorhynchos elongatus	Lanky Buttons		R	2	18/09/1965	Unlikely
Leptorhynchos orientalis	Eastern Annual Buttons		R	2	24/09/1938	Unlikely
Logania saxatilis	Rock Logania		R	2	24/08/1946	Unlikely
Luzula ovata	Clustered Wood-rush		R	2	24/11/1992	Unlikely
Maireana excavata	Bottle Fissure-plant		V	2	2/10/1992	Possible
Maireana rohrlachii	Rohrlach's Bluebush		R	2	11/05/2015	Known
Myriophyllum integrifolium	Tiny Milfoil		R	2	27/01/1993	Unlikely
Olearia passerinoides ssp. *glutescens*	Sticky Daisy-bush		R	2	5/04/1987	Possible
Pilularia novae-hollandiae	Austral Pillwort		R	2	25/10/1992	Unlikely
Ptilotus erubescens	Hairy-tails		R	2	19/10/2012	Known
Rumex dumosus	Wiry Dock		R	2	21/10/2012	Known
Rytidosperma tenuius	Short-awn Wallaby-grass		R	2	11/11/1993	Possible

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Swainsona behriana	Behr's Swainson-pea		V	2	28/09/2010	Possible

Conservation status

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. ssp.: the conservation status applies at the sub-species level.

Source of Information

2. **Biological Database of South Australia data extract (data extraction 5/8/2015) - 20 km buffer applied to project site.**

5.1.4 Threatened and migratory fauna species

The 20km search identified 26 nationally listed fauna species under the EPBC Act as potentially occurring or having suitable habitat potentially occurring within the project boundary (Table 16). These consisted of:

- Two fish species, one critically endangered and one vulnerable;
- 21 bird species: three listed as critically endangered, three endangered, two vulnerable, ten as migratory and three as marine;
- One mammal species listed as vulnerable and
- Two reptile species; one listed as nationally endangered and one as vulnerable.

A summary of these species and comment regarding their likelihood of occurrence within the project boundary provided in Table 16. Three out of the 26 identified fauna species, were determined as possibly occurring within the project boundary. The Rainbow Bee-eater (*Merops ornatus*) and Pygmy Blue-tongue Lizard (PBTL) are known to the site and were observed during the spring 2015 survey. The PBTL was also observed during the summer/autumn 2016 and summer 2017 targeted surveys.

The two species that are known to occur within the project boundary are discussed in further detail in Section 6.2.

The BDBSA search identified 30 state listed fauna species under the NPW Act as having previous records within 20 km of the centre of the project boundary (Table 17), consisting of:

- Two mammal species listed as State endangered, which were both determined as unlikely to occur and one mammal species listed as State rare which was determined as possibly occurring within the project boundary;
- 26 avian species were listed. One species is known to the project site and was observed during the spring 2015 survey, the Blue-winged Parrot (*Neophema chrysostoma*). Nine species were determined as possibly occurring within the project boundary and 16 were determined as unlikely; and
- One reptile species listed as State rare.

A summary of these species and comment regarding their likelihood of occurrence within the project boundary is provided in Table 17. BDBSA records of threatened fauna within 20 km of the project site are shown in Figure 11. See Appendix 4 for all BDBSDA fauna records within 20km of the site

Threatened fauna species known to the project site are discussed further in Section 6.2.

Table 16. Nationally threatened fauna species potentially occurring within the project boundary.

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Fish						
Galaxias rostratus	Flathead Galaxias	CE		1		Unlikely
Maccullochella peelii	Murray Cod	VU		1		Unlikely
Aves						
Apus pacificus	Fork-tailed Swift	Mi, Ma		1		Possible
Ardea alba	Great Egret	Ma, Mi, W		2	24/11/01	Possible – fly over
Ardea ibis	Cattle Egret	Ma, Mi, W		1		Possible – fly over
Botaurus poiciloptilus	Australasian Bittern	EN	V	1		Unlikely
Calidris ferruginea	Curlew Sandpiper	CE, Ma		1		Unlikely
Cinclosomosa punctatum anachoreta	Spotted Quail-thrush	CE		1		Unlikely
Gallinago hardwickii	Latham's Snipe	Ma, Mi, W	R	1		Unlikely
Haliaeetus leucogaster	White-bellied Sea-Eagle	Ma	E	1		Unlikely
Hirundapus caudacutus	White-throated Needle-tail	Mi, T		1		Unlikely
Leipoa ocellata	Malleefowl	VU	V	1		Unlikely
Merops ornatus	Rainbow Bee-eater	Mi, T		2	EBS Surveys	Known
Motacilla cinerea	Grey Wagtail	Ma		1		Unlikely
Motacilla flava	Yellow Wagtail	Ma, Mi, T		1		Unlikely
Myiagra cyanoleuca	Satin Flycatcher	Ma, Mi, T	E	1		Unlikely
Numenius madagascariensis	Eastern Curlew	Ma		1		Unlikely
Pandion haliaetus	Eastern Osprey	Ma, Mi, W	E	1		Unlikely
Pedionomus torquatus	Plains-wanderer	CE	E	1		Unlikely
Pezoporus occidentalis	Night Parrot	EN		1		Unlikely
Rostratula australis	Australian Painted Snipe	EN, Ma	V	1		Unlikely

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Tringa nebularia	Common Greenshank	Ma, Mi, W		1		Unlikely
Zoothera lunulata halmaturina	Bassian Thrush	VU		1		Unlikely
Mammals						
Pteropus poliocephalus	Grey-headed Flying-fox	VU		1		Unlikely
Reptiles						
Aprasia pseudopulchella	Flinders Ranges Worm-lizard	VU		1		Possible
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	EN	E	2	EBS Surveys	Known

Conservation status

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. ssp.: the conservation status applies at the sub-species level. Mi: listed as migratory under the EPBC Act. Ma: listed as marine under the EPBC Act. MI, T: listed as migratory terrestrial under the EPBC Act. Mi, W: listed as migratory wetland under the EPBC Act.

Source of Information

1. **EPBC Act Protected Matters Report (data extraction 13/8/2015) – 20 km buffer applied to project boundary.**
2. **Biological Database of South Australia data extract (data extraction 5/8/2015) - 20 km buffer applied to project boundary.**

Table 17. State threatened fauna species potentially occurring within the project boundary (20km buffer).

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Mammals						
Dasyurus viverrinus	Eastern Quoll		E	2	1/1/1880	Unlikely
Bettongia lesueur	Burrowing Bettong	EX	E	2	1/1/1922	Unlikely
Trichosurus vulpecula	Common Brushtail Possum		R	2	1/01/1988	Possible
Aves						
Anas rhynchotis	Australasian Shoveler		R	2	27/01/2006	Unlikely
Anhinga novaehollandiae	Australasian Darter		R	2	27/1/2003	Unlikely
Ardeotis australis	Australian Bustard		V	2	13/7/1985	Unlikely
Biziura lobata	Musk Duck		R	2	27/1/2003	Unlikely
Corcorax melanorhamphos	White-winged Chough		R	2	8/8/2013	Possible
Cladorhynchus leucocephalus	Banded Stilt		V	2	1/09/2000	Unlikely
Falco peregrinus	Peregrine Falcon		R	2	1/8/2002	Possible
Falcunculus frontatus	Crested Shrike-tit		R	2	9/02/2012	Possible
Gerygone fusca	Western Gerygone		R	2	2/12/1985	Unlikely
Lichenostomus cratitius	Purple-gaped Honeyeater		R	2	1/1/1985	Unlikely
Melanodryas cucullata cucullata	Hooded Robin		R	2	1/9/2002	Possible
Melithreptus gularis	Black-chinned Honeyeater		V	2	28/11/2003	Unlikely
Microeca fascinans fascinans	Jacky Winter		R	2	1/4/1999	Possible
Myiagra inquieta	Restless Flycatcher		R	2	1/6/2002	Unlikely
Neophema chrysostoma	Blue-winged Parrot		V	2	26/10/2011	Known
Neophema elegans	Elegant Parrot		R	2	1/01/2006	Possible
Oxyura australis	Blue-billed Duck		R	2	27/1/2002	Unlikely
Pachycephala inornata	Gilbert's Whistler		R	2	1/9/2001	Unlikely

Scientific name	Common name	Conservation status		Source of information	Last sighting (year)	Likelihood of occurrence within project area
		Aus	SA			
Petroica boodang	Scarlet Robin		R	2	1/11/1985	Unlikely
Plectorhyncha lanceolata	Striped Honeyeater		R	2	11/06/1985	Unlikely
Polytelis anthopeplus	Regent Parrot	V	V	2	21/11/1997	Unlikely
Stagonopleura guttata	Diamond Firetail		V	2	1/9/2002	Possible
Turnix varius	Painted Button-quail		R	2	9/02/2012	Possible
Zoothera lunulata	Bassian Thrush		R	2	1/11/1985	Unlikely
Reptiles						
Morelia spilota	Carpet python		R	2	8/07/1963	Unlikely

Conservation status

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. ssp.: the conservation status applies at the sub-species level. Mi: listed as migratory under the EPBC Act. Ma: listed as marine under the EPBC Act.

Source of Information

2. Biological Database of South Australia data extract (data extraction 5/8/2015) - 20 km buffer applied to project boundary.

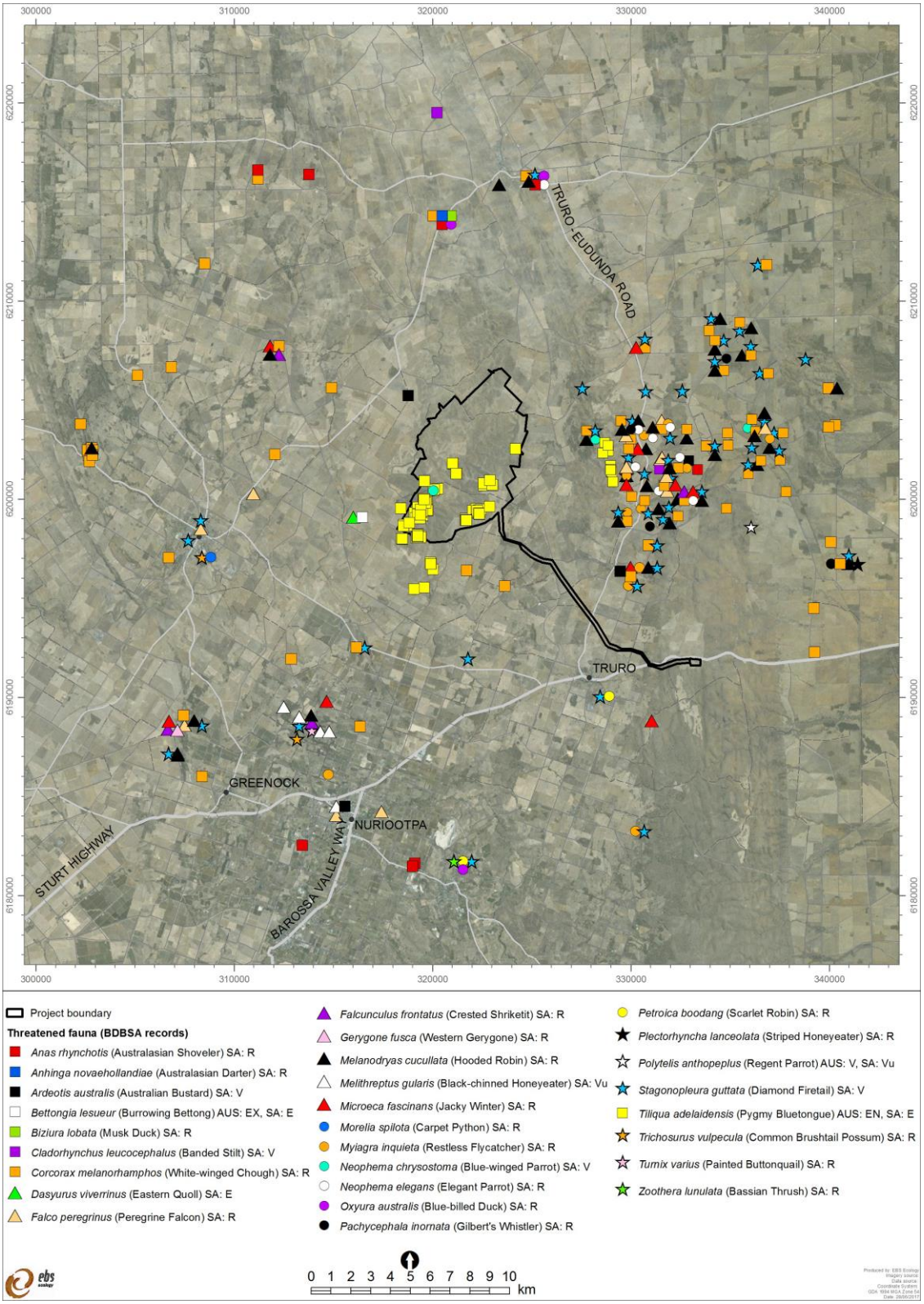


Figure 11. Threatened fauna (BDBSA) clipped to a 20km search.

5.2 Field survey

The spring 2015 flora and fauna assessment was conducted from 8 to 11 September 2015. The flora and fauna survey included a general vegetation / habitat assessment and condition rating of the vegetation within the main turbine area of the project boundary (infrastructure area), and a bird and bat survey. A vegetation assessment of additional infrastructure areas such as the main substation, terminal substation, access tracks, construction compound and transmission line, were completed 23, 24, 29 and 30 November 2016, 1 December 2016 and mostly recently on 5 April 2017 (Table 5).

5.2.1 Vegetation associations

Eleven vegetation associations were mapped within the project boundary, with a Significant Environmental Benefit (SEB) condition range of 0:1 to 6:1 based on vegetation condition alone. In line with NVC policy, the ratings for some areas may increase if they provide important habitat for threatened species. This will be described further in the Native Vegetation Clearance Report.

Table 18 provides an overall summary of the vegetation associations. Table 19 to Table 29 describes each association in more detail with photographic representation in Figure 12 to Figure 29. Figure 30 to Figure 35 shows vegetation associations and SEB condition ratios within the project boundary (proposed infrastructure area, transmission line and terminal substation).

Table 18. Overall summary of vegetation associations.

	Vegetation association	Area	Condition
1	*Lomandra effusa* + *Austrostipa sp*. grasslands	196.2 ha	1:1-6:1
2	*Austrostipa sp*. grassland	1751.7 ha	1:1-5:1
3	Planted species	21.8 ha	0:1
4	*Eucalyptus leucoxylon* +/- *Eucalyptus porosa* +/- *Callitris gracilis* open woodland	64.7 ha	2:1-6:1
5	*Juncus spp.* (Rush) and *Juncus pallidus* (Pale rush) Sedgeland +/- *Phragmites australis* (Common Reed)	52.1 ha	3:1
6	Cropping	1388.8 ha	0:1
7	*Eucalyptus porosa*+/- *Eucalyptus odorata*+/- *Eucalyptus gracilis* open woodland	2.4 ha	4:1
8	Pasture grassland / exotic grassland	868.2 ha	0:1-1:1
9	*Eucalyptus odorata* +/- *Eucalyptus porosa* closed woodland over grassy understorey	6.8 ha	4:1
10	*Eucalyptus camaldulensis* ssp. *camaldulensis* +/- *Eucalyptus leucoxylon* Closed Tall Shrubland over *Austrostipa* sp. (Spear-grass) near creeklines	2.3 ha	6:1
11	*Eucalyptus leucoxylon* Tall Open Woodland over shrubby understorey	3.6 ha	5:1-6:1

Association 1 *Lomandra effusa* + *Austrostipa sp*. Grasslands.

Table 19. Summary of vegetation Association 1.

Description	Open Grasslands with occasional emergent trees. Grasslands generally had weed cover between *Lomandra tussocks* with occasional native grasses and other species. However grassland in the proposed terminal substation area was dominated by native species. This association is protected under the EPBC Act if it meets minimum criteria (see section 5.1.2).
Common native understorey species	*Lomandra effusa* (Scented Mat-rush), *Lomandra multiflora* (Many flower Mat Rush), *Austrostipa sp.* (Spear Grass), *Enneapogon nigricans* (Black-head Grass), *Aristida behriana* (Brushwire Grass), *Ptilotus spathulatus* (Pussy-tails), *Vittadinia gracilis* (Woolly New Holland Daisy), *Maireana enchylaenoides* (Wingless fissure Plant). Occasional emergent *Eucalyptus leucoxylon* ssp. (South Australian Blue Gum).
Common weed species	*Avena barbata (Wild oats), Hordeum vulgare (Barley), Taraxacum officinale (Dandelion), Vulpia myuros (Fescue), Artemisa tridentate (Sagebrush). Juncus acutus* (Spiny Rush) *was noted in creeklines*
Conservation flora significant species	None
Vegetation condition	Poor (3:1) to Moderate (6:1)

Figure 12. Representation of Association 1 (Turbine Area).

Figure 13. Representation of Association 1 (Transmission Line 4:1).

Figure 14. Representation of Association 1 (Terminal Sub-station 6:1) (EPBC listed site 18).

Association 2 *Austrostipa* sp. Grassland.

Table 20. Summary of vegetation Association 2.

Description	Open Grasslands with occasional emergent trees and varying from expanses of native grass to highly degraded weed dominated grasslands, particularly along roadsides or near infrastructure. Soils vary from rocky hills with no emergent trees to heavier soils in lower lying areas with more scattered trees.
Common native understorey species	*Austrostipa* (Spear-grass) species dominate with native species including *Austrostipa scabra (Spear grass), Austrostipa eremophila (*Rusty Spear Grass*), Austrostipa* sp. *(*Spear Grass*, Austrodanthonia* sp. (Wallaby Grass)*, Enneapogon nigricans* (Black-head Grass), *Aristida behriana* (Brush Wire-grass), *Ptilotus spathulatus* (Pussy-tails), *Vittadinia gracilis* (Woolly New Holland Daisy), *Maireana enchylaenoides* (Wingless fissure Plant). *Vittadinia blackii* (Western New Holland Daisy) was common along roadsides. Scattered *Lomandra effusa* (Scented Mat Rush) and occasional emergent trees including *Eucalyptus leucoxylon* (South Australian Blue Gum)*, Eucalyptus porosa* (Mallee Box) and *Eucalyptus odorata* (Peppermint Box).
Common weed species	*Avena* barbata. (Wild oats), *Hordeum vulgare* (Barley), *Taraxacum officinale* (Dandelion), *Vulpia myuros* (Fescue) *Bromus* sp. (Bromus), *Cynara cardunculus* (Artichoke thistle), *Echium plantagineum* (Salvation Jane), Thick patches of *Carthamus lanatus* (Saffron Thistle) in the far north of the turbine area.
Conservation significant species	None
Vegetation condition	Very Poor (1:1) – Poor (4:1)

Figure 15. *Austrostipa* sp. grasslands on rocky hills.

Figure 16. *Austrostipa* sp. grasslands on flats of heavier soils with scattered trees.

Figure 17. *Austrostipa* sp. grasslands on roadsides – degraded, but often with many native grasses.

Association 3 Planted species.

Table 21. Summary of vegetation Association 3.

Description	Patches of planted vegetation.
Common overstorey and midstorey species	Common species in planted areas: *Pinus sp, Eucalyptus sp.* (interstate species*), Eucalyptus cladoclayx (*Sugar Gum*).* Other common species in revegetation areas: *Acacia paradoxa* (Kangaroo Thorn), *Acacia pycnantha* (Golden Wattle), *Allocasuarina verticillata* (Drooping Sheoak), *Rhagodia parabolica* (Mealy Saltbush)
Common weed species	*Avena* sp. (Wild oats), *Hordeum vulgare* (Barley), *Taraxacum officinale* (Dandelion), *Vulpia myuros* (Fescue),
Conservation significant species	None
Vegetation condition	Very Poor (0:1)

Figure 18. Representation of Association 3.

Association 4 *Eucalyptus leucoxylon* +/- *Eucalyptus porosa* open woodland.

Table 22. Summary of vegetation Association 4.

Description	Open woodland over mixed native and exotic grassland with occasional shrubs. Tree density varies across the project area.
Common native	*Eucalyptus leucoxylon* (Bluegum), *Eucalyptus porosa* (Mallee Box), *Bursaria spinosa* ssp. *spinosa* (Sweet Bursaria), *Allocasuarina verticillata* (Drooping Sheoak), *Austrostipa sp*, (Spear-grass), *Lomandra multiflora* (Many Flower Mat-rush), *Aristida behriana* (Brush Wire-grass), *Rytidosperma* sp. (Wallaby Grass). Occasional *Euphorbia drummondi* (Caustic weed)
Common weed species	*Avena barbata* (Wild oats), *Hordeum vulgare* (Barley), *Taraxacum officinale* (Dandelion), *Vulpia myuros* (Fescue), *Cynara cardunculus* (Artichoke thistle)
Conservation significant species	None
Vegetation condition	Very Poor (2:1) - Moderate (6:1)

Figure 19. Open Woodland in wind turbine area.

Figure 20. Open woodland along transmission line.

Association 5 *Juncus* spp. (Rush) and *Juncus pallidus* (Pale rush) Sedgeland +/- *Phragmites australis* (Common Reed).

Table 23. Summary of vegetation Association 5.

Description	Inundated creeklines with patches of native sedges and reeds but dominated in large areas by the invasive weed **Juncus acutus* (Spiny Rush). *Muehlenbaeckia florentula* (Lignum), native grasses and grassy weeds along fringes.
Common native understory species	*Cyperus gymnocaulous* (Spiny Flat-sedge), *Juncus pallidus* (Pale Rush), *Juncus sp.* (Rush), *Carex* sp. (Sedge), *Eleocharis acuta* (Common Spike-rush). Scattered patches of *Phragmites australis* (Common Reed) and *Cymbopogon ambiguus* (Lemon Grass), *Austrostipa* sp. (Spear-grass) and *M. florentula* along creekline fringes.
Common weed species	Dense patches of **Juncus acutus* (Spiny rush). **Rosa canina* (Dog Rose), **Cotula coronopifolia* (Water Buttons), **Cynara cardunculus* (Artichoke thistle), **Silybum marianum* (Variegated Thistle). Occasional **Lycium ferocissimum* (African Boxthorn).
Conservation significant species	None
Vegetation condition	Poor (2:1 - 3:1)

Figure 21. Representation of Association 5.

Figure 22. Representation of Association 5 showing Spiny Rush weed invasion.

Association 6 Cropping.

Table 24. Summary of vegetation Association 6.

Common weed species	*Triticum aestivum* (Common Wheat), *Bromus* sp. (Brome), *Avena barbata* (Wild oats), *Hordeum vulgare* (Barley), *Taraxacum officinale* (Dandelion), *Vulpia myuros* (Fescue), *Artemisia tridentate* (Wild Sage).
Conservation significant species	None
Vegetation condition	Poor (0:1)

Figure 23. Representation of Association 6.

Association 7 *Eucalyptus porosa +/- Eucalyptus odorata +/- Eucalyptus gracilis* open woodland.

Table 25. Summary of vegetation Association 7.

Description	Degraded open woodland with low diversity
Common native overstorey and midstorey species	*Eucalyptus porosa +/- Eucalyptus gracilis +/- Eucalyptus odorata* (Peppermint Box). Scattered *Bursaria spinosa* ssp. *spinosa* (Sweet Bursaria)
Common native understorey species	*Austrostipa sp.* (Spear-grass), *Maireana enchylaenoides* (Wingless Fissure-plant), *Vittadinia gracilis* (Woolly New Holland Daisy)
Common weed species	*Avena* sp. (Wild Oats), *Bromus sp.* (Brome), *Erodium sp.* (Long Heron's-bill), *Hordeum vulgare* (Barley), *Trifolium angustifolium* (Narrow-leaf Clover)
Conservation significant species	None
Vegetation condition	Poor (4:1)

Figure 24. Representation of Association 7.

Association 8 Pasture Grassland / exotic grassland.

Table 26. Summary of vegetation Association 8.

Description	Degraded grasslands dominated by weeds with very few native species
Common native understorey species	Scattered or over *Austrostipa sp. (Spear Grass) grazed grazing areas.* *Vittadinia blackii* (Western New Holland Daisy) was common along roadsides
Common weed species	*Avena* sp. (Wild Oats), *Bromus sp.* (Brome), *Erodium sp.* (Long Heron's-bill), *Hordeum vulgare* (Barley), *Trifolium angustifolium* (Narrow-leaf Clover)
Conservation significant species	None
Vegetation condition	Very Poor (1:1)

Figure 25. Exotic grassland with planted trees.

Association 9 *Eucalyptus odorata* / *Eucalyptus porosa* Woodland.

Table 27. Summary of vegetation Association 9.

Description	Woodland to open woodland with *E. odorata* being the dominant tree present. Understorey was weed dominated and degraded sparse native understorey. This association was observed during surveying for the proposed Transmission Line during early summer 2016 when not all plants are in their visible life phase. This association is protected under the EPBC Act if it meets minimum criteria (see section 5.1.2).
Common native understorey species	*Eucalyptus odorata* (Peppermint Box, *Eucalyptus porosa* (Mallee Box), *Austrostipa* sp. (Spear-grass), *Rytidosperma* sp. (Wallaby Grass), *Atriplex semibaccata* (Creeping Saltbush), *Aristida behriana* (Brush Wire-grass), *Maireana enchylaenoides* (Wingless Fissure-plant) and *Arthropodium strictum* (Common Vanilla-lily).
Common weed species	*Avena* sp. (Wild Oats), *Bromus sp.* (Brome).
Conservation significant species	None
Condition	Poor (4:1)

Figure 26. Peppermint Box Woodland with weedy understorey – transmission line.

Figure 27. Peppermint Box Woodland with weedy understorey – transmission line.

Association 10 *Eucalyptus camaldulensis* ssp. *camaldulensis* / *Eucalyptus leucoxylon* Tall Woodland near creeklines.

Table 28. Summary of vegetation Association 10.

Description	Tall woodland along creeklines dominated by *E. camaldulensis* ssp. *camaldulensis* (River Red Gum). Understorey patchy dominated by dense native grass or sometimes degraded and weed dominated.
Common native understorey species	*E. camaldulensis* ssp. *camaldulensis* (River Red Gum)/*Eucalyptus leucoxylon* (South Australian Blue Gum)*, Eleocharis acuta* (Spike-rush), *Juncus pallidus (*Pale Rush)*, Austrostipa* sp. (Spear-grass), *Rytidosperma* sp. (Wallaby Grass), *Atriplex semibaccata* (Creeping Saltbush), *Aristida behriana* (Brush Wire-grass), *Maireana enchylaenoides* (Wingless Fissure-plant), *Arthropodium strictum* (Common Vanilla-lily).
Common weed species	*Avena* sp. (Wild Oats), *Bromus sp.* (Brome), *Trifolium* sp. (Narrow-leaf Clover).
Conservation significant species	None
Condition	Moderate (6:1)

Figure 28. River Red Gum Creekline – Transmission line area.

Association 11 *Eucalyptus leucoxylon* Woodland over grass and shrubby understorey.

Table 29. Summary of vegetation Association 11.

Description	Woodland in the south of the site in good condition with grass understorey but increased cover of shrubs and more diverse than other associations.
Common native understorey species	*Eucalyptus leucoxylon* (South Australian Blue Gum), *Rhagodia parabolica* (Mealy Saltbush), *Dianella revoluta* (Black-anther Flax-lily), *Vittadinia blackii* (Western New Holland Daisy), *Austrostipa sp.* (Spear-grass), *Rytidosperma* sp. (Wallaby Grass), *Atriplex stipitata* (Bitter Saltbush), *Aristida behriana* (Brush Wire-grass).
Common weed species	*Avena* barbata (Wild Oats), *Bromus hordeaceus ssp. hordeaceus* (Soft Brome), *Trifolium angustifolium* (Narrow-leaf Clover), *Sonchus* sp. (Sow-thistle)
Conservation significant species	*Olea europaea* (Olive)
Condition	Moderate (6:1)

Figure 29. Vegetation Association 8 with *Vittadinia blackii* and native grasses.

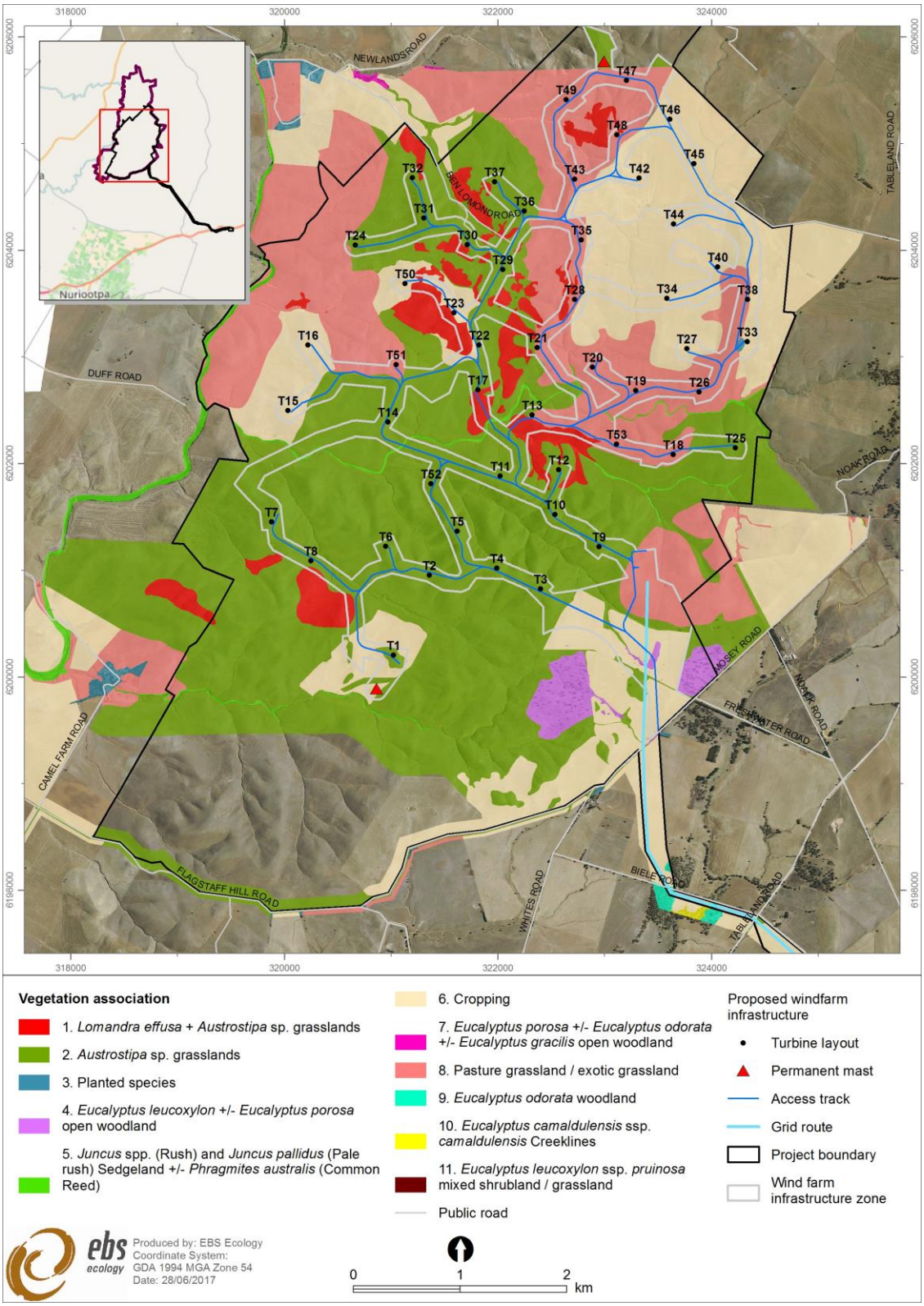


Figure 30. Vegetation associations in site boundary and proposed substation (including utility zone, battery storage, concrete batching plant, construction compound and material laydown area).

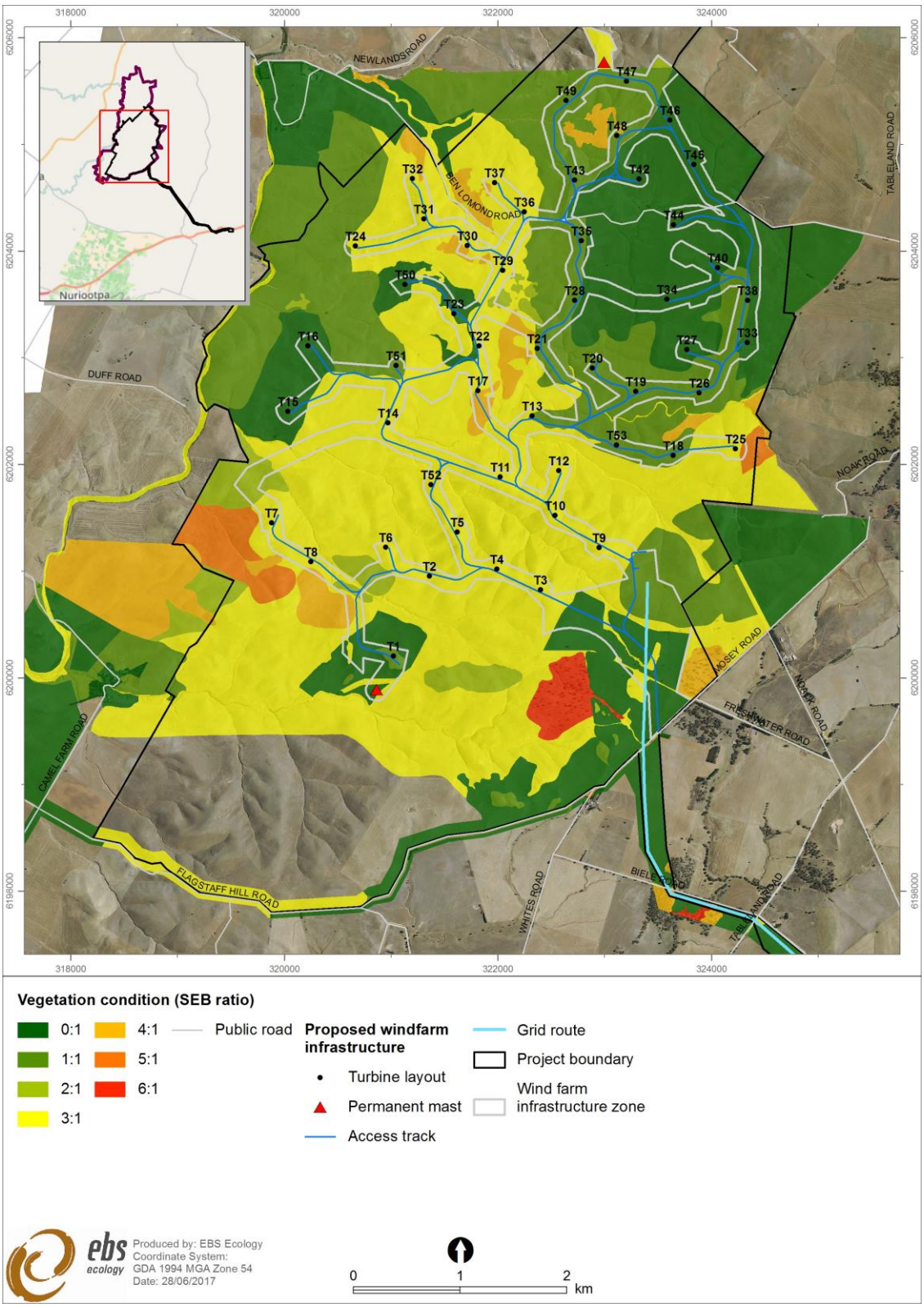


Figure 31. SEB conditions of vegetation associations in site boundary and proposed substation (including utility zone, battery storage, concrete batching plant, construction compound and material laydown area).

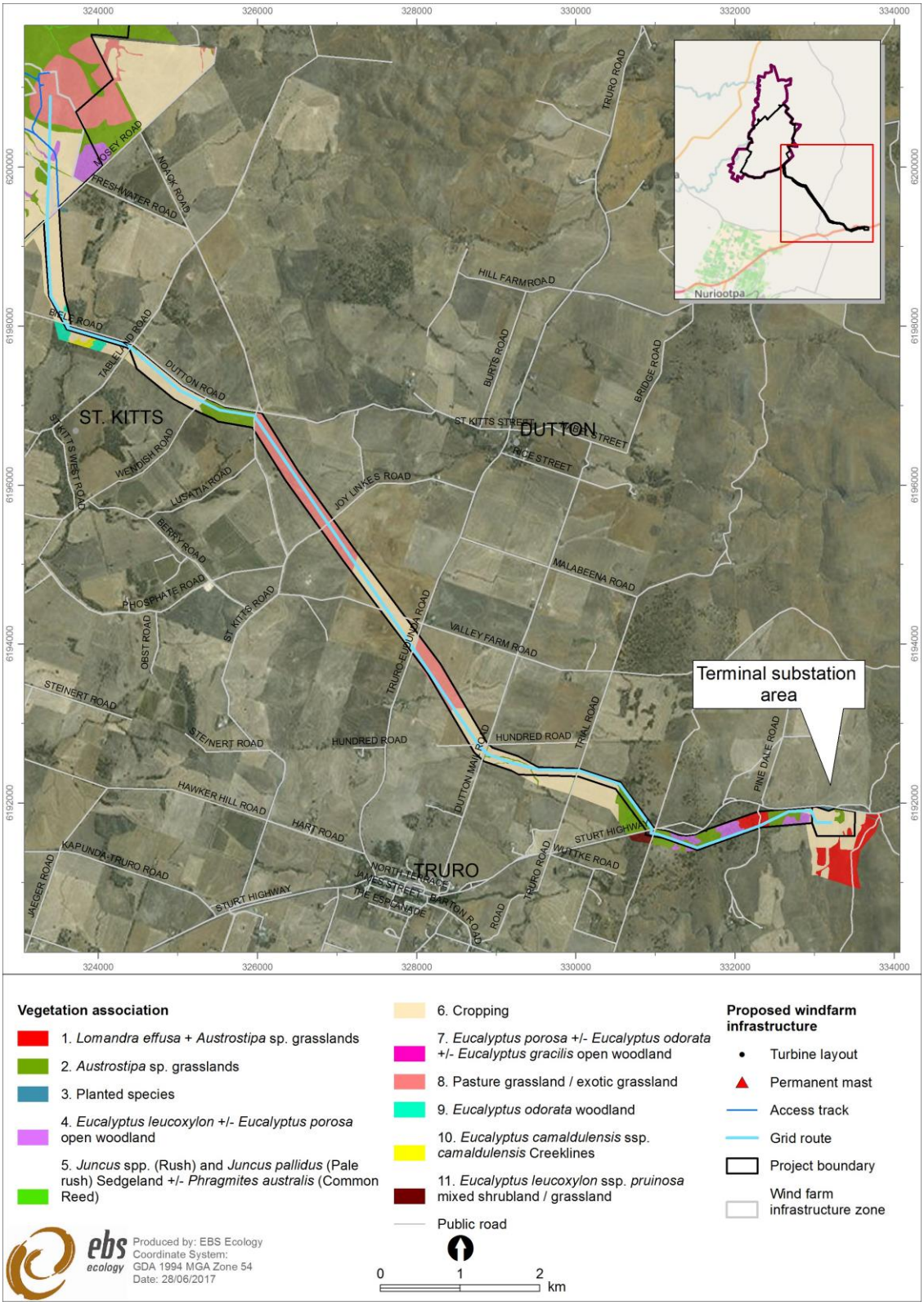


Figure 32. Vegetation association in proposed transmission route and terminal substation.

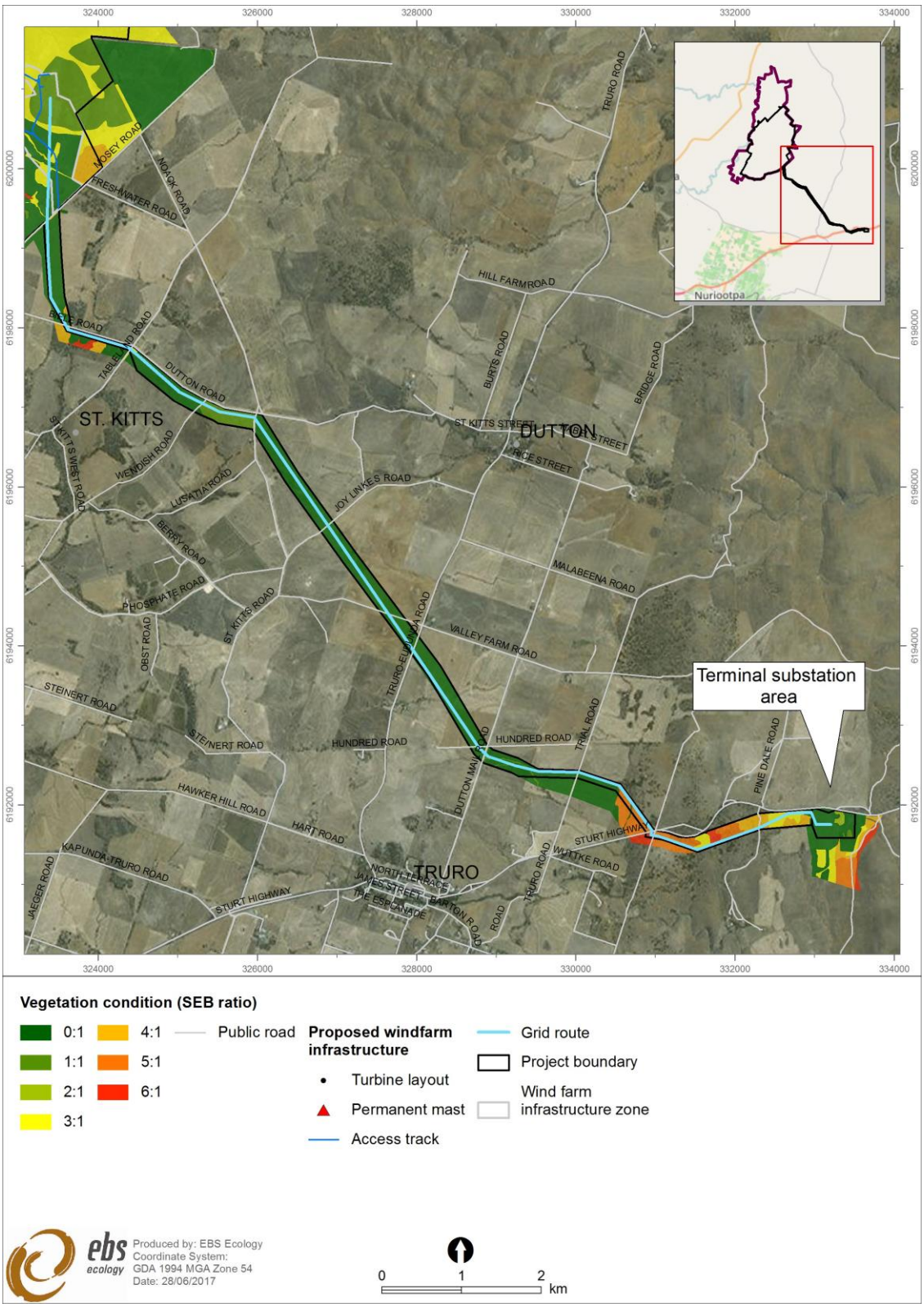


Figure 33. Vegetation condition in proposed transmission route and terminal substation.

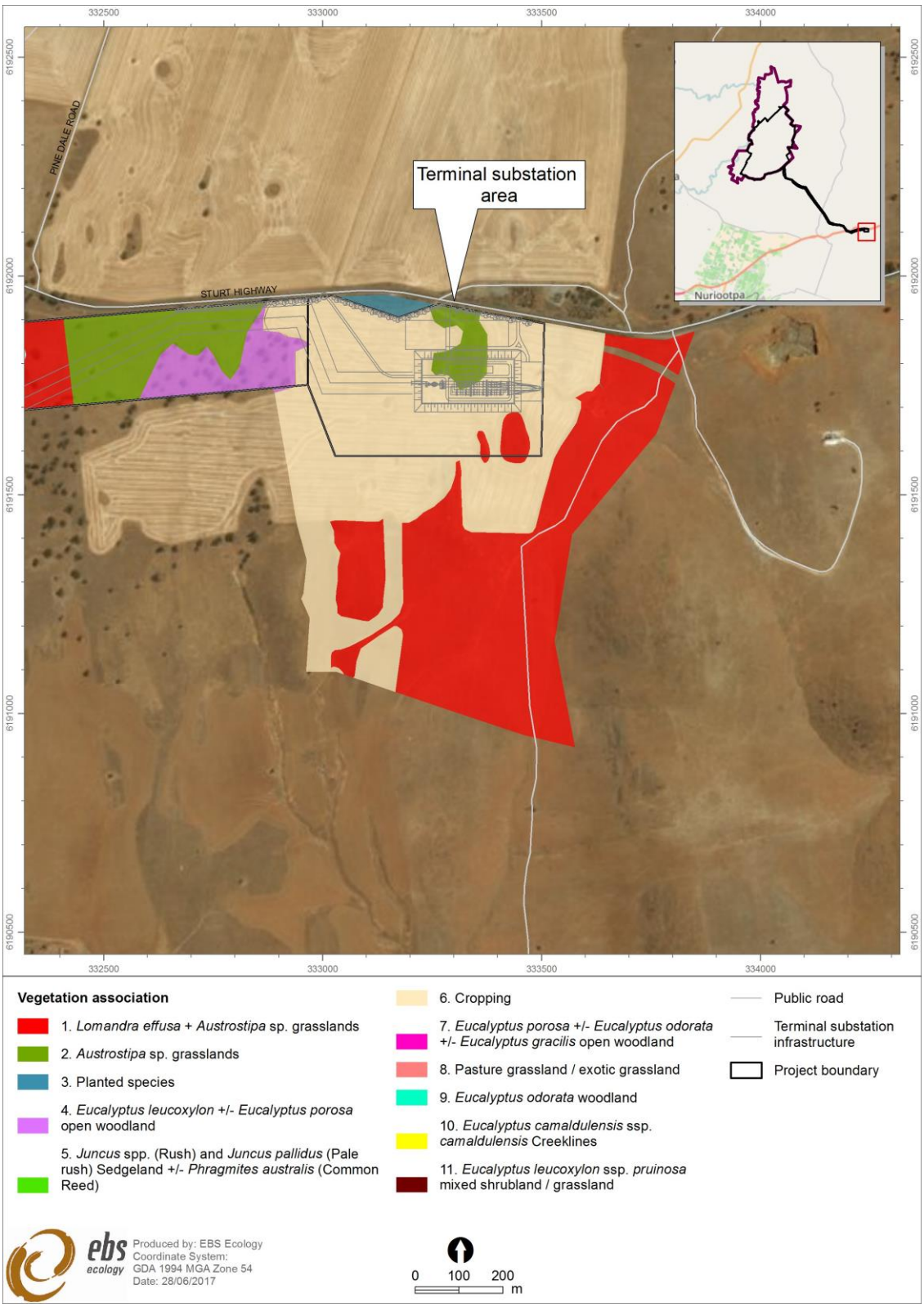


Figure 34. Vegetation associations (close-up) of the terminal substation area.

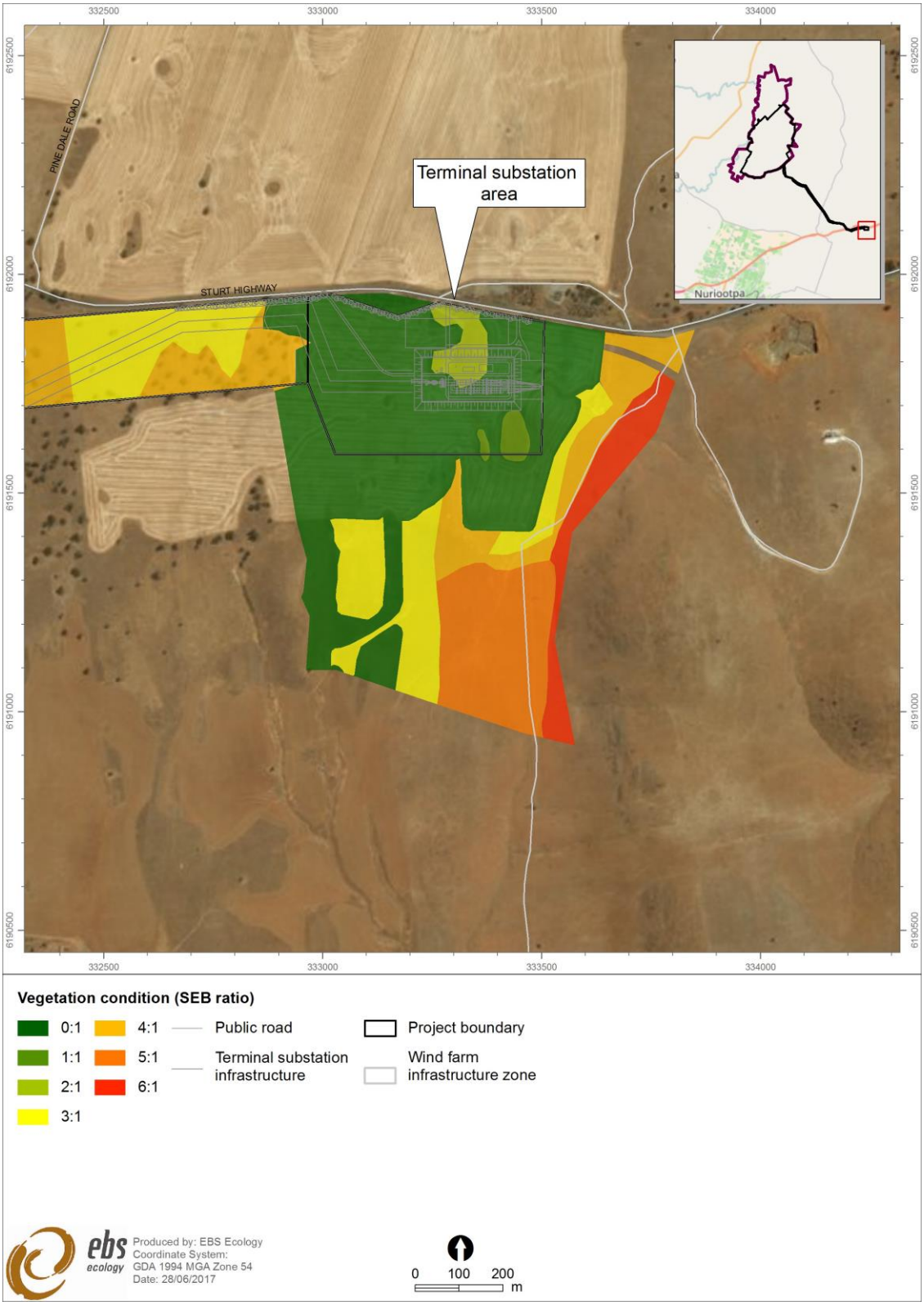


Figure 35. Vegetation condition (close-up) of the terminal substation area.

5.2.2 Threatened ecological communities

Two EPBC listed ecological communities were assessed for qualification within the project boundary:

- Iron-grass Natural Temperate Grassland of South Australia; and
- Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia.

5.2.3 Iron-grass Natural Temperate Grassland of South Australia

There were 21 sites assessed within the *Lomandra* Grasslands across the project site in 2015 (Figure 36, Figure 37), to confirm whether they qualified as the nationally listed threatened ecological community (Table 30). Additional *Lomandra* grasslands were observed whilst surveying the proposed transmission line and terminal substation (Figure 37). Site 17 (transmission line) was assessed during summer 2016 surveying, whilst sites 18-21 (terminal substation) were assessed in autumn 2017.

One of the sites assessed for the terminal substation (18, Figure 14), qualified as EPBC listed and another two sites (19 and 21) are considered likely to qualify if surveyed when more plants are in their visible life phase (early/mid spring), as they were only a few species short of qualifying. Site 20 may also possibly qualify. None of the other sites met criteria qualified as either condition A or B, and therefore, do not qualify as a threatened ecological community. Of the 21 *Lomandra* sites, 13 come under Condition class C, which are considered degraded patches amenable to rehabilitation. Five of the sites (*Lomandra* Site 2, 14, 15, 19 and 21) were within 1-3 native species of meeting the condition class B threshold (Table 30).

Based on vegetation identifying high value Lomandra Grassland in the general Terminal Substation area, the final design was located in cropping and *Austrostipa* sp. grassland to avoid *Lomandra* Grassland except for a small degraded patch (Figure 34). However, there is *Lomandra* grassland further west along the Transmission Line that may be impacted. The site (17) was considered unlikely to qualify due to the lack of grasses, but was only briefly assessed and it is recommend that specific areas impacted are assessed in spring once the impact footprint is finalised.

Any new or intensified activities that may or are likely to have a significant impact upon this community should be referred to the Australian Minister for the Environment and Water Resources for assessment and approval (unless they are subject to an exception under the EPBC Act). Activities that may have a significant impact include, but are not restricted to, clearing of remnants or supporting vegetation, grazing, introducing excessive nutrients to remnants and introducing potentially invasive pasture species into the proximity of remnants (DEWR 2007).

Table 30. Results for *Lomandra* Grassland within the project boundary.

Lomandra site	Diversity of native plant species	Broad-leaved herbaceous species^	Native perennial grass species	Tussock count (per m)	Condition class rating	Time of survey	Likelihood of qualifying
1	3	0	1	>1/m	No rating	Spring	NA
2	13	4	4	>1/m	Class C	Spring	NA
3	9	3	2	>1/m	Class C	Spring	NA

Lomandra site	Diversity of native plant species	Broad-leaved herbaceous species^	Native perennial grass species	Tussock count (per m)	Condition class rating	Time of survey	Likelihood of qualifying
4	2	1	0	>1/m	No rating	Spring	NA
5	3	1	1	>1/m	No rating	Spring	NA
6	9	3	2	>1/m	Class C	Spring	NA
7	9	4	3	>1/m	Class C	Spring	NA
8	9	4	3	>1/m	Class C	Spring	NA
9	9	4	3	>1/m	Class C	Spring	NA
10	2	0	1	>1/m	No rating	Spring	NA
11	4	2	2	>1/m	No rating	Spring	NA
12	4	2	2	>1/m	No rating	Spring	NA
13	3	2	1	>1/m	No rating	Spring	NA
14	14	7	4	>1/m	Class C	Spring	NA
15	15	5	6	>1/m	Class C	Spring	NA
16	10	2	5	>1/m	Class C	Spring	NA
17	7	2	1	>1/m	Class C	Summer	Unlikely
18	17	3	9	>1/m	Class B	Autumn	Qualifies
19	15	3	5	>1/m	Class C	Autumn	Likely
20	11	2	4	>1/m	Class C	Autumn	Possible
21	13	2	4	>1/m	Class C	Autumn	Likely
Minimum Criteria							
0.1 ha	> 30	+10	≥5	1/m	Class A	0.1 ha	
0.25 ha	> 15	+3	>4	1/m	Class B	0.25 ha	
No minimum	> 5	No minimum	≥1	> 5			

5.2.4 Peppermint Box (odorata) Grassy Woodland of South Australia

The project site was assessed for any Peppermint Box that may qualify against the criteria outlined in *EPBC Act Policy Statement 3.7, Nationally Threatened Species and Ecological Communities, Peppermint Box (Eucalyptus odorata) Grassy Woodland of South Australia and Iron-grass Natural Temperate Grassland of South Australia.*

During spring 2015 flora assessment, the only patch of Peppermint Box that was identified within the project boundary, wasn't dominated by *Eucalyptus odorata*; it was a large mix of *E. odorata*, *E. porosa* and *E. gracilis*, and therefore did not qualify.

Patches of woodland dominated by Peppermint Box were observed during the summer 2016 flora survey (Figure 38). An assessment of these against EPBC Act Policy Statement 3.7 found them to be Class C (Table 31) which is not listed under the EPBC Act but is 'Amenable to rehabilitation'. However, site 1 was only one species short of qualifying as Class B in the overall diversity category and had a high enough diversity of herbs and grasses to qualify. This survey was undertaken in early summer which is not an optimum time for observing all possible species present due to dry conditions. Therefore it is difficult to say

with certainty that these areas do not qualify as threatened ecological communities, particularly site 1. It would be preferable if the proposed transmission line avoided these areas completely.

An additional survey was undertaken on 5 April 2017 to assess Peppermint Box as part of the finalisation of the transmission line, including the route along Biele Road. From observations made, it appeared degraded and may not qualify for the EPBC listed TEC. This statement cannot be certain without adequate access and additional surveying in spring. It did not appear planted. It would be EBS's recommendation to position the transmission line through cropping land where possible rather than where Peppermint Box is present.

Based on the survey results the final infrastructure design was amended to avoid the Peppermint Box likely to qualify (north of Biele Road), but a more degraded occurrence south of the road may be subject to a small impact footprint (Figure 38). If this cannot be avoided it is recommended that clearance is kept to the minimum required for safety around powerlines and poles are located away from this area.

The Peppermint Box assessment sites (within the proposed transmission line) are shown in Figure 38.

Table 31. Results for *Peppermint Box* within the project boundary (summer 2016).

Peppermint Box site	Diversity of native plant species	Broad--leaved herbaceous species^	Native perennial grass species	Condition Class	Time of Survey	Likelihood of qualifying
1	14	5	4	Class C	Summer	Likely
2	11	2	4	Class C	Summer	Possible
3	10	0	4	Class C	Summer	Unlikely
Minimum criteria						
0.1 ha	> 30	+10	≥5	A		
0.25 ha	> 15	+3	≥2	B		
No minimum	> 5	No minimum	≥1	C		

5.2.5 Flora

A total of 168 species were recorded during flora surveys in 2015, 2016 and 2017 across the 11 associations, including 92 native and 76 exotic species (Appendix 1). These figures likely represent some species twice as it is unclear if some species, identified to genus level in 2015, were subsequently identified to species level during the surveys in 2016 and 2017.

There were no conservation rated flora species identified during the vegetation surveys in 2015, 2016 and 2017 within the proposed Twin Creek Wind Farm project boundary. However, there was a *Maireana* species scattered in the eastern half of the proposed terminal substation footprint that requires further investigation to determine the exact species, which could be potentially threatened. This area contains EPBC listed *Lomandra* grasslands and would be best avoided all together. Additionally, four species with state ratings are known to occur within the project boundary based on BDBSA records.

5.2.6 Weeds

A total of 76 weeds were observed across the site during the flora surveys. One of these (African Boxthorn) is classed as a Weed of National Significance (WoNS). Eight were classed as Declared Plants for South Australia (DP) under the *Natural Resources Management Act 2004*, and a further 13 were considered environmental weeds (Table 32).

Landholders are obliged to control declared weeds on their property, as they are known to cause significant economic, social and environmental impacts. Environmental weeds have the potential to cause significant environmental impacts, but their control is not legislated.

Table 32. Declared and environmental weeds located within the project boundary.

Scientific name	Common name	WONS	Declared	Environmental
Avena barbata	Wild Oats			✓
Carthamus lanatus	Saffron Thistle			✓
Cirsium vulgare	*Spear Thistle*			✓
Cynara cardunculus ssp. *flavescens*	Artichoke Thistle		✓	
Echium plantagineum	Salvation Jane		✓	
Ehrharta longiflora	Annual Veldt Grass			✓
Hordeum vulgare	Barley			✓
Hypochaeris radicata	Rough Cat's Ear			✓
Juncus acutus	Spiny Rush			✓
Lycium ferocissimum	African Boxthorn	✓	✓	
Marrubium vulgare	Horehound		✓	
Olea europaea	Olive		✓	
Pinus sp.	Pine			✓
Rosa canina	Dog Rose		✓	✓
Salvia verbenaca var.	Wild Sage			✓
Scabiosa atropurpurea	Pincushion			✓
Schinus molle	Pepper-tree			✓
Silybum marianum	Variegated Thistle		✓	
Solanum elaeagnifolium	Silver-leaf Nightshade		✓	
Solanum nigrum	Black Nightshade			✓
Sonchus oleraceus	Common Sow-thistle			✓
Taraxacum officinale	Dandelion			✓

Status: Declared - Declared plant under the *Natural Resources Management Act 2004*
Environmental - Environmental weed (DPTI Environmental Weeds List)

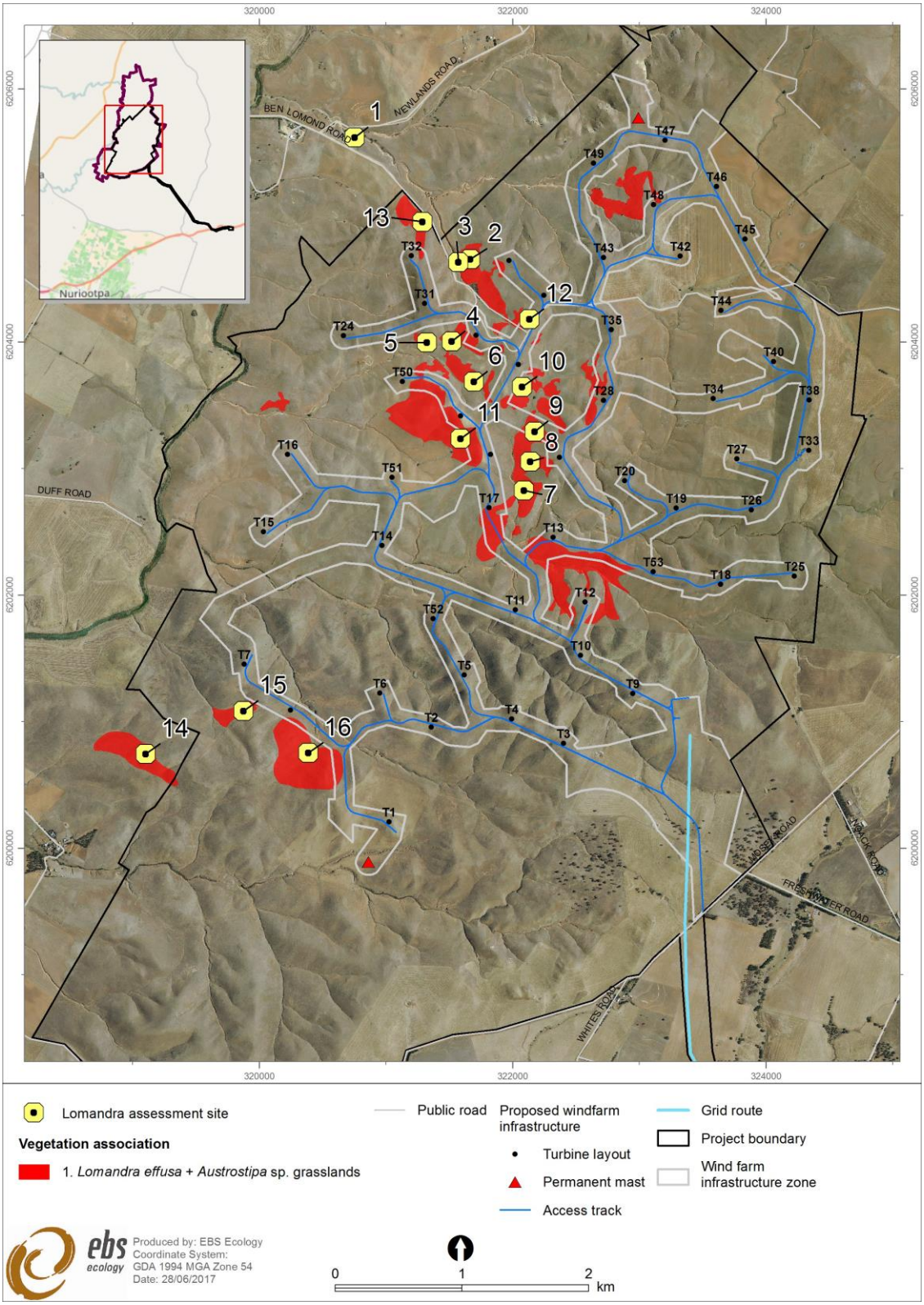


Figure 36. *Lomandra* Grassland assessment sites within the wind turbine and infrastructure zones.

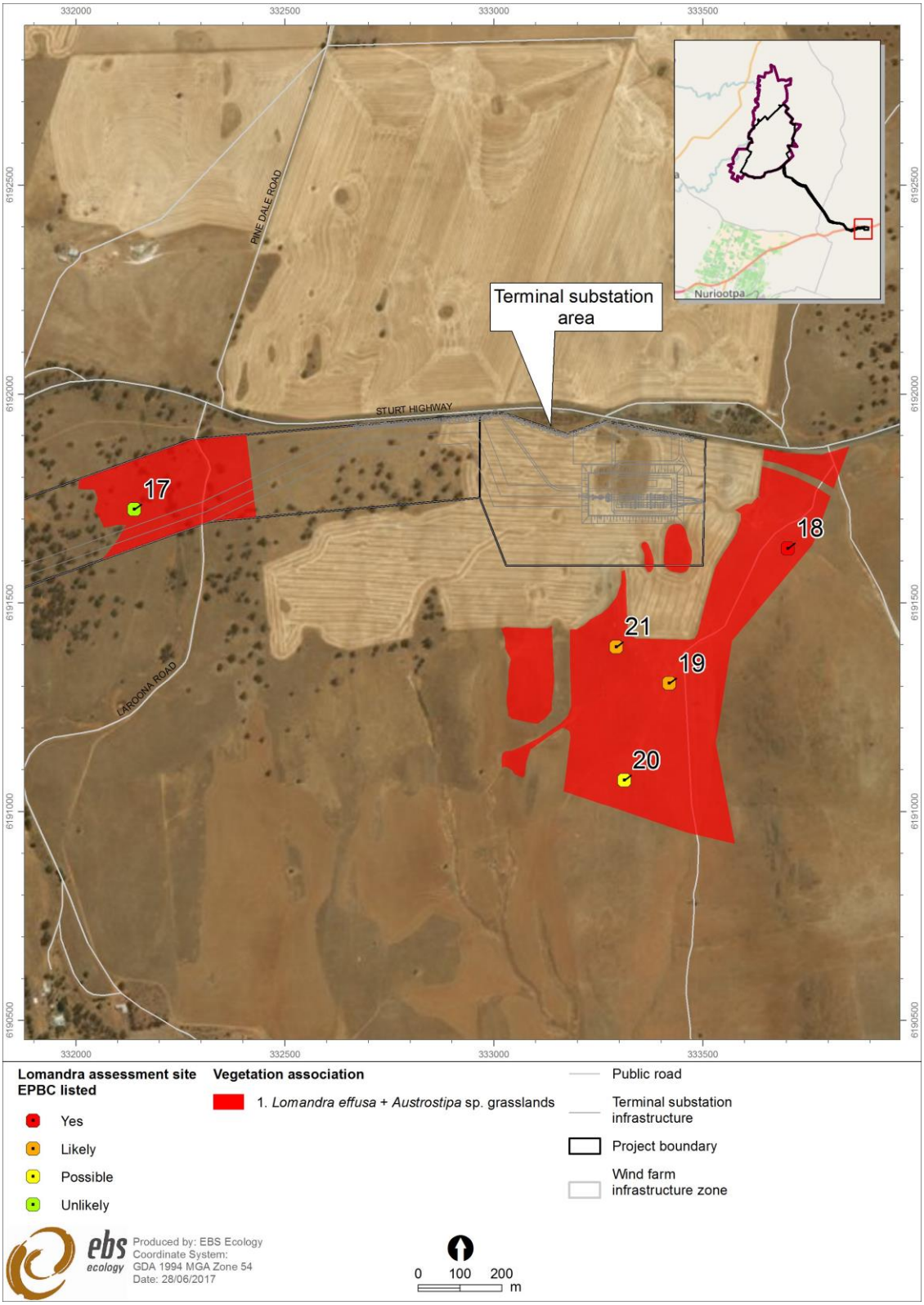


Figure 37. *Lomandra* Grassland assessment sites within the proposed terminal substation area.

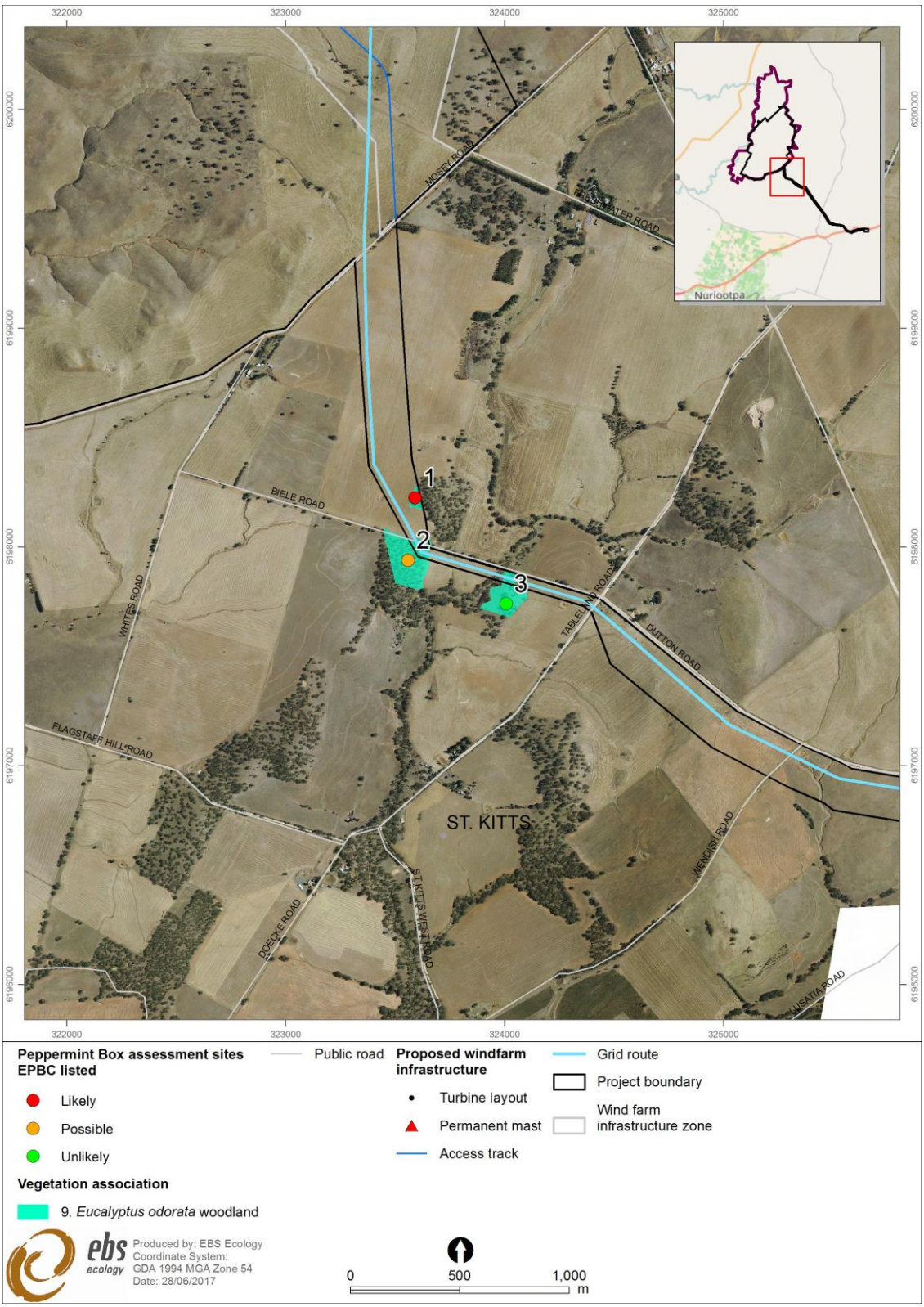


Figure 38. Peppermint Box assessment sites within the proposed transmission line.

5.3 Fauna

5.3.1 Terrestrial native fauna species

Non-avian terrestrial fauna were opportunistically recorded; a record of the number of individuals observed and a GPS location of each observation was undertaken. A single reptile species was recorded that was not identified during the BDBSA search, the Mallee Black-headed Snake (*Parasuta spectabilis*) (Table 33). With the exception of the PBTL, none of the reptile species recorded have a conservation rating and can be classed as common in suitable habitats.

Two amphibian species, the Common Froglet (*Crinia signifera*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*) were recorded during the September 2015 survey, neither of which has a conservation rating (Table 33). The Common Froglet was observed at a single creekline, and is expected to be widespread across much of the site, as it is one of the most common species of frog in South Australia. A single Spotted Marsh Frog was heard during the September 2015 survey. This species is very adaptable and is often one of the first frogs to take advantage of new dams, ditches and water-covered areas on disturbed ground. It can be found in woodland, shrubland and grassland; it is usually found under cover near water by day.

Table 33. Terrestrial non-avian fauna.

Scientific name	Common name	Conservation status			Number observed
		Aus	SA	Intro	
Amphibian					
Crinia signifera	Common Eastern Froglet	-	-		1
Limnodynastes tasmaniensis	Spotted Marsh Frog	-	-		1
Reptiles					
Parasuta spectabilis	Mallee Black-headed Snake	-	-		1
Pogona barbata	Eastern Bearded Dragon	-	-		5
Tiliqua adelaidensis	Pygmy Blue-tongue Lizard	EN	E		115
Tiliqua rugosa	Sleepy Lizard	-	-		16
Tiliqua scincoides	Eastern Bluetongue Lizard	-	-		1
Mammals					
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	-	-		6
Macropus fuliginosus	Western Grey Kangaroo	-	-		14
Macropus robustus	Euro	-	-		2
*Oryctolagus cuniculus**	Rabbit (European Rabbit)	-	-		8
*Vulpes vulpes**	Fox (Red Fox)	-	-		1

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
***delineates introduced species.**

Three native terrestrial mammal species were observed, none of which have a conservation rating (Table 33). Six Southern Hairy-nosed Wombats (*Lasiorhinus latifrons*) were observed by field staff with many other wombat warrens observed along the edges of drainage areas. Two introduced mammal species

were detected during the September 2015 survey: a single Red Fox (*Vulpes vulpes*) and the European Rabbit (*Oryctolagus cuniculus*). Rabbit scratching's and scars were also detected opportunistically.

5.3.2 Flinders Worm Lizard

No Flinders Worm Lizards were detected during the September spring 2015 survey.

5.3.3 Pygmy Blue-tongue Lizard

The PBTL was also observed during the summer and autumn 2016 targeted surveys and the summer 2016/2017 targeted survey, with a total number of 115 individuals observed (Table 33).

Habitat categorisation was completed within the entire project boundary. The habitat and potential presence of PBTLs were assessed during the spring 2015 survey and categorised as likely, possible or not likely. This initial habitat mapping aided subsequent targeted surveys within 'likely' and 'possible' areas which were investigated further to determine the spread and potential numbers of PBTL.

Six individual PBTLs were identified during the broad sweep of assessing potential habitat across the project site during the spring 2015 survey; suitable habitat was identified across the entire project site with the exception of cropping and drainage areas (Figure 39).

Habitat categorization was updated in the summer 2016/2017 surveys as the project boundary was more extensively searched. Generally, a large proportion of the project site is considered possible or likely habitat for the PBTL due to the open grasslands, slopes and spider holes observed across the site. Areas considered unlikely to contain PBTLs are cropping, very steep, very rocky or areas with no evidence of spider holes. Due to the widespread nature of the PBTL population in the project area, habitat was further categorized into areas that are either likely to have a high abundance of lizards or likely to have a low abundance of lizards. This information will be valuable for identifying areas that may be appropriate for the translocation of PBTL, as part of this project.

Turbine locations

Each of the proposed WTG was assessed for the presence of PBTLs across an area of approximately 100 m x 100 m. A total of 115 PBTLs were recorded at WTG locations and within transmission corridors (Table 33). Six of out 49 potential turbine locations inspected, contained lizards while lizards were observed in close proximity to a further seven, and within much of the uncropped transmission corridor.

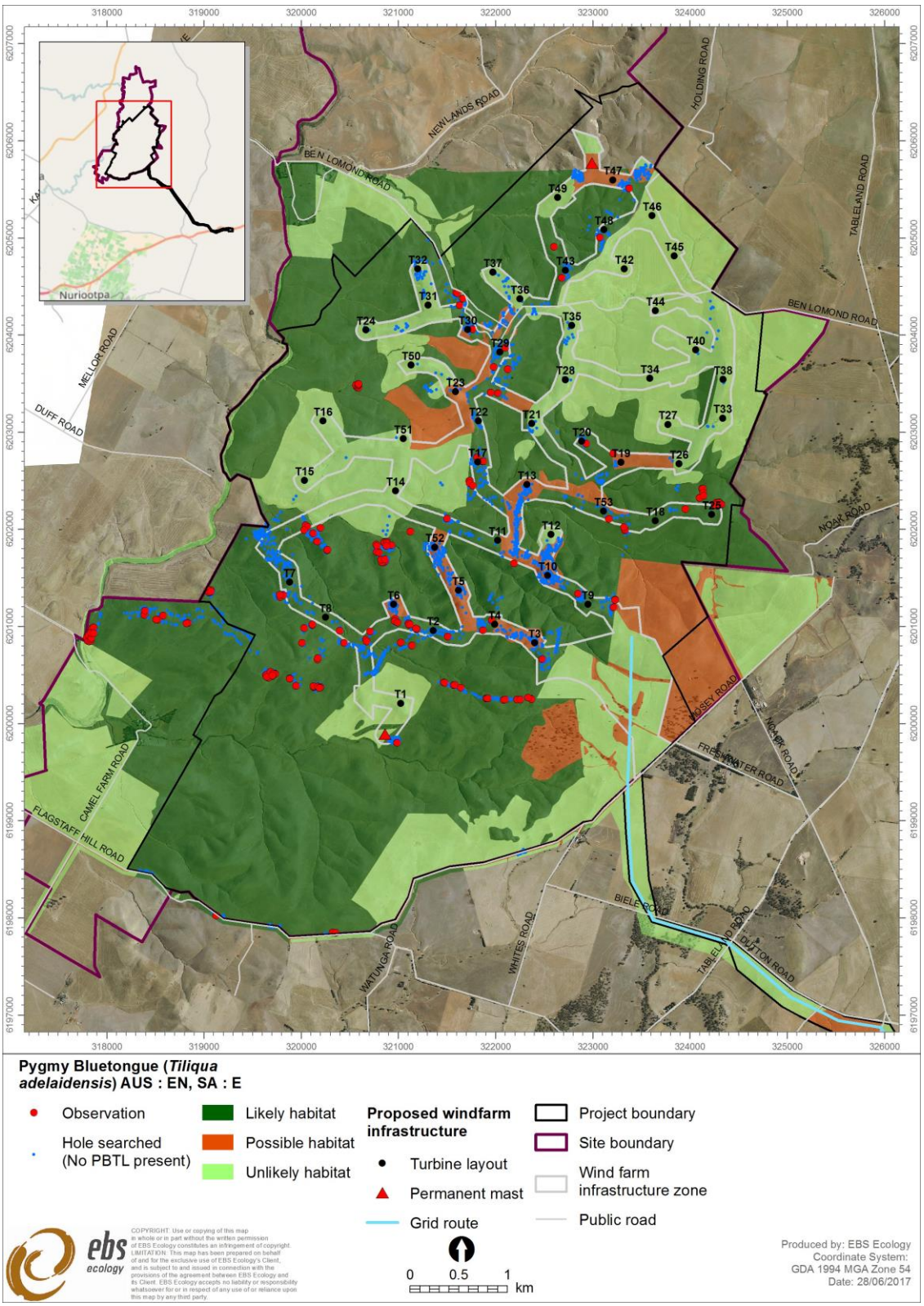


Figure 39. Categorisation of habitat suitability for PBTL.

Across the southern area of the wind farm development area, PBTL were found at one of the 12 proposed WTG locations, and in very close proximity to a further five. PBTL were found within many sections of the transmission corridor. Across the northern property of the project site, five of the 37 proposed turbine locations contained PBTLs, and a further two PBTL were found in very close proximity to WTG. The northern property contains large areas of less suitable habitat for PBTLs with steeper and rockier terrain as well as a larger area that is used for cropping.

The number of individual PBTLs and the number of spider holes surveyed at each turbine location is provided in Table 34. PBTL were recorded in six of the turbine locations specifically. Recommendations have been provided for each turbine site, with reference to potential translocation sites (sites which would be most appropriate to move lizards from).

Table 34. Summary results from each turbine assessment – summer 2016/2017.

Turbine	No. of holes recorded	PBTL records	Comments	Recommendation
1	0	0	Small patch of rocky area within crop	Suitable for development
2	0	0	Patch of rocky habitat within crop	Suitable for development
3	25	0	Possible PBTL. Spider holes present, no PBTL observed	PBTL in corridor – needs micro siting (may be suitable translocation)
4	30	1	Good holes, low density of PBTL near to turbine	Low number of PBTL Present, may be able to micro-site. (may be suitable translocation)
5	21	0	Lots of holes, no PBTL recorded	Micro-siting required but may be suitable for development.
6	29	0	Good PBTL holes, no PBTL recorded; surrounding corridor has high density of PBTL	PBTL in corridor – final turbine position to be micro-sited to avoid impact
7	18	0	Good holes, low density of PBTL near to turbine	Low number of PBTL Present, may be able to micro-site, dependant on surrounding area.
8	20	0	Good holes, no PBTL recorded	Micro-siting required but may be suitable for development
9	0	0	PBTL found in corridor but not in turbine location. 0	PBT in corridor – low abundance (suitable for translocation or micro-siting). (may be suitable translocation)
10	28	0	PBTL found in corridor but not in turbine location. Suitable holes present	PBT in corridor – low abundance (suitable for translocation or micro-siting)
11	0	0	PBTL found in corridor but not in turbine location.	PBT in corridor – low abundance (suitable for translocation or micro-siting)
12	1	0	Dense, weedy vegetation, no PBTL recorded	Suitable for development
14	0	0	cropped	Suitable for development
15	0	0	cropped	Suitable for development
16	0	0	cropped	Suitable for development
17	12	2	PBTL present; suitable burrows	PBTL present - final turbine position to be micro-sited to avoid impact

Turbine	No. of holes recorded	PBTL records	Comments	Recommendation
18	2	0	PBTL present in close proximity to turbine location	PBTL abundance high in corridor. Micro-siting may be possible here
19	5	0	PBTL present in close proximity to turbine	PBTL in corridor - final turbine position to be micro-sited to avoid impact
20	7	1	PBTL found	PBTL found - final turbine position to be micro-sited to avoid impact
21	1	0	Rocky, steep, no PBTL recorded	Suitable for development
22	3	0	PBTL in surrounding corridor. PBTL likely here	PBTL likely - final turbine position to be micro-sited to avoid impact
23	3	0	Heavily grazed. Suitable holes observed	Micro-siting required but may be suitable for development
24	0	0	Heavily grazed	Suitable for development
25	2		PBTL found in close proximity	Micro-siting required but may be suitable for development
26	1	0	Rocky, shallow soil.	Suitable for development
27	0	0	Rocky, shallow soil.	Suitable for development
28	4	0	Rocky, shallow soil.	Suitable for development
29	23	1	Good holes, PBTL found	PBTL found - final turbine position to be micro-sited to avoid impact
30	16	1	Good holes, PBTL found	PBTL found - final turbine position to be micro-sited to avoid impact
31	0	0	Rocky, steep, shallow soil	Suitable for development
32	31	0	Rocky, steep, shallow soil	Suitable for development
33	0	0	Crop	Suitable for development
34	0	0	Crop	Suitable for development
35	4	0	Crop	Suitable for development
36	1	0	Good holes, possible PBTL. No PBTL recorded	Micro-siting required but may be suitable for development
37	2	0	Possible PBTL in corridor. Turbine site rocky	Micro-siting required but may be suitable for development
38	0	0	Crop	Suitable for development
39	0	0	Crop	Suitable for development
40	2	0	Crop	Suitable for development
41	3	0	Crop	Suitable for development
42	0	0	Crop	Suitable for development
43	2	1	PBTL recorded	PBTL recorded - final turbine position to be micro-sited to avoid impact
44	0	0	Crop	Suitable for development
45	0	0	Crop	Suitable for development
46	0	0	Crop	Suitable for development
47	42	0	Good holes, no PBTL recorded	Micro-siting required but may be suitable for development

Turbine	No. of holes recorded	PBTL records	Comments	Recommendation
48	0	0	Rocky, steep, no PBTL recorded	Suitable for development
49	0	0	Rocky, steep, no PBTL recorded	Suitable for development

Access and infrastructure layouts

A greater PBTL survey focus was given to turbine locations than was given track locations, due to the larger infrastructure footprint of the turbine foundation, crane hard standing and laydown areas.

As per the survey of the proposed turbine locations, the survey of the southern area of the wind farm development area, found higher numbers of PBTLs and more habitat classed as likely when compared to the northern property (Figure 39). Figure 40 shows the likely PBTL habitat as either likely to have a low abundance or high abundance of PBTL; this mapping has been based on the number of PBTL observed and the categorisation of habitat suitability throughout the site. Figure 41 and Figure 42 show PBTL habitat mapped along the proposed delivery route, transmission line and terminal substation. There were also several sections where habitat was determined as possible. Figure 42 shows the section mapped as likely habitat in higher resolution.

Substation (near Mosey Road)

Habitat mapping and a targeted survey was carried out within the proposed substation area; the majority of the area was determined as unlikely habitat for PBTL, however the northern extent was mapped as likely with one PBTL observation and a number of spider holes present.

Transmission Corridor

The transmission corridor is either all cropped or unsuitable for PBTL, with the exception of the uncropped habitat along Flagstaff Hill Road. This habitat has PBTL on both sides of the road. It is recommended that micro-siting occurs along this area of the transmission line and/or the road corridor can be utilised.

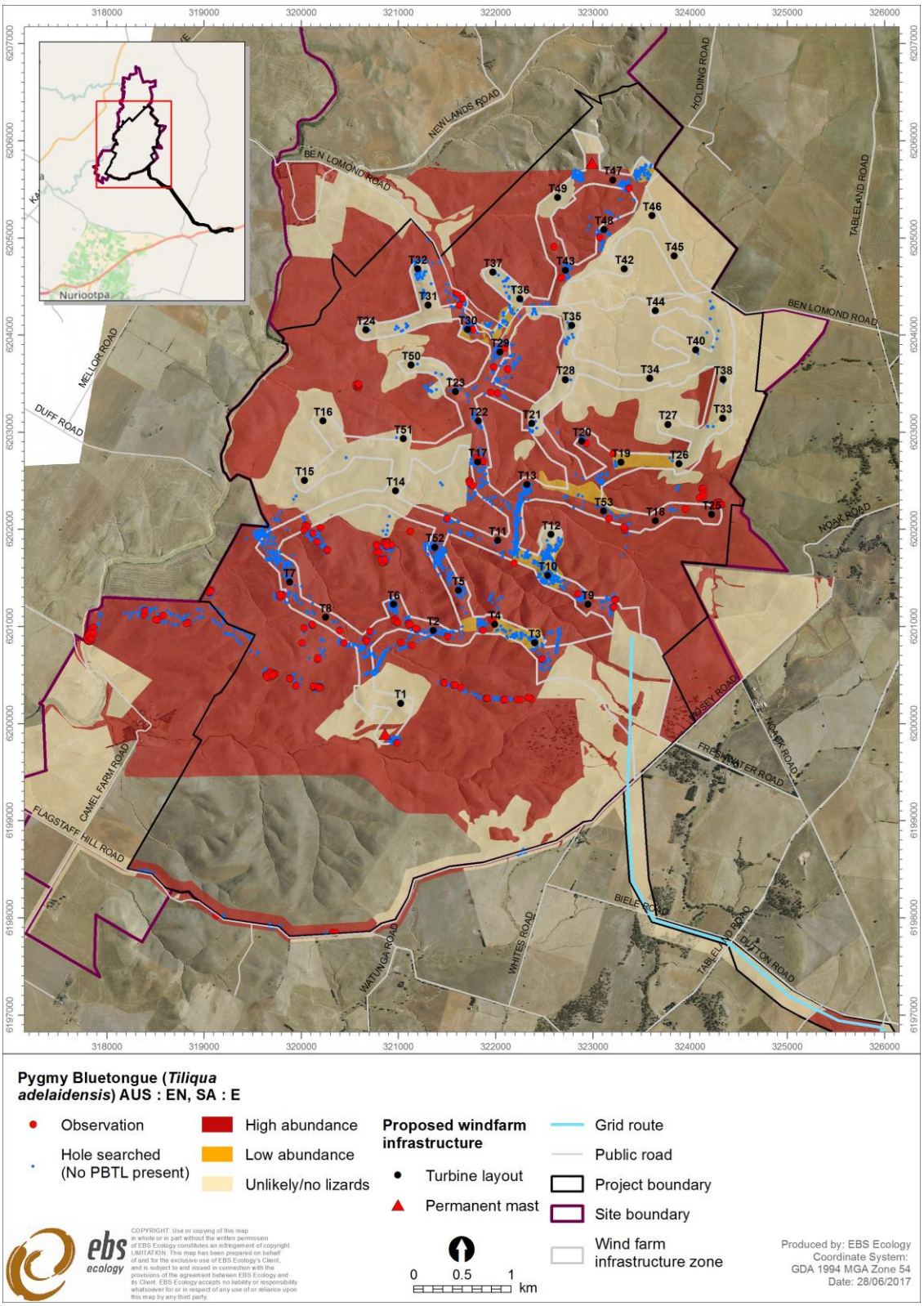


Figure 40. Likely PBTL habitat as either likely to have a low abundance or high abundance of PBTL.

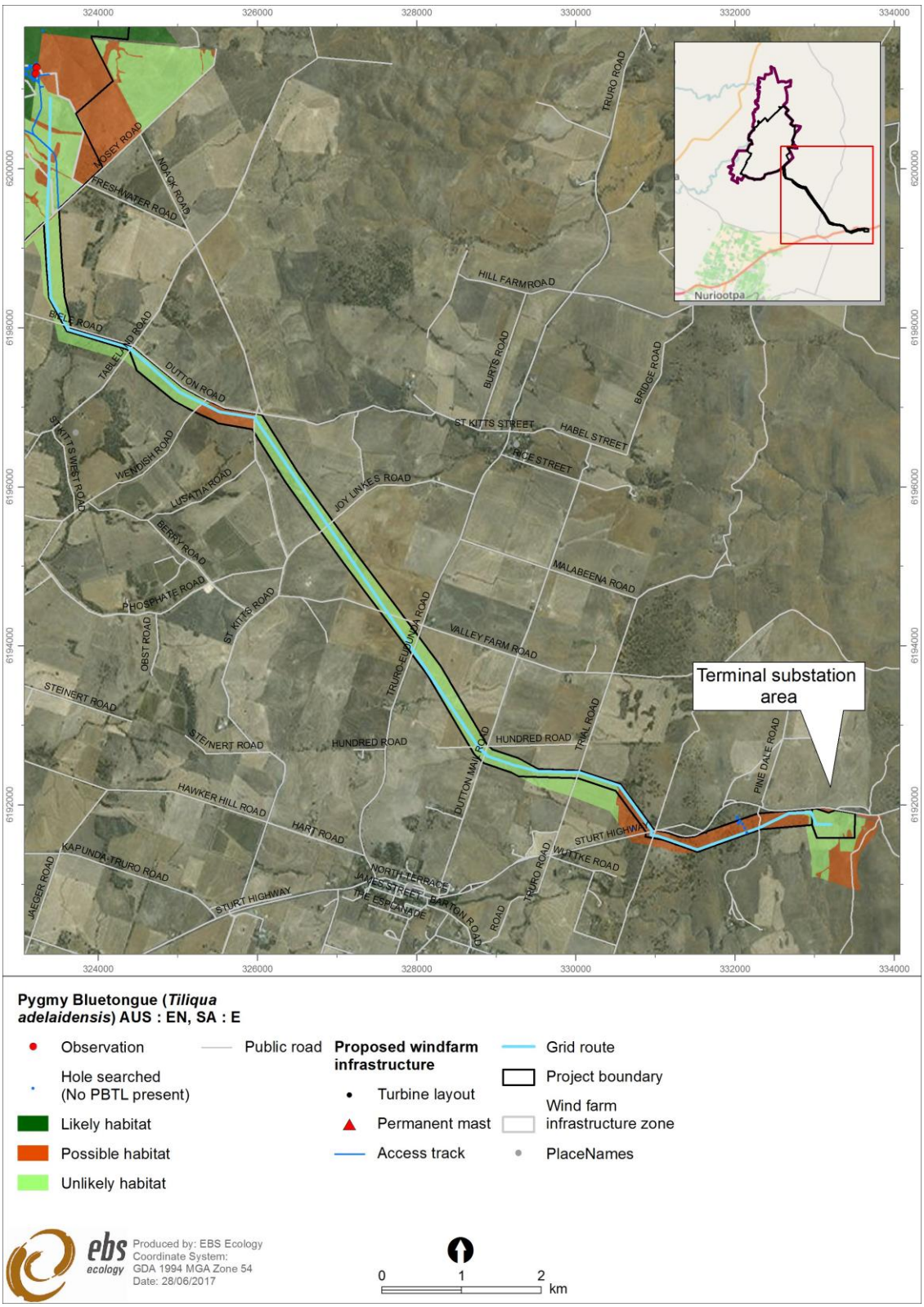


Figure 41. PBTL habitat assessed within proposed transmission line and terminal substation area.

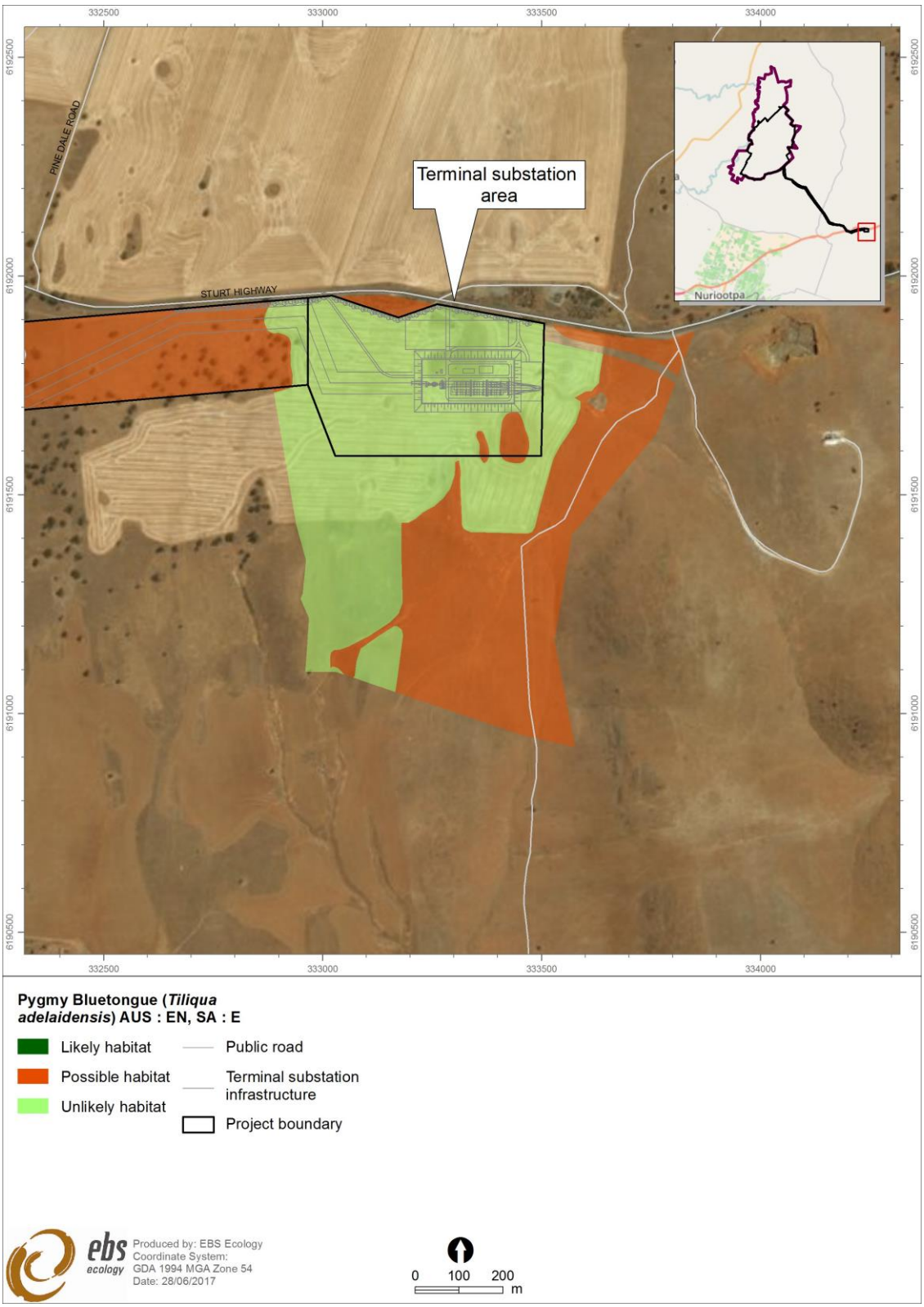


Figure 42. PBTL habitat area (close-up) assessed for the proposed terminal substation area.

5.3.4 Threatened and migratory bird species

One species with an EPBC migratory rating, the Rainbow Bee-eater (*Merops ornatus)* and a single species with a state conservation rating of rare, the Blue-winged Parrot (*Neophema chrysostoma*), were observed during the spring 2015 survey (Figure 43). No species of conservation significance were observed during the summer, autumn and winter 2016 surveys.

The Rainbow Bee-eater was observed opportunistically in Association 7: *Eucalyptus porosa* +/- *Eucalyptus odorata* +/- *Eucalyptus gracilis* open woodland (Figure 43). Seven Rainbow Bee-eaters were observed flying over open woodland during the Lomandra Grassland field trip (8 October 2015). Three individual Blue-winged Parrots were observed flying over Associations 1 and 2: *Lomandra effusa* + *Austrostipa sp*. grasslands and *Austrostipa sp.* grassland (respectively). It is believed that Blue-winged Parrots utilise these vegetation associations for foraging. The Blue-winged Parrot has previously been recorded within the project boundary, with the most recent BDBSA record being 26/10/2011 (Table 17). Whilst nesting sites for both these species were not recorded on site, both species have the potential to breed on site. Both the Rainbow Bee-eater and the Blue-winged Parrot are discussed in more detail in Section 6.2.

5.3.5 Birds

Spring 2015

A total of 1,448 individuals from 48 bird species were observed during 16 point counts and opportunistic surveys across the Twin Creek Wind Farm project site during the spring 2015 survey.

Six species of bird observed were non-native; Eurasian Skylark (*Alauda arvensis*), European Goldfinch (*Carduelis carduelis*), Feral Pigeon [Rock Dove] (*Columba livia),* House Sparrow (*Passer domesticus*), European Starling (*Sturnus vulgaris*) and European Blackbird (*Turdus merula*).

Point Count

Sixteen (16) point count surveys were performed within the project boundary (Figure 43). The location of these 16 point count sites are summarised in Appendix 2.

The most abundant species observed during dedicated point count surveys (Table 35) were the Common Starling (*Sturnus vulgaris*) (343 individuals), Galah (*Eolophus roseicapilla*) (274 individuals) and Australian Magpie (*Gymnorhina tibicen*) (170 individuals).

Opportunistic birds

Of the 1,448 individual birds recorded, 300 individuals from 30 species were observed opportunistically across the site (Table 35). Many of these were observed during active searching, as well as while moving between bird point count sites. The species with the highest representation in opportunistic observations were the Australian Magpie (*Gymnorhina tibicen*) (72 individuals), Galah (*Eolophus roseicapilla*) (56 individuals) and the Little Corella (*Cacatua sanguinea*) (30 individuals).

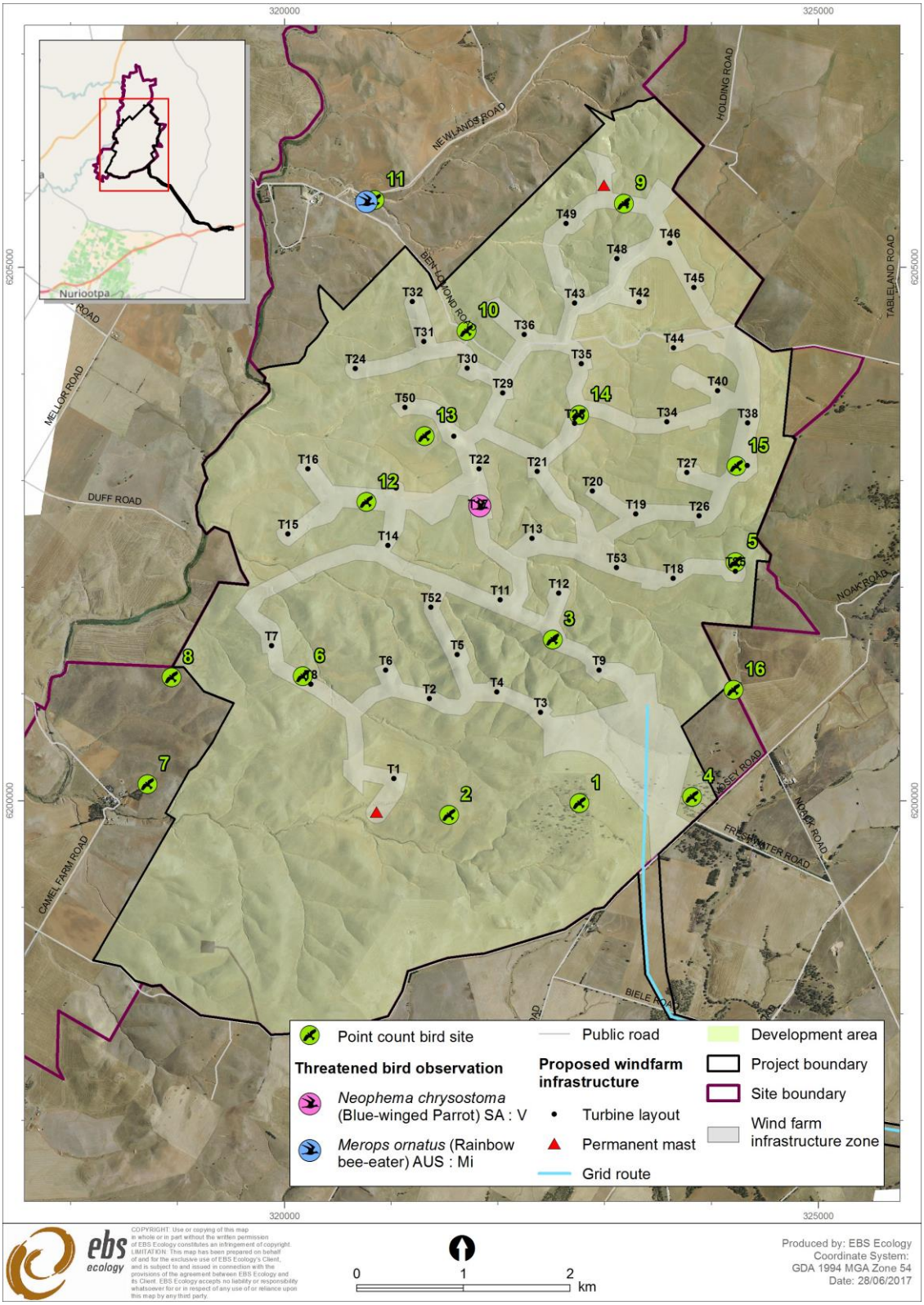


Figure 43. Bird point count sites and threatened bird observations (EBS spring 2015).

Table 35. Bird survey results spring 2015.

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	13	14	27
Acrocephalus australis	Australian Reed Warbler	-	-	-		1	1
Alauda arvensis	Eurasian Skylark	-	-	*	9	5	14
Anas superciliosa	Pacific Black Duck	-	-	-	2	11	13
Anthochaera carunculata	Red Wattlebird	-	-	-		1	1
Anthus australis	Australian Pipit	-	-	-	18	6	24
Aquila audax	Wedge-tailed Eagle	-	-	-	4		4
Ardea pacifica	White-necked Heron	-	-	-		1	1
Cacatua sanguinea	Little Corella	-	-	-		30	30
Carduelis carduelis	European Goldfinch	-	-	*	2		2
Chenonetta jubata	Maned (Australian Wood Duck)	-	-	-	2	4	6
Cincloramphus cruralis	Brown Songlark	-	-	-	7	5	12
Cincloramphus mathewsi	Rufous Songlark	-	-	-	1		1
Circus assimilis	Spotted Harrier	-	-	-		1	1
Columba livia	Feral Pigeon [Rock Dove]	-	-	*		8	8
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	-		1	1
Corvus coronoides	Australian Raven	-	-	-	19	13	32
Corvus mellori	Little Raven	-	-	-	38	17	55
Daphoenositta chrysoptera	Varied Sittella	-	-	-	5		5
Egretta novaehollandiae	White-faced Heron	-	-	-	5	1	6
Elanus axillaris	Black-shouldered Kite	-	-	-		3	3
Eolophus roseicapilla	Galah	-	-	-	274	56	330
Falco berigora	Brown Falcon	-	-	-		1	1
Falco cenchroides	Nankeen Kestrel	-	-	-	11	3	14
Falco longipennis	Australian Hobby	-	-	-	1		1
Fulica atra	Eurasian Coot	-	-	-		1	1
Gavicalis virescens	Singing Honeyeater	-	-	-	1		1
Grallina cyanoleuca	Magpie-lark	-	-	-	2		2
Gymnorhina tibicen	Australian Magpie	-	-	-	170	72	242
Hirundo neoxena	Welcome Swallow	-	-	-	4	10	14
Merops ornatus	Rainbow Bee-eater	Mi	-	-		7	1

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Manorina melanocephala	Noisy Miner	-	-	-	32		32
Microcarbo melanoleucos	Little Pied Cormorant	-	-	-		1	1
Neophema chrysostoma	Blue-winged Parrot	-	V	-		3	3
Ocyphaps lophotes	Crested Pigeon	-	-	-	4		4
Pachycephala rufiventris	Rufous Whistler	-	-	-	1		1
Pardalotus striatus	Striated Pardalote	-	-	-	10		10
Passer domesticus	House Sparrow	-	-	*	30		30
Petrochelidon nigricans	Tree Martin	-	-	-	4		4
Platycercus elegans	Crimson Rosella	-	-	-	60	5	65
Podargus strigoides	Tawny Frogmouth	-	-	-	1		1
Psephotus haematonotus	Red-rumped Parrot	-	-	-	47		47
Ptilotula penicillata	White-plumed Honeyeater	-	-	-	1	3	4
Rhipidura albiscapa	Grey Fantail	-	-	-	3		3
Rhipidura leucophrys	Willie Wagtail	-	-	-	8	6	14
Sturnus vulgaris	Common Starling	-	-	*	343	10	353
Turdus merula	Common Blackbird	-	-	*	14		14
Vanellus tricolor	Banded Lapwing	-	-	-	2		2
	Total:				**1148**	**300**	**1448**

^ 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. **Mi**: Migratory. **Intro**: Introduced (* denotes introduced species). **OPP**: Opportune. **PC**: Point Count.

Thirteen (13) out of the total 48 species were only recorded opportunistically:

- Australian Reed Warbler (*Acrocephalus australis*);
- Red Wattlebird (*Anthochaera carunculata*);
- White-necked Heron (*Ardea pacifica*);
- Little Corella (*Cacatua sanguinea);*
- Spotted Harrier (*Circus assimilis*);
- Feral Pigeon (*Columba livia*);
- Black-faced Cuckoo-shrike (*Coracina novaehollandiae*);
- Black-shouldered Kite (*Elanus axillaris*);
- Brown Falcon (*Falco berigora*);
- Eurasian Coot (*Fulica atra*);
- Rainbow Bee-eater (*Merops ornatus*);
- Little Pied Cormorant (*Microcarbo melanoleucos*); and
- Blue-winged Parrot (*Neophema chrysostoma*).

Summer 2016

A total of 1,255 individuals from 24 bird species were observed during dedicated point count and opportunistic surveys across the Twin Creek Wind Farm project site.

The species with the greatest number of recorded individuals was the Common Starling (240 individuals) followed closely by the Australian Magpie (221 individuals). There were five species for which only a single individual was recorded during the summer 2016 survey: the Australian Owlet-nightjar (*Aegotheles cristatus*), which was heard at point count site number one (Table 36), Red Wattlebird (*Anthochaera carunculata*), Brown Songlark (*Cincloramphus cruralis*), Brown Falcon (*Falco berigora*) and Singing Honeyeater (*Gavicalis virescens*).

Point Count

Sixteen (16) point count surveys were re-surveyed across the project area (Figure 43). Of the 1,255 birds that were observed during the summer 2016 survey, 924 of these were recorded during point count surveys. The introduced House Sparrow recorded the highest number of individuals with 203 birds. The Australian Owlet-nightjar was the only new bird species recorded from the previous spring 2015 survey.

Opportunistic birds

Of the 1,255 individual birds recorded, 331 individuals from 13 species were observed opportunistically across the site (Table 36). The species with the highest representation in opportunistic observations was the Australian Raven with 104 individuals.

Table 36. Bird survey results summer 2016.

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	11	4	15
Aegotheles cristatus	Australian Owlet-nightjar				1		1
Anthochaera carunculata	Red Wattlebird	-	-	-	1		1
Anthus australis	Australian Pipit	-	-	-	19	7	26
Aquila audax	Wedge-tailed Eagle	-	-	-	4	2	6
Chenonetta jubata	Maned (Australian Wood Duck)	-	-	-	5		5
Cincloramphus cruralis	Brown Songlark	-	-	-	1		1
Columba livia	Feral Pigeon [Rock Dove]	-	-	*	6		6
Corvus coronoides	Australian Raven	-	-	-	53	104	157
Eolophus roseicapilla	Galah	-	-	-	167	48	215
Falco berigora	Brown Falcon	-	-	-		1	1
Falco cenchroides	Nankeen Kestrel	-	-	-	11	6	17
Gavicalis virescens	Singing Honeyeater	-	-	-	1		1
Grallina cyanoleuca	Magpie-lark	-	-	-	8		8
Gymnorhina tibicen	Australian Magpie	-	-	-	132	89	221
Manorina melanocephala	Noisy Miner	-	-	-	23		23
Ocyphaps lophotes	Crested Pigeon	-	-	-	12	4	16
Pardalotus striatus	Striated Pardalote	-	-	-	2		2
Passer domesticus	House Sparrow	-	-	*	203		203
Platycercus elegans	Crimson Rosella	-	-	-	25	2	27
Psephotus haematonotus	Red-rumped Parrot	-	-	-	44	2	46
Ptilotula penicillata	White-plumed Honeyeater	-	-	-	3		3
Rhipidura leucophrys	Willie Wagtail	-	-	-	12	2	14
Sturnus vulgaris	Common Starling	-	-	*	180	60	240
	Total:				**924**	**331**	**1255**

^ 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. **Mi**: Migratory. **Intro**: Introduced (* denotes introduced species). **OPP**: Opportune. **PC**: Point Count.

Autumn 2016

A total of 751 individuals from 30 bird species were observed during dedicated point count and opportunistic surveys across the Twin Creek Wind Farm project site (Table 37).

Three species of bird observed were non-native; Eurasian Skylark (*Alauda arvensis*), House Sparrow (*Passer domesticus*) and the European Starling (*Sturnus vulgaris*). In addition, four new species were observed. These were the Musk Lorikeet (*Glossopsitta concinna*), Zebra Finch (*Taeniopygia guttata*), White-backed Swallow (*Cheramoeca leucosterna*), and the Little Buttonquail (*Turnix velox*). This has resulted in a total of 54 species being observed across the project site (across spring, summer and autumn surveys).

Point Count

Sixteen (16) point count surveys were undertaken across the project area (Figure 43). The most abundant species detected during dedicated point count surveys (Table 37) were the Australian Magpie (97 individuals), the introduced Common Starling (74 individuals), and Galah (55 individuals).

Opportunistic birds

A total of 178 individuals from 7 species were observed opportunistically across the site (Table 37). The species with the highest representation in opportunistic observations were the Common Starling (150 individuals).

During a separate field survey, performed on 5 April 2016 whilst surveying additional areas for PBTL, EBS field staff observed a White-fronted Chat (*Epthianura albifrons*) nest (Figure 44). This species had not been recorded on site previously by EBS.

Table 37. Bird survey results autumn 2016.

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	6	0	6
Alauda arvensis	Eurasian Skylark			*	14	0	14
Anthus australis	Australian Pipit	-	-	-	24	0	24
Aquila audax	Wedge-tailed Eagle	-	-	-	1	3	4
Coracina novaehollandiae	Black-faced Cuckoo shrike	-	-	-	2	0	2
Corvus coronoides	Australian Raven	-	-	-	18	7	25
Corvus mellori	Little Raven	-	-	-	49	0	49
Eolophus roseicapilla	Galah	-	-	-	55	0	55
Falco cenchroides	Nankeen Kestrel	-	-	-	2	7	9
Gavicalis virescens	Singing Honeyeater	-	-	-	11	0	11
Grallina cyanoleuca	Magpielark	-	-	-	4	0	4
Gymnorhina tibicen	Australian Magpie	-	-	-	97	4	101

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Hirundo neoxena	Welcome Swallow	-	-	-	3	0	3
Manorina melanocephala	Noisy Miner	-	-	-	32	0	32
Ocyphaps lophotes	Crested Pigeon	-	-	-	7	0	7
Pardalotus striatus	Striated Pardalote	-	-	-	17	0	17
Passer domesticus	House Sparrow	-	-	*	15	0	15
Petrochelidon nigricans	Tree Martin	-	-	-	25	0	25
Platycercus elegans	Crimson Rosella	-	-	-	34	0	34
Psephotus haematonotus	Red-rumped Parrot	-	-	-	29	0	29
Ptilotula penicillata	White-plumed Honeyeater	-	-	-	12	0	12
Rhipidura leucophrys	Willie Wagtail	-	-	-	18	0	18
Sturnus vulgaris	Common Starling	-	-	*	74	150	224
Vanellus tricolor	Banded Lapwing	-	-	-	7	0	7
Cheramoeca leucosterna	White-backed Swallow	-	-	-	2	0	2
Epthianura albifrons	White-fronted Chat	-	-	-	3	5	8
Anas gracilis	Grey Teal	-	-	-	3	0	3
Glossopsitta concinna	Musk Lorikeet	-	-	-	8	0	8
Turnix velox	Little Buttonquail	-	-	-	1	0	1
Taeniopygia guttata	Zebra Finch	-	-	-	0	2	2
	Total:				**178**	**573**	**751**

^ 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. **Mi**: Migratory. **Intro**: Introduced (* denotes introduced species). **OPP**: Opportune. **PC**: Point Count.

Figure 44. White-fronted Chat nest recorded during the additional one-day survey 5 April 2016.

Winter 2016

A total of 743 individuals from 30 bird species were observed during dedicated point count and opportunistic surveys across the Twin Creek Wind Farm project site (Table 38). The species observed were typical of those inhabiting open country and woodlands in South Australia.

The most numerous species observed were the Galah (163 individuals), Australian Magpie (148 individuals) and Little Raven (116 individuals). Two new species were recorded in winter 2016: the Pacific Black Duck (*Anas superciliosa*) and the White-faced Heron (*Egretta novaehollandiae)*.

Point Count

Sixteen (16) point count surveys were re-surveyed across the project area (Figure 43). A total of 743 birds were observed during the winter 2016 surveys. The most abundant species recorded was the Galah, with 128 recorded. The Musk Lorikeet and Little Button-quail, which were first recorded in autumn 2016, were again observed in the winter 2016 survey during point counts.

Opportunistic birds

A total of 132 birds from nine species were opportunistically sighted during the winter 2016 surveys. Of the nine species, three were raptors: Nankeen Kestrel (27 individuals), Brown Falcon (3 individuals) and Wedge-tailed Eagle (2 individuals).

Table 38. Bird survey results autumn 2016.

Scientific name	Common name	Conservation status^			Number observed^		
		Aus	SA	Intro	PC	OPP	Total
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	-	4		4
Alauda arvensis	Eurasian Skylark	-	-	*	13		13
Anas gracilis	Grey Teal	-	-	-	2		2
Anas superciliosa	Pacific Black Duck	-	-	-	1		1
Anthochaera carunculata	Red Wattlebird	-	-	-	1		1
Anthus australis	Australian Pipit	-	-	-	32		32
Aquila audax	Wedge-tailed Eagle	-	-	-		2	2
Chenonetta jubata	Maned (Australian Wood Duck)	-	-	-	2	8	10
Cincloramphus cruralis	Brown Songlark	-	-	-	2		2
Columba livia	Feral Pigeon [Rock Dove]	-	-	*	3		3
Corvus mellori	Little Raven	-	-	-	116		116
Egretta novaehollandiae	White-faced Heron	-	-	-	3	2	5
Eolophus roseicapilla	Galah	-	-	-	128	35	163
Falco berigora	Brown Falcon	-	-	-	2	3	5
Falco cenchroides	Nankeen Kestrel	-	-	-	13	27	40
Gavicalis virescens	Singing Honeyeater	-	-	-	5		5
Glossopsitta concinna	Musk Lorikeet	-	-	-	11		11
Gymnorhina tibicen	Australian Magpie	-	-	-	106	42	148
Hirundo neoxena	Welcome Swallow	-	-	-	11		11
Manorina melanocephala	Noisy Miner	-	-	-	34		34
Ocyphaps lophotes	Crested Pigeon	-	-	-	2		2
Pardalotus striatus	Striated Pardalote	-	-	-	33		33
Passer domesticus	House Sparrow	-	-	-	13		13
Petrochelidon nigricans	Tree Martin	-	-	-	29	12	41
Platycercus elegans	Crimson Rosella	-	-	-	33		33
Psephotus haematonotus	Red-rumped Parrot	-	-	-	22	1	23
Ptilotula penicillata	White-plumed Honeyeater	-	-	-	4		4
Rhipidura leucophrys	Willie Wagtail	-	-	-	17		17
Sturnus vulgaris	Common Starling	-	-	-	97		97
Turnix velox	Little Buttonquail	-	-	-	1		1
	Total:				**740**	**132**	**872**

^ 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. **Mi**: Migratory. **Intro**: Introduced (* denotes introduced species). **OPP**: Opportune. **PC**: Point Count.

5.3.6 Peregrine Falcon

Eleven records of the Peregrine Falcon are situated outside of the Twin Creek Wind Farm project site (including to the west, east and south) (Figure 11). No nest locations or individual Peregrine Falcon observations were recorded during the spring 2015, summer 2016, autumn 2016 or winter 2016 surveys.

5.3.7 Wedge-tailed Eagle

Targeted Wedge-tailed Eagle nest surveys have been conducted during their breeding season in spring (September) 2015 and winter (August) 2016. A total of three potential Wedge-tailed Eagle nests were located within the proposed Twin Creek Wind Farm site (Figure 45). These nests were typically found in wooded areas within the project boundary, which were scarcely scattered across the site. The three nests were situated within *Eucalyptus leucoxylon* ssp. Woodland (Association 4). Photographic representation of all Wedge-tailed Eagle nests was recorded (Figure 46 to Figure 48). One out of the three nests (Nest 3) was active during the spring 2015 (Table 39) and winter 2016 survey (Table 40), however given that this was likely to belong to a single breeding pair, all three nests could be potentially utilised for breeding in the future.

Breeding behaviour was recorded during the spring 2015 and winter 2016 surveys. During the spring 2015 survey, a single adult was observed flying from Nest 3, and an additional pair of Wedge-tailed Eagles were flushed when entering the area. The pair were observed flying on thermals approximately 600 m from the point count area (where the nests were recorded), 300 m above ground. The August 2016 survey recorded a Wedge-tailed Eagle sitting in Nest 3, however neither eggs nor young were discernable. Wedge-tailed Eagles were observed on two of the three days of surveys in August 2016.

Wedge-tailed Eagles were also observed during the autumn (April 2016) and summer (February 2016) surveys. In autumn, there were four observations of the Wedge-tailed Eagle, three of which were opportunistic sightings. These sightings were spread across the site, with observations occurring close to WTG21, WTG14 and WTG31. Only one Wedge-tailed Eagle was observed during point counts in autumn, at point count 008 (Figure 6). During the summer (February 2016) survey, six Wedge-tailed Eagles were observed on site (four during point count surveys and two during opportunistic observations). Two opportune sightings were recorded south of WTG46. During point count observations, two were sighted and another two individuals were observed being chased by ravens which dropped down into the valley rather than flying high above the ridgeline.

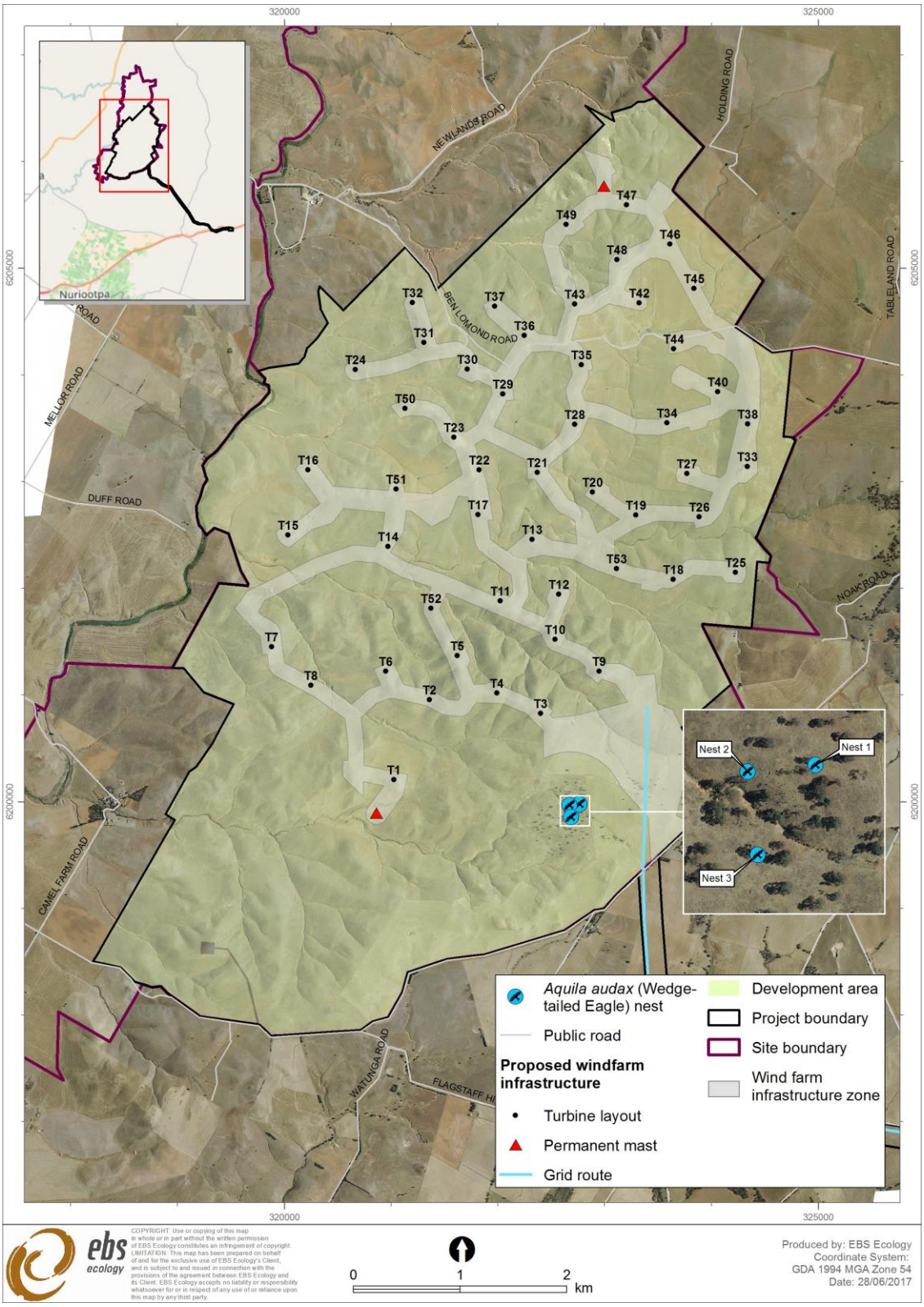


Figure 45. Wedge-tailed Eagle nest locations.

Figure 46. Nest 1.

Figure 47. Nest 2.

Figure 48. Nest 3.

Table 39. Location of Wedge-tailed Eagle nests within the project boundary in spring 2015.

Nest no.	Easting	Northing	Nest height in tree (m)	Size of nest	Nest material	White wash	Intact/ dilapidated	Condition	Fledge / no fledge	Active / not active
1	322766	6199977	15	M	A	A	I	M	N	NA
2	322673	6199968	15	S	A	A	D	P	N	NA
3	322687	6199854	10	L	P	P	I	G	N	A

Size of nest: S (small), M (medium) or L (large), Nest material: A (absent) or P (present), White wash: A (absent) or P (present), I (intact) or D (dilapidated), Condition: P (poor), M (medium) or G (Good), Fledge/no fledgling: N (no fledgling), Active / not active: NA (not active) or A (active).

Table 40. Location of Wedge-tailed Eagle nests within project boundary in winter 2016.

Nest no.	Easting	Northing	Nest height in tree (m)	Size of nest	Nest material	White wash	Intact/ dilapidated	Condition	Fledge / no fledge	Active / not active
1	322766	6199977	15	L	A	A	I	G	N	NA
2	322673	6199968	15	M	A	A	I	G	N	NA
3	322687	6199854	10	L	P	A	I	G	N	A

Size of nest: S (small), M (medium) or L (large), **Nest material**: A (absent) or P (present), **White wash**: A (absent) or P (present), I (intact) or D (dilapidated), **Condition**: P (poor), M (medium) or G (Good), **Fledge/no fledgling:** N (no fledgling), **Active / not active**: NA (not active) or A (active).

5.3.8 At-risk flight height / movements of birds

Minimum and maximum flight heights were recorded for raptor species and threatened avian species. The report has been based on indicative dimensions of 112 m for the tower height and 67 m for the blade lengths. The risk assessment in this report has been based on the lowest extent of a rotating blade tip being 45 m from the ground (based on the indicative dimensions provided by RES). If the tower height and/or blade length (and ultimately the lowest extent of the rotating tip and the rotor swept area) change through the detail design of the project, the risk assessment may need to be redone.

Flight heights of seven bird species were recorded during the spring 2015 survey (Table 41); these included six raptor species and one with a state conservation rating. A Wedge-tailed Eagle performed two flight movements with the highest being 300m above the ground; the Australian Hobby (*Falco longipennis*) and Spotted Harrier (*Circus assimilis*) were observed flying low to the ground in search of food (Table 41).

Flight heights of three species of bird were recorded during the summer 2016 survey (Table 42). Wedge-tailed Eagles recorded two movements at low minimum and maximum heights, one of which was due to the fact a number of ravens chased a pair of eagles low into the valley. The Nankeen Kestrel was the raptor with the most number of observations recorded flying across the site during the summer 2016 survey; minimum height ranges were as low as 1m and maximum height ranges as high as 80 m (Table 42).

Flight heights of two species of raptor were recorded during the autumn 2016 survey, being the Nankeen Kestrel and the Wedge-tailed Eagle (Table 43). Of the four recorded Wedge-tailed Eagle observations, all but one are at low altitudes, between 10 and 45 m, however one flight recorded was at very high altitudes, with the lowest flights recorded at 300-350 m. A total of nine flight observations were recorded for the Nankeen Kestrel. The majority of these flights were at relatively low altitudes, with only two maximum flights heights recorded above 50m in altitude.

Flight heights of three species of raptor were recorded during the winter 2016 survey; Nankeen Kestrel, Brown Falcon and Wedge-tailed Eagle (Table 44). A total of 36 Nankeen Kestrel flights were recorded, with the altitudes ranging between ground level and 85 m. Of the 36 flights recorded, five were at altitudes greater than 40 m. Four Brown Falcon flights were recorded, with maximum flight heights reaching 40 m. Two Wedge-tailed Eagles flights were recorded, with altitudes ranging between 15 and 120 m.

Table 41. Flight details of raptor and threatened birds species determined as possibly at-risk of colliding with turbines (spring 2015).

Common name	Scientific name	Total movements	Min height (m)	Max height (m)	At-risk flights recorded Y/N
Wedge-tailed Eagle	*Aquila audax*	2	10	300	Y
Spotted Harrier	*Circus assimilis*	1	0	5	N
Black-shouldered Kite	*Elanus axillaris*	1	0	0	N
Black-shouldered Kite	*Elanus axillaris*	1	30	60	Y

Black-shouldered Kite	*Elanus axillaris*	1	10	40	N
Brown Falcon	*Falco berigora*	1	10	100	Y
Nankeen Kestrel	*Falco cenchroides*	1	30	200	Y
Nankeen Kestrel	*Falco cenchroides*	1	50	200	Y
Nankeen Kestrel	*Falco cenchroides*	1	0	30	N
Nankeen Kestrel	*Falco cenchroides*	1	5	40	N
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N
Nankeen Kestrel	*Falco cenchroides*	1	15	150	Y
Australian Hobby	*Falco longipennis*	1	0	15	N
Blue-winged Parrot	*Neophema chrysostoma*	1	10	40	N

Table 42. Flight details of raptor and threatened birds species determined as possibly at-risk of colliding with turbines (summer 2016).

Common name	Scientific name	Total movements	Min height (m)	Max height (m)	At-risk flights recorded Y/N
Wedge-tailed Eagle	*Aquila audax*	1	15	70	Y
Wedge-tailed Eagle	*Aquila audax*	1	5	20	N
Brown Falcon	*Falco berigora*	1	20	50	Y
Nankeen Kestrel	*Falco cenchroides*	2	10	32	N
Nankeen Kestrel	*Falco cenchroides*	1	2	25	N
Nankeen Kestrel	*Falco cenchroides*	1	1	5	N
Nankeen Kestrel	*Falco cenchroides*	1	5	20	N
Nankeen Kestrel	*Falco cenchroides*	1	10	80	Y
Nankeen Kestrel	*Falco cenchroides*	1	15	60	Y
Nankeen Kestrel	*Falco cenchroides*	1	5	50	Y
Nankeen Kestrel	*Falco cenchroides*	1	15	40	N
Nankeen Kestrel	*Falco cenchroides*	1	10	60	Y
Nankeen Kestrel	*Falco cenchroides*	1	10	80	Y

Table 43. Flight details of raptor and threatened birds species determined as possibly at-risk of colliding with turbines (autumn 2016).

Common name	Scientific name	Total movements	Min height (m)	Max height (m)	At-risk flights recorded Y/N
Wedge-tailed Eagle	*Aquila audax*	1	10	45	Y
Wedge-tailed Eagle	*Aquila audax*	1	10	15	N

Wedge-tailed Eagle	*Aquila audax*	1	10	40	N
Wedge-tailed Eagle	*Aquila audax*	1	300	350	Y
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N
Nankeen Kestrel	*Falco cenchroides*	1	10	30	N
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N
Nankeen Kestrel	*Falco cenchroides*	1	10	40	N
Nankeen Kestrel	*Falco cenchroides*	1	10	50	Y
Nankeen Kestrel	*Falco cenchroides*	1	20	30	N
Nankeen Kestrel	*Falco cenchroides*	1	40	50	Y
Nankeen Kestrel	*Falco cenchroides*	1	60	80	Y
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N

Table 44. Flight details of raptor and threatened birds species determined as possibly at-risk of colliding with turbines (winter 2016).

Common name	Scientific name	Total movements	Min height (m)	Max height (m)	At-risk flights recorded Y/N
Wedge-tailed Eagle	*Aquila audax*	1	35	120	Y
Wedge-tailed Eagle	*Aquila audax*	1	15	60	Y
Brown Falcon	*Falco berigora*	1	25	35	N
Brown Falcon	*Falco berigora*	1	0	5	N
Brown Falcon	*Falco berigora*	1	15	40	Y
Brown Falcon	*Falco berigora*	1	0.5	2.5	N
Nankeen Kestrel	*Falco cenchroides*	1	20	35	N
Nankeen Kestrel	*Falco cenchroides*	1	20	35	N
Nankeen Kestrel	*Falco cenchroides*	1	25	50	Y
Nankeen Kestrel	*Falco cenchroides*	1	10	20	N
Nankeen Kestrel	*Falco cenchroides*	1	2	10	N
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N
Nankeen Kestrel	*Falco cenchroides*	1	5	10	N
Nankeen Kestrel	*Falco cenchroides*	1	40	85	Y
Nankeen Kestrel	*Falco cenchroides*	1	2	10	N
Nankeen Kestrel	*Falco cenchroides*	1	5	40	N
Nankeen Kestrel	*Falco cenchroides*	1	5	15	N
Nankeen Kestrel	*Falco cenchroides*	1	40	85	Y

Nankeen Kestrel	*Falco cenchroides*	1	5	60	Y
Nankeen Kestrel	*Falco cenchroides*	1	0.5	4	N
Nankeen Kestrel	*Falco cenchroides*	1	25	35	N
Nankeen Kestrel	*Falco cenchroides*	1	2	10	N
Nankeen Kestrel	*Falco cenchroides*	1	20	80	Y
Nankeen Kestrel	*Falco cenchroides*	1	25	35	N
Nankeen Kestrel	*Falco cenchroides*	1	5	15	N
Nankeen Kestrel	*Falco cenchroides*	1	20	30	N
Nankeen Kestrel	*Falco cenchroides*	1	1	30	N
Nankeen Kestrel	*Falco cenchroides*	1	2	20	N
Nankeen Kestrel	*Falco cenchroides*	1	5	15	N
Nankeen Kestrel	*Falco cenchroides*	1	10	15	N
Nankeen Kestrel	*Falco cenchroides*	1	1	5	N
Nankeen Kestrel	*Falco cenchroides*	1	6	15	N
Nankeen Kestrel	*Falco cenchroides*	1	8	15	N
Nankeen Kestrel	*Falco cenchroides*	1	5	15	N
Nankeen Kestrel	*Falco cenchroides*	1	10	20	N
Nankeen Kestrel	*Falco cenchroides*	1	5	0.5	N
Nankeen Kestrel	*Falco cenchroides*	1	10	15	N
Nankeen Kestrel	*Falco cenchroides*	1	10	20	N
Nankeen Kestrel	*Falco cenchroides*	1	5	15	N
Nankeen Kestrel	*Falco cenchroides*	1	10	25	N
Nankeen Kestrel	*Falco cenchroides*	1	8	15	N

5.3.9 Bats

Bat surveys were performed on the nights of 9 and 10 September 2015. Two AnaBat devices were used over both nights however one AnaBat failed to work on the second night. Survey sites were located within wooded areas or near surface water located within the project area (Figure 7).

A second bat survey was performed over four nights in February and March 2016. This survey utilised three AnaBat devices. The sites chosen for the survey repeated within wooded areas or near surface water located within the project boundary, that were selected in September 2015.

The AnaBat survey in September 2015 confirmed the presence of seven bat species (Table 45):

- White-striped Free tail-bat (*Austronomus australis*)
- Gould's Wattled Bat (*Chalinolobus gouldii*)

- Chocolate Wattled Bat (*Chalinolobus morio*)
- Southern Free tail-bat (*Mormopterus species 4)*
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
- Large Forest Bat (*Vespadelus darlingtoni*) and
- Southern Forest Bat (*Vespadelus regulus*).

Sample AnaBat files taken from six of the bat species, is shown in Appendix 3.

Three bat species that were identified as potentially occur within the project boundary (based on potential habitat and distribution of the species), but were undetected during the surveys, were:

- Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*) (State rare);
- Inland Broad-nosed Bat (*Scotorepens balstoni*); and
- Little Forest Bat (*Vespadelus vulturnus*).

It is possible that these species would occur, although only infrequently and in low numbers. Hence, the potential risk of impact to these species is considered to be very low.

None of the recorded bat species have a conservation rating. The number of AnaBat calls recorded for each species are summarised in Table 45. Refer to Figure 7 for the location of the bat survey sites. Due to overlapping call frequencies and/or insufficient call quality, some of the bat calls could not be ascribed to a particular species.

Based on the total number of AnaBat calls and captures, the Gould's Wattled Bat was the most common species. The number of calls may not reflect abundance, but would suggest the project site is subject to a relatively low level of bat activity; this may also be due to the fact the majority of the project site is void of suitable habitat for bats.

The AnaBat survey in February/March 2016 confirmed the presence of at least seven bat species (Table 46). Again, based simply on amount of calls recorded, the Gould's Wattled Bat was the most common species.

The bat species detected onsite are thought to be common throughout the region with the majority of bats recorded, being within the vicinity of habitat features such as woodlands and open water. Adopting buffers between turbines and avoiding identified bat habitat features can minimise significant impacts on bat species using the site.

Table 45. Bat survey results September 2015.

Species	Common name	Conservation status		AnaBat	No. calls recorded Sept 2015^
		Aus	SA		
Austronomus australis	White-striped Free tail-bat			✓	155
Chalinolobus gouldii	Gould's Wattled Bat			✓	171

Species	Common name	Conservation status		AnaBat	No. calls recorded Sept 2015^
		Aus	SA		
Chalinolobus gouldii or Mormopterus species 4 "big dick"				✓	65
Chalinolobus morio	Chocolate Wattled Bat			✓	42
Mormopterus species 4 "big dick"	Southern Free tail-bat			✓	18
Nyctophilus geoffroyi	Lesser Long-eared Bat			✓	25
Vespadelus darlingtoni	Large Forest Bat			✓	
Vespadelus regulus	Southern Forest Bat			✓	8

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.

^Note: The number of AnaBat calls recorded is not necessarily indicative of abundance. Multiple calls could constitute a single bat flying past the AnaBat detector numerous times, or multiple individuals. Bat activity levels also vary depending on the weather conditions. Generally high activity is recorded on warm nights. Results should not be compared within and between survey periods due to different survey effort and weather conditions.

Table 46. Bat survey results February/March 2016.

Species	Common name	Conservation status		AnaBat	No. calls recorded Sept 2016^
		Aus	SA		
Austronomus australis	White-striped Free tail-bat			✓	9
Chalinolobus gouldii	Gould's Wattled Bat			✓	713
Chalinolobus gouldii or Mormopterus species 4 "big dick"				✓	75
Chalinolobus morio	Chocolate Wattled Bat			✓	62
Mormopterus species 3 or4	Southern Free tail-bat			✓	45
Nyctophilus geoffroyi	Lesser Long-eared Bat			✓	310
Vespadelus darlingtoni	Large Forest Bat			✓	3
Vespadelus regulus	Southern Forest Bat			✓	32

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.

^Note: The number of AnaBat calls recorded is not necessarily indicative of abundance. Multiple calls could constitute a single bat flying past the AnaBat detector numerous times, or multiple individuals. Bat activity levels also vary depending on the weather conditions. Generally high activity is recorded on warm nights. Results should not be compared within and between survey periods due to different survey effort and weather conditions.

6 DISCUSSION

6.1 Flora

In total, 168 flora species were recorded during the 2015 and 2016 field surveys, including 76 exotic species (which equates to 45% of the total number of flora species). All vegetation associations exhibited a degree of weed invasion and damage from stock. Out of the 76 weed species recorded, one was a Weed of National Significance (African Boxthorn), eight were classified as declared under the *Natural Resources Management Act 2004 (*NRM Act), and 13 as environmental weed species.

Appendix 1 summaries the flora species recorded in each of the 11 vegetation associations (including exotic species). The most widespread native species included *Austrostipa species, (Spear grasses), Aristida behriana (Brush-wire Grass), Lomandra effusa* (Scented Mat-rush), *Eucalyptus odorata* (Peppermint Box), *Eucalyptus leucoxylon* (South Australian Blue-Gum) and *Ptilotus spathulatus* (Pussy-tails). The most common weeds included *Avena barbata* (Wild Oats), *Ehrharta longiflora* (Annual Veldt Grass), *Erodium cicutarium* (Cut-leaf Heron's-bill), *Bromus species* (Brome), *Hordeum* spp. (Barley grass), *Marrubium vulgare* (Horehound) and *Medicago polymorph*a ssp. *polymorpha* (Burr-medic). *Scabiosa atropurpurea* (Pincushion) and *Brassica* sp. were common along roadsides. Many exotic species were present across all vegetation associations.

No flora species of National or State conservation significance were recorded during the spring 2015 survey. However, four species with a state conservation rated flora species are known to occur within the project boundary through the BDBSA database results: *Maireana rohrlachii* (Rohrlach's Bluebush), *Ptilotus erubescens* (Hairy-tails), *Rumex dumosus* (Wiry Dock) and *Eucalyptus behriana* (Broad-leaf Box). The former three species have records scattered throughout the turbine area (Figure 10). *E. behriana* occurred on the northern side of Dutton Road directly adjacent (but outside) the proposed transmission line corridor. *Cryptandra campanulata* (Long-flower Cryptandra) was also determined as likely to occur within the project boundary based on last records and their proximity to the project site.

Maireana rohrlachii is found in sandy clay loam, limestone plain and open mallee. *Ptilotus erubescens* typically occurs within better quality habitat, such as relatively fertile soils of grasslands and woodlands. *R. dumosus* occurs on loamy or sandy soils, but also on clays. Impact on these species would be low, if vegetation determined as preferred habitat was not removed. *Eucalyptus behriana* grows on sites that retain soil moisture better than surrounding sites, usually on heavy soils in slight depressions or in gently undulating terrain (Nicolle, 2013).

Two ecosystems on the ‘Provisional List of Threatened Ecosystems of South Australia’ were observed during the field surveys: *Lomandra effusa* Grassland (Endangered) and *Eucalyptus odorata* (Peppermint Box) +/- *Eucalyptus leucoxylon* (South Australian Blue Gum) Grassy Low Woodlands (Endangered). Ecosystems are not currently officially protected under South Australian legislation. However, both vegetation communities are protected under the EPBC Act if their condition is sufficient and qualifies as condition Class A or B as outlined under EPBC Act requirement.

Lomandra Grasslands and Peppermint Box Woodlands across the project site were assessed against EPBC Act criteria.

Peppermint Box woodland occurred along the proposed transmission line near Biele Road. These areas could largely be avoided when considering the location of transmission line infrastructure. Out of the three Peppermint Box sites assessed in summer, none of them qualified for listing at the time of the survey (summer). The sites were categorised as Class C and are not protected under the EPBC Act, but are considered amenable to rehabilitation. However, if surveyed during spring when more plants are in their visible life phase, site 1 is considered likely to qualify, whilst site 2 is considered to possibly qualify. Another area of Peppermint Box just north of Biele Road was visited in April 2017, as part of the finalistaion of the transmission line. From observations made, it appeared degraded and may not qualify for the EPBC listed TEC. The proposed transmission line was amended to avoid the area likely to qualify (Site 1), but a small area of Site 2 may be subject to some clearance (Figure 38). Clearance in this area should be the minimum required for safety under powerlines and no poles should be located within the woodland. However, the impact site should be assessed in spring to determine if it qualifies as an EPBC listed community, and the final design reviewed to ensure the impact is not considered significant. Should the impact be considered significant an EPBC referral is required (if the site qualifies).

Lomandra grasslands (Association 1) occurred in patches across the project site (Figure 36). Of the 21 Lomandra sites assessed, site 18 (substation) qualified as an EPBC listed community, rated as Class B. Of the other sites, 1-16 did not qualify and were surveyed in spring which is the optimal time. These included seven sites rated as condition class C and nine sites with no rating. Site 17 was surveyed in summer, but had low diversity and was unlikely to qualify (Class C). Sites 19-21 were surveyed in early autumn when dry and all rated as Class C, but are considered likely to or possibly qualifying if surveyed during the optimal time in spring.

Condition Class C areas are typically significantly degraded (low condition), are not included as a listed ecological community and therefore do not trigger the ‘significant test’ of the EPBC Act. Class C is indicative of patches that are degraded but could be rehabilitated to the listed ecological community through measures such as weed control, natural regeneration and protection from grazing. Areas that did not qualify in any class were highly degraded, but should still be avoided where possible.

Lomandra sites that qualify or are likely to qualify for EPBC listing were located in the eastern half of the area proposed for the terminal substation. The western half of this area comprised degraded Lomandra grasslands or cropping and any infrastructure should be targeted for this area to minimise impact and avoid a possible EPBC referral. Based on these findings, the terminal substation was positioned in cropping land, Austrostipa grassland and only a small degraded patch of Lomandra grassland (Figure 37). An EPBC referral is unlikely to be required for *Lomandra* grassland based on the current design. However, there is *Lomandra* grassland further west along the Transmission Line that may be impacted (site 17) and a spring survey is recommended to confirm that area is not EPBC listed.

6.2 Fauna

6.2.1 Habitat

The project site is generally void of good quality vegetation to sustain significant fauna diversity, although some pockets do exist. Diversity across the different fauna classes was average; 48 bird species were recorded, five species of reptile, two species of amphibian, three species of native mammal (excluding bats) and seven species of bat (during the spring 2015 survey). There were a high number of exotic birds and weed species recorded during the spring 2015 survey. The main focus of the proposed Twin Creek Wind Farm will be minimising vegetation clearance of any remaining/scattered woodland areas within the infrastructure zone as well as micro-sighting to avoid known PBTL habitat.

The vegetation communities in best condition, scoring up to 6:1, were Association 4 (*E. leucoxylon* +/- *E. porosa* open woodland), Association 10 (*Eucalyptus camaldulensis* ssp. *camaldulensis* +/- *Eucalyptus leucoxylon*) and Association 11 (*Eucalyptus leucoxylon* Tall Open Woodland over shrubby understorey).

Association 4 lies mainly within the project boundary but outside of the infrastructure zone, with areas scoring 6:1 outside of the current impact footprint. The woodland areas mapped within the project site typically contained medium/large hollows, in particular *E. odorata* open woodland (Association 7) and *E. leucoxylon* open woodland (Association 4) (Figure 49). Scats and feathers were observed at the entrance of some of the hollows. This indicates that bird species are likely to utilise hollows for protection and breeding. A single Tawny Frogmouth (*Podargus strigoides*) was observed in Association 7, which demonstrates this species ability to utilise favourable habitat in an otherwise fragmented landscape (Figure 50).

6.2.2 Bird guilds

The project site is within a fragmented landscape so it makes sense that species in a community such as this, will exploit the same set of resources in a similar manner. For instance waterfowl, parrots and woodland birds were present within the project site. Waterfowl included White-necked Heron, Eurasian Coot, Australian Reed Warbler, White-faced Heron, Pacific Black Duck and Australian Wood Duck. The parrot family included the Red-rumped Parrot, Adelaide Rosella and Blue-winged Parrot, and there was a good spread of woodland birds including: the Striated Pardalote, Varied Sittella, Rufous Whistler, Grey Fantail, Yellow-rumped Thornbill, White-plumed Honeyeater, Red Wattlebird and Black-faced Cuckoo-shrike. The Red-rumped Parrot also took advantage of a human modified resource, such as a feeding lot, to supplement their diet (Figure 51).

There were raptor species that were recorded within the 20km BDBSA data that were not recorded onsite (see Appendix 4). These include species such as the Black Falcon (*Falco subniger*) and Little Eagle (*Hieraaetus morphnoides*), which may be transient through the proposed wind farm area. The Little Eagle is considered widespread, but uncommon. It is widespread over diverse habitats, including woodland, open scrub, and open country intermixed with wooded hills across farmland, irrigated land. The Black Falcon uses tree-lined water-courses, isolated stands of trees. This species typically hunts over wetlands,

temporary waters where prey is abundant. It is considered uncommon; migratory with main stronghold and breeding region in the interior of Queensland and North West Victoria. Like many other raptor species, there is some risk of bird strike from wind turbines, however it is difficult to predict based on no observations and there no flight heights recorded for both these bird species (and others that were not recorded onsite).

Figure 49. Medium to large hollows was observed within *E. leucoxylon* +/- *E. porosa* open woodland).

Figure 50. A single Tawny Frogmouth was observed in the small patch of Association 7 (intersection of Newlands Road and Ben Lomond Road.

Figure 51. Red-rumped Parrots utilising feeding lots placed within open woodland areas.

6.2.3 Threatened bird species

Two birds of conservation significance were recorded during the spring 2015 survey.

Rainbow Bee-eater

The Rainbow Bee-eater is listed as migratory under the EPBC Act. It is distributed across much of mainland Australia. The number of locations that the Rainbow Bee-eater occurs in is unknown, and has not been estimated. It is assumed that the species is widespread given its ability to undertake long-distance movements (Barrett *et al*. 2003), and will migrate to southern Australia, and remain from spring to summer. The Rainbow Bee-eater occurs in open woodlands and shrubland, including mallee, and in open forests that are usually dominated by eucalypts. It also occurs in grasslands (Gibson 1986) as well as riparian, floodplain or wetland areas in semi-arid and arid areas (Badman 1989). As the Rainbow Bee-eater is a predictable seasonal visitor to the project area, it is unlikely regional populations would be impacted upon by the proposed wind farm. Flight height and behaviour are generally unknown for this species to be able to make further conclusions.

Blue-winged Parrot

The State rated Blue-winged Parrot has a preference for open woodland, cropland and open country, where it feeds on the seeds of native and introduced grasses. They are locally nomadic, and can be often encountered in flocks of 20-100 or more during the non-breeding season. Come the breeding season, Blue-winged parrots tend to be found in pairs or small parties. Like other *Neophema species,* they are quiet, unobtrusive and predominantly forage on the ground. The flight pattern of the Blue-winged Parrot is

high, swift and direct. Blue-winged Parrots are partly nomadic and may be encountered in the company of the Elegant Parrot. The habitats within which they occur include: heathland, open country, open woodland, cropland, and semi-arid scrub. They feed on the seeds of native and introduced grasses as well as shrubs and herbaceous plants. Blue-winged Parrots nest in the cavities of small trees.

Woodland areas with tree hollows should be avoided during the construction of the wind farm and existing tracks will be used where possible, rather than creating new tracks through pasture grass sites and cropland.

6.2.4 Mammals

With the exception of bat species, three mammal species were recorded during the spring 2015 survey.

Euro and Western Grey Kangaroo

There were only two Euro's observed during the spring 2015 survey; a higher number of Western Grey Kangaroos (*Macropus fuliginosus*) utilised the project area for grazing. There is unlikely to be any impact on these species as part of the proposed wind farm development.

Southern Hairy-nosed Wombat (Lasiorhinus latifrons)

A total of six Southern Hairy-nosed Wombats were observed in spring 2015 and winter 2016. Most of their warrens are situated on the edges of drainage areas throughout the project area (Figure 52). The Southern Hairy-nosed Wombat does not have a national or state conservation status. Populations are known from the project area and their presence is often indicated by their extensive burrow networks. Southern Hairy-nosed Wombats are primarily grazers, mainly feeding on native grasses. Population levels fluctuate with climatic conditions, with declines observed during drought conditions. Potential impacts associated with the development may include mortality via collision and damage to burrow systems associated with vehicle access. Such impacts are considered localised; enforcement of speed limits as part of on-site management would reduce this risk.

Bats

There are significant knowledge gaps regarding the diversity, distribution and abundance of bat species in the region. Species thought to be once common may now be regionally threatened. Based on AnaBat recordings and trapping, at least seven bat species are known to inhabit the project area.

AnaBat data enables the identification of most bats to species level, but is not a suitable measure of abundance, given the number of calls recorded may be related to the activity of one individual or many, and detection depends on a number of other factors such as microphone sensitivity and climatic conditions.

Some calls fall in to the overlap of parameters between two species and species identification cannot be confirmed without trapping.

AnaBat calls were captured within a range of the habitats present. Bats forage around woodland vegetation, in open space and over open water, dependent on the species foraging strategies. Many bat

species found in South Australia use an 'edge-space' aerial foraging strategy focused on treed habitat and water bodies, and are expected to stay within close proximity to these features (Churchill 2008). This is generally the case for the bat species recorded during the field survey.

Figure 52.Southern Hairy-nosed Wombat and its offspring sitting on a burrow.

Linear features such as roads, drains and ridges have been recorded to have high bat activity (often associated with vegetation or water) and bats have been observed to navigate and forage along the length of these features (Churchill 2008). Higher bat activity levels are generally observed in wooded areas, where bat foraging and roosting habitat is abundant.

Although not recorded, the Yellow-bellied Sheath tail Bat (*Saccolaimus flaviventris*) listed as rare under the NPW Act may potentially exist in the project area. Although this species occurs across much of Australia, it is never found in large numbers. The species migrates from northern Australia into south-eastern Australia during the summer months (Churchill 2008). All records of this species from the region are from late March to early June, suggesting that it is an autumn migrant (Kahrimanis *et al.* 2001). This species is considered an occasional seasonal visitor that may roost temporarily in tree hollows within the project area.

The Yellow-bellied Sheath tail Bat flies predominately above the tree canopy, thus it is rarely trapped or detected via AnaBat. The flight height of this species makes it potentially vulnerable to turbine strike, however, given it is an infrequent visitor, the overall risk to the species is considered low. The species prefers large hollow trees and is therefore also threatened by the clearance of such trees.

Some suitable bat roosting habitat was present in woodland associations within the project area. Any clearance of such habitats would result in direct removal of potential roosting habitat for bats, and possibly the destruction of roosting bats. Clearance of any roosting habitat should be avoided, especially given low levels of remnant vegetation within the region (Graham *et al.* 2001).

Bat-strike interactions are possible during the operation of proposed wind turbines in the project site; this is based on the fact the site is generally devoid of trees and vegetative cover. Although it is not known which species may fly within the rotor-swept area, it is expected that several species may have interactions with turbines within the project area. Little is known about the effect of operating turbines on bat behaviour, whether bats avoid turbines or not, and the actual number of bat-strikes that have been caused by operational wind farms in Australia (T. Reardon pers. comm. 2011).

Most of the bat species likely to occur at the site forage within and around woodland vegetation, which is limited onsite. The interaction between such bat species and turbines can be reduced by implementing a buffer between turbines and wooded habitats. Bat species with open space foraging strategies are difficult to avoid since they may forage throughout the project area, up to 100 m in height.

Without more detailed knowledge of the bat species present, their distribution and their behaviours in the project area (pre/post construction and during operation), it is difficult to accurately assess the impacts of the proposed wind farm on bats. Ideally, on-going monitoring of bat populations would be undertaken to gain a better understanding of their regional status and utilisation of the site. A methodology should be developed for detecting bat-strikes that may occur during the operational stages of the wind farm, as well as a procedure for reporting bat-strikes that may occur.

6.2.5 Flinders Ranges Worm-Lizard

Flinders Ranges Worm-lizard (*Aprasia pseudopulchella*) was not targeted during this survey; however potential habitat for this species exists within the project area. Suitable habitat for this species includes unploughed grasslands, particularly where flat surface rocks occur in the landscape, and woodland areas containing loose woody debris and leaf litter.

The Flinders Ranges Worm-lizard is a very small, worm-like, burrowing lizard with poorly developed hind limb flaps (Figure 53). It burrows freely in loose sand and soil, under rocks and litter in open woodland, native tussock grassland, riparian habitats and rocky isolates. It prefers stony soils, or clay soils with a stony surface, and has been found sheltering beneath stones and rotting stumps or occasionally in ant and termite nests. Their diet consists almost entirely of the larvae and pupae of ants.

The Flinders Worm-lizard is endemic to South Australia and although it has a national conservation rating, it does not have a state conservation rating. At the time (approximately 1993) when the national conservation rating was assigned to this species, little was known about its habits and abundance (M Hutchinson. pers. comm.). Since the early 1990s, this species has been found at numerous sites. The state conservation ratings have been updated more recently than the national ratings, which have caused the difference between the two.

Figure 53. Image of a nationally vulnerable Flinders Ranges Worm-lizard (EBS 2004).

6.2.6 Pygmy Blue-tongue Lizard

The PBTL is the smallest member of the genus *Tiliqua*, which consists of seven terrestrial lizard species commonly known as Blue-tongues. The PBTL is a moderate sized skink which has a total length of less than 20 cm. It has a relatively heavy body, large head and short limbs. Its body colour varies from grey brown to orange brown, and may include a series of black flecks along the back and flanks. The distinct orange coloured eye and black pupil are other distinguishable features of the species (Figure 54).

Figure 54. Pygmy Blue-tongue Lizard.

Refuge, movement, breeding and diet

Pygmy Blue-tongue Lizards use un-occupied spider burrows as refuges, basking sites and ambush points. The entrance holes are circular in cross section, up to 20 mm in diameter, and lack any sign of excavated soil at the entrances. The average depth of holes is approximately 25 cm, ranging from 10 to 75 cm. These holes appear indistinguishable from holes inhabited by mygalomorph and lycosid spiders (Figure 55). The lizards make no obvious external modifications to the holes, except for a slight bevelling of the edges caused by their movement. Pygmy Blue-tongue Lizards may deposit scats near the perimeter of the burrow entrance (A. Fenner, pers. comm., 2010). Burrow entrances are used as vantage points from which lizards are able to make short forays after any prey detected nearby. The lizards are extremely sensitive to both movement and noise. Only one adult lizard is found in each active burrow.

The PBTL is a largely sedentary species, with most adults in a three-year study by Milne (1999, cited in Milne and Bull 2000) moving no greater than 20 m from their burrows. The males are more active than females during spring, most likely searching for mating partners. The PBTL has a spring mating season (October and November) (Milne and Bull 2000) and bears live young, like the other *Tiliqua* species. Males can reproduce from one year of age and females are sexually mature from approximately three years of age, and can have up to four young each season. Young are born between January and March, and disperse from the mother's burrow within weeks of their birth to find burrows of their own (Clarke 2000; Duffy *et al.* 2009; Milne and Bull 2000).

Figure 55. A Wolf Spider (*Lycosa* sp.) next to its hole (note: the tip of the Burrowscope is 6 mm).

Conservation status

The PBTL is currently listed as nationally endangered under the *Environment Protection and Biodiversity Conservation Act 1999* and endangered in South Australia under the *National Parks and Wildlife Act 1972*. These classifications are consistent with the International Union for Conservation of Nature (IUCN) (2001) criteria for listing species on the IUCN Red List System (Duffy *et al.* 2009).

Distribution and populations

The PBTL is endemic to South Australia, where their population is severely fragmented (Duffy *et al.* 2009). Very little information exists on the past distribution of the species, with the few known localities extending from the Adelaide Plains to the North Mount Lofty Ranges (Duffy *et al.* 2009). The relative abundance of PBTL in European collections of specimens in the 19th century suggests that the species was formerly more common, and has undergone a marked decrease in distribution (Shea 1992, in Duffy *et al.* 2009).

The PBTL is now known from 27 sites, ranging from north of Port Wakefield in the Hummocks to south of Peterborough and west of Clare (Duffy *et al.* 2009) (Figure 56). All known populations are located on private land, most of which are used for sheep grazing. They are generally surrounded by unsuitable habitat, usually cropped agricultural land. However, the full extent of most populations has not yet been determined, and it is possible that some apparently isolated localities belong to single contiguous populations (J. Schofield pers. comm.). From previous studies completed in the southern area of the wind

farm development area, EBS has mapped where these previous records were found (DEWNR 2016) (Figure 57).

The total population size of the PBTL is uncertain (Duffy *et al.* 2009). Prior to 2000, the population was estimated to be around 5000 lizards, based on 10 known populations. Since this time, another 17 populations have been discovered. Suitable habitats are largely on private land, therefore historically surveys were not as accessible. However, due to the PBTL Recovery Plan efforts, university studies and also by wind farm surveys, surveys of PBTLs have increased in the last few years. Since 2000, another 17 populations have been discovered. Overall population numbers are hard to estimate due to the fluctuations in the population numbers (M. Hutchinson pers. comm.).

Habitat requirements

Pygmy Blue-tongue Lizards are known to occupy native grassland habitats (Milne 1999). Even highly degraded grasslands (dominated by exotic species) are potential habitat, providing that the area is unploughed and the soil structure remains intact (J Schofield pers. comm. 2008). The species has been recorded at sites dominated by species including *Austrostipa* spp. (Spear-grasses), *Austrodanthonia* spp. (Wallaby Grasses), *Maireana* spp. (Bluebush), *Aristida behriana* (Brush Wire-grass) and *Lomandra* spp. (Iron-grasses) (Hutchinson *et al.* 1994, Souter *et al.* 2007, in Duffy *et al.* 2009).

Refuge requirements

A study into the habitat requirements of the species (Souter 2003, in Duffy *et al.* 2009) indicated that the abundance of the species within grasslands was dependent on the availability of deep spider burrows in well-draining soils. Suitable lizard burrows were absent or scarce in areas that lacked native grassland or had a dense cover of introduced species.

Soil which is either not deep enough or free-draining enough inhibits spiders from constructing suitable burrows, and therefore these areas lack habitat suitable for PBTLs. The lizards tend to be present in greatest densities on the lower slopes of hillsides, where the soil and consequently the spider burrows are deepest (Schofield 2006, in Duffy *et al.* 2009).

The habitat and targeted PBTL surveys determined that suitable habitat was identified across the entire project site, with the exception of cropping, steep/rocky areas and drainage areas. A total of six PBTLs were observed during the habitat survey (spring 2015), while 115 individuals were observed during the targeted surveys.

The southern area of the wind farm development area has optimal habitat for the species, which consist of gentle sloping rolling hills with plenty of spider holes. The northern section still has PBTLs present however, they are typically in lower densities where infrastructure is proposed. Utilising cropping areas as much as possible for major infrastructure layouts will reduce the impact to PBTL habitat. The potential

impacts of a wind farm development within the project area on PBTL Lizard individuals or populations may include the following:

Short-term

- Potential direct loss of individuals through habitat clearance during construction;
- Sedimentation of burrows from construction run-off (soil); and
- Noise and vibration disturbance during construction.

Long-term

- Potential loss of habitat;
- Division and isolation of sub-populations by vehicular access tracks;
- Sedimentation of burrows from run-off from access tracks; and
- Potential disturbance to populations in close proximity to turbines from blade shadow flicker.

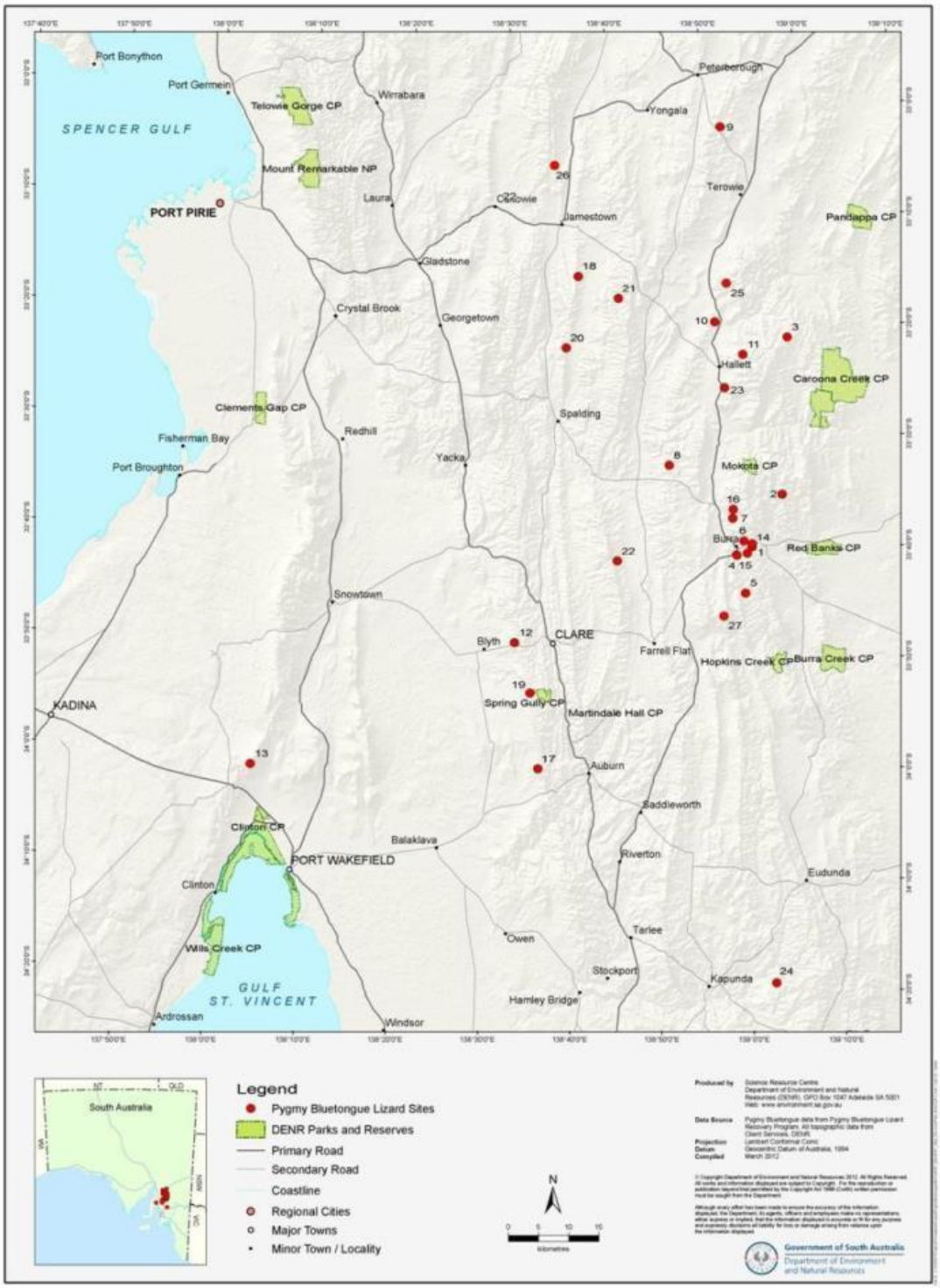


Figure 56. Known Pygmy Blue-tongue Lizard sites (2012).

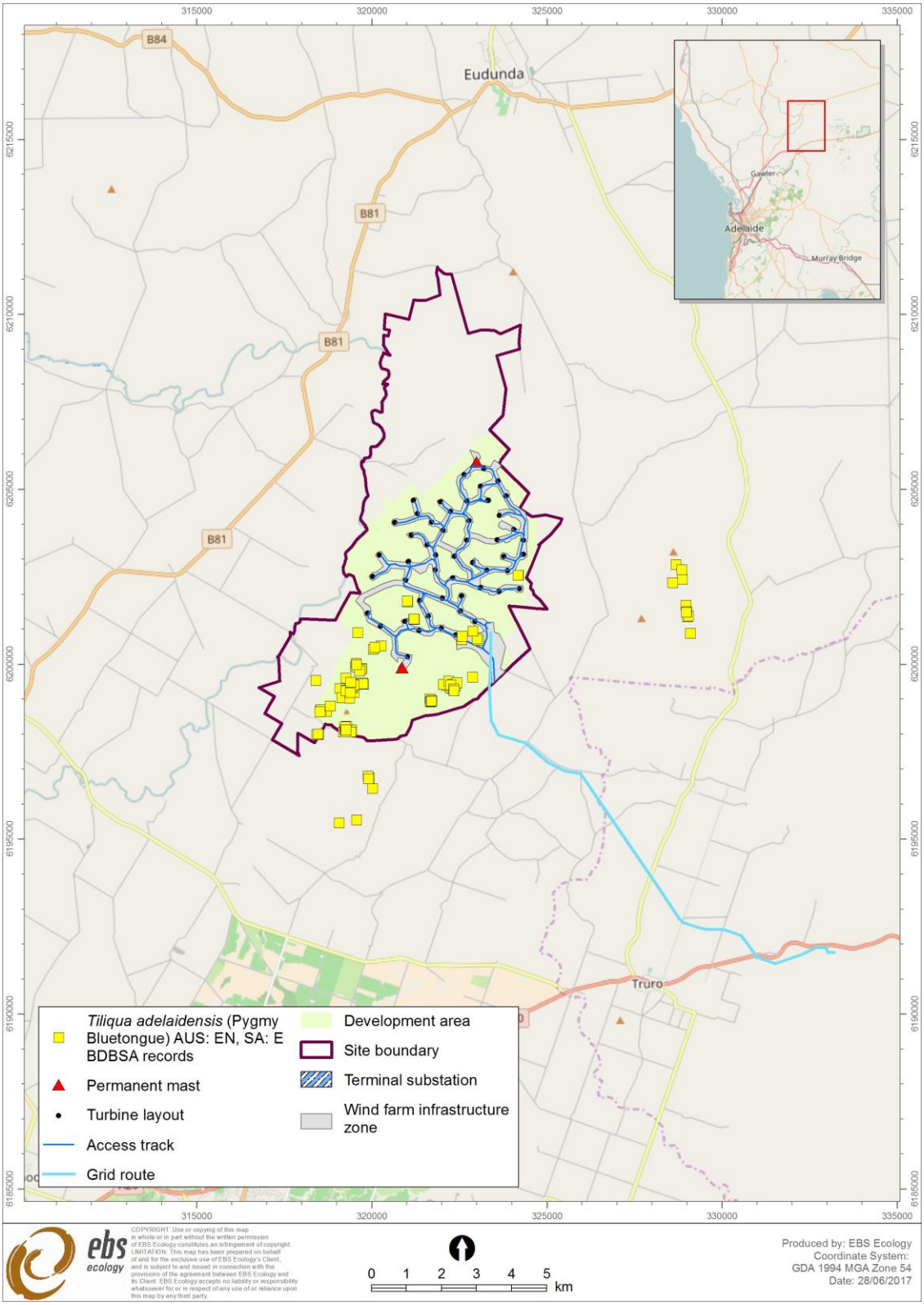


Figure 57. Known PBTL records within the project boundary.

Translocation Plan and PBTL Offset

An impact assessment on the PBTL will be conducted as part of the EPBC referral process for this project, and which is a deliverable that RES has committed to. A suitable offset will also be calculated and developed as part of the impact assessment process. This will be based on the calculated impacts on the species and offsetting the residual impact of the project on the PBTL.

A translocation plan for the species will also be developed as part of the impact assessment process. Possible translocation suitability is shown in Figure 58; though PBTL were located in many of the transmission corridors, the potential for a translocation from those which are likely to have a low abundance of PBTL is most plausible.

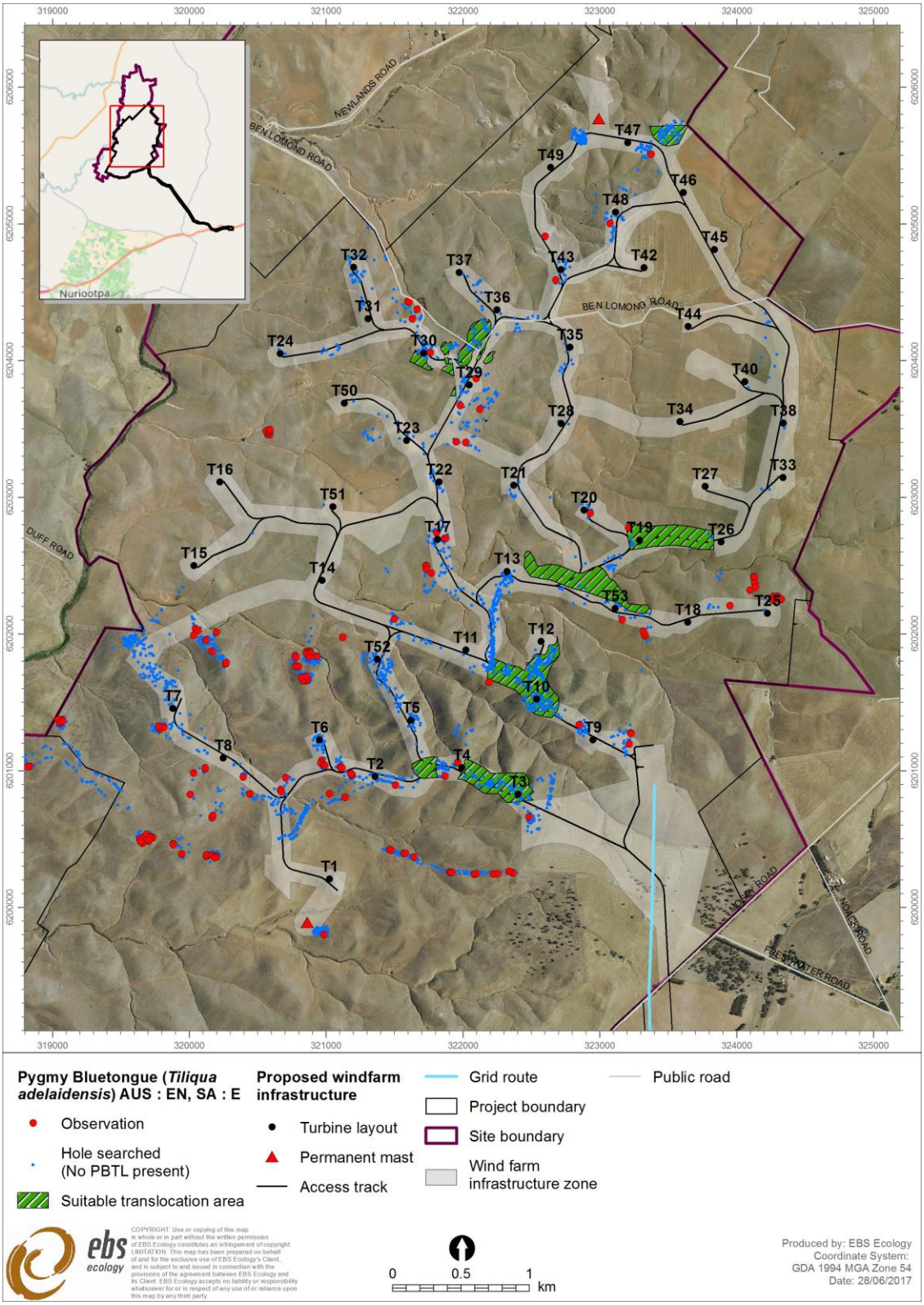


Figure 58. Possible translocation PBTL suitability.

6.3 Reducing impacts to raptors via nest buffers

A range of direct and indirect impacts of wind farms on birds are recognised with mortality via direct collision with turbines being an obvious impact. Other impacts include displacement due to habitat loss and various types of disturbance effects (Drewitt and Langston 2006). There is little available data on the disturbance effects of wind farm developments on birds in Australia.

Suitable buffers need to be considered in the planning process in order to reduce the likelihood of impacts on birds in the area. Buffers are primarily aimed at reducing the disturbance to the birds during breeding season and when juveniles are near fledging. Raptor species such as the Wedge-tailed Eagle and Peregrine Falcon are considered significant when assessing bird interactions with wind farms, as they conduct regular flights at heights coinciding with turbine rotor swept areas (where turbine blades operate).

The benefit of a buffer around nests is as follows:

- Buffers are generally focussed around areas of high activity; these are where either species may potentially nest
- During the construction of the proposed wind farm, raptor species are more likely to be at risk of disturbance from activities conducted within close proximity to nest locations. By implementing a buffer, this would contribute to decreasing disturbance levels to these species
- Wedge-tail Eagles are territorial and typically return to the same area to nest each year. By placing a buffer distance around the nest location, this would assist with lessoning disturbance levels to this species.
- Juveniles are particularly susceptible to collision, as newly fledged chicks have not learnt how to forage on their own nor avoid structures such as turbines. Buffers around nest sites will assist in decreasing the chance of a juvenile eagle or falcon colliding with a turbine.

6.4 Collision risks

6.4.1 Bird species

One of the principal risks to birds and bats posed by turbines is the potential for individuals to be killed as a result of collision with moving rotor blades (Smales 2006). However, a recently published study from Tasmania by Hull *et al* (2013) suggests that the likelihood of collision for different species is not related to their abundance on site. Findings showed that approximately 18% (of 85 species) and 21% (of 77 species) of all bird species recorded at two sites were reported to have collided with a turbine. The number of species found during carcass searches is likely to be higher, with 82 and 14 records (at the two sites) not being able to be identified to species level (feather spots were recorded).

There are also complexities in the assessment of collision risk for bird species, with species clearly displaying avoidance behaviour within wind farms. Hull and Muir (2013) found that whilst avoidance behaviours varied dependent on species and site, raptors generally displayed a high avoidance rate. This

means that they have actively changed their behaviour to avoid turbines. The study by Hull and Muir (2013) concentrated on White-bellied Sea-eagles (*Haliaeetus leucogaster*) and Wedge-tailed Eagles (*Aquila audax fleayi* (Tasmanian subspecies)) and found that both species actively change their flight paths to avoid turbines. It was also found that Wedge-tail Eagles have a higher avoidance rate in bad weather (rainy and windy weather) (Hull and Muir 2013).

6.4.2 Bat species

The potential impacts of wind turbines on bats are another complex area. Bat collisions have been reported at wind farms in Australia, but few published studies are available. Barotrauma, an impact that is thought to be caused by a sudden drop in pressure around turbine blades, has been suggested as a potential cause of bat deaths at wind farms overseas, but the incidence of barotrauma has been recently queried (Grodskey et al. 2011; Rollins et al. 2012). Collisions with blades are considered to be the primary cause of fatality. In the most extensive Australian study undertaken on the impact of wind farms on bats, Hull and Cawthen (2013) found 54 bat carcasses across two wind farm sites within an eight year period. This is likely to be an underestimation based on survey design, detectability of carcasses and scavenging of carcasses. However, the focus of the Hull and Cawthen (2013) study was to determine the bat species colliding with turbines. It was found that of the 54 carcasses, 38 were of Gould's Wattled Bat (*Chalinolobus gouldii*), 14 were likely to be Gould's Wattled Bat and two were likely to be Forest Bats (*Vespadelus sp.*). Both of these species are open air foragers, and make flights at a moderate to high height, placing them within the at-risk zone of a turbine. Several other species, known to occur at the two study sites, were not represented by the carcasses, presumably as they are low-flying / foraging species (Hull and Cawthen 2013). Both Gould's Wattled Bat and species of *Vespadelus* have been recorded via AnaBat, and as such could be impacted by the proposed wind farm.

7 RECOMMENDATIONS

The following recommendations have been made to mitigate the significant impacts of the development of the proposed Twin Creek Wind Farm on native vegetation, threatened species and ecological communities, as well as Pygmy Blue-tongue Lizards and suitable Pygmy Blue-tongue Lizard habitat:

7.1 Pygmy Blue-tongue Lizard

- Submit an EPBC referral for the project. The presence of PBTL is known to the project site. Extensive surveys have shown that PBTL are located across the entire wind farm area, excluding cropped and small areas of unsuitable habitat. Areas which are suitable to PBTL should be avoided. Utilising cropping areas as much as possible for major infrastructure layouts will reduce the impact to PBTL habitat; the project design has taken into account this recommendation;
- Micro-site around proposed turbines and all associated infrastructure including access tracks, substations and transmission line (should pre-construction surveys identify PBTL as present). Surveys are recommended prior to construction, to determine which spider holes are occupied so as to determine the best options possible with regard to turbine and infrastructure placement;
- Micro-site the transmission line; the uncropped habitat along Flagstaff Hill Road supports PBTL on both sides of the road. It is recommended that micro-siting occurs here (should pre-construction surveys identify PBTL as present) and that the transmission is aboveground in this area (unless the road corridor can be used in some way);
- Micro-site proposed terminal substation for potential habitat and presence of PBTL;
- A translocation of PBTL from areas of less suitability is recommended which will assist with reducing potential impacts on PBTL; and
- Develop and implement a suitable offset area for PBTL with an appropriate management plan to guide future management of the offset area.

7.2 Other

- **Minimise clearance of scattered woodland / patches identified in vegetation associations across the project area;**
  A 200 m buffer between woodland areas and proposed turbine locations is recommended. This is aimed at minimising disturbance to wooded areas where woodland birds and bats are likely to roost.
- **Avoid or minimise clearance of Peppermint Box Woodland (endangered for South Australia) –** some patches containing Peppermint Box came close to qualifying. When micro-siting occurs pre- construction, it would be beneficial to assess the patches (during an optimal time of the year) that almost qualified. If Peppermint Box is affected, undertake further surveying in spring to determine with certainty if they qualify as listed communities.

- **Avoid clearance of Lomandra Grasslands that are EPBC listed, or likely to qualify.**
  Completely avoid clearance of Lomandra grasslands near sites 18-21 (eastern half of proposed substation area. If these grasslands are affected, undertake further surveying in spring to determine with certainty if they qualify as listed communities.
- **Avoid or minimise clearance of all Lomandra Grasslands where possible (endangered for South Australia) –** several patches of Lomandra almost qualified within the proposed terminal substation area. Micro site substation away from these areas, or undertake an additional survey prior to construction to determine if these areas qualify as a Class B.
- **Avoid clearance of vegetation with higher offset ratings.** This will minimise clearance of high quality vegetation as well as lowering the offset cost. General offset ratios have been provided in Section 5.2.1, whilst detailed offset values for individual areas have been supplied as mapping layers. These will be presented in the clearance report when the impact footprint is finalised.
- **Buffer known Wedge-tailed Eagle nests by 500 m;**
  Although the three nest locations are situated outside of the current project area, the infrastructure zone and boundary may change over time. Any turbine location should be at least 500 m from a known Wedge-tailed Eagle nest, to reduce likelihood of impact; the project design has taken into account this recommendation;
- **Avoid clearance near known threatened flora species records.**
  Ensure staff are made aware of the species features to assist avoiding impact. Flag or signage to protect the rare *Eucalyptus behriana* along Dutton Road.
- **Seek approval from the NVC regarding any vegetation clearance that is required and provide an appropriate SEB offset.**
  All native vegetation within the project area is protected by the *Native Vegetation Act 1991* and any proposed clearance will need to be assessed against native vegetation principles (unless under exemption). A clearance application to the Native Vegetation Council is required if the proposed infrastructure involves the clearance of native vegetation not covered by exemptions. An appropriate SEB offset area needs to be identified.

General recommendations with respect to the future development of the site:

- **Development a Weed Management Plan/Rehabilitation Plan**
  When an SEB offset is determined (when a Native Clearance Report is prepared for the Native Vegetation Council), a Weed Management Plan or Rehabilitation Plan will assist with this.

- **Construction Environmental Management Plan (CEMP)**

- **Best practice environmental management measures**
  Best practice environmental management measures should be adopted during and following the construction phase. For example, vehicles and equipment should be cleaned to ensure they are free of plant material and soil, to reduce the dispersal of exotic flora species into, out of, and within the project area. Control of declared and environmental weeds found within the site may be

required. The construction footprint should be minimised, e.g. along access tracks, in turn-around areas and around turbine pads.

- **Staff training and awareness**

  Staff working in the project area should be aware of the threatened flora and fauna species and ecological communities present and potentially present; and the potential and actual impacts of construction, operation and maintenance of the proposed wind farm on flora and fauna species and habitats. Training should reinforce staff expectations to minimise potential impacts related to on-site works, and encourage staff to report significant flora and fauna sightings.

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9 APPENDICES

Appendix 1.Flora species recorded in each of the eleven vegetation associations (including exotic species).

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Acacia acinacea	*Wreath Wattle*	*2*			√									√
Acacia argyrophylla	*Silver Mulga-bush*	*2*												√
Acacia paradoxa	Kangaroo Thorn	1			√					√				
Acacia pycnantha	*Golden Wattle*	*1,2*			√	√								√
Acacia sp.	*Wattle*	*2*				√								
Alectryon oleifolius ssp. canescens	Bullock Bush	*1,2*						√						
Allocasuarina verticillata	*Drooping Sheoak*	*2*			√	√	√					√	√	
Aristida behriana	*Brush Wire-grass*	*2*		√	√							√	√	√
Arthropodium sp.	*Vanilla-lily*	*2*		√			√	√						√
Asperula conferta	*Common Woodruff*	*2*			√									
Atriplex semibaccata	*Berry Saltbush*	*2*		√								√		
Atriplex stipitata	*Bitter Saltbush*	*2,3*		√										√
Austrostipa blackii	*Crested Spear-grass*	1		√	√		√					√		
Austrostipa eremophila	*Rusty Spear-grass*	1						√						√
Austrostipa mollis group	*Soft Spear-grass*	*1,2*					√							
Austrostipa scabra	Spear-grass	1		√	√		√							
Austrostipa scabra ssp. *falcata*	*Slender Spear-grass*	*2*			√							√		√
Austrostipa sp.	*Spear-grass*	*2*					√	√					√	
Austrostipa sp.		1		√			√	√		√	√			
Brachyscome lineariloba	Hard-head Daisy	*2*					√							
Bursaria spinosa ssp.	Bursaria	2						√		√				√
Calandrinia sp.	Purslane/Parakeelya	1,2						√						

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Callitris gracilis	Southern Cypress Pine	1			✓									
Calocephalus citreus	Lemon Beauty-heads	2												✓
Carex sp.	Sedge	2						✓						
Cheilanthes austrotenuifolia	Annual Rock-fern	1						✓						
Cheilanthes lasiophylla	Woolly Cloak-fern	2						✓						
Chenopodium desertorum ssp.	Desert Goosefoot	2												✓
Chenopodium pumilio	Small Crumbweed	3		✓										
Chloris sp.	Windmill Grass	3		✓										
Convolvulus erubescens complex		1,2		✓	✓		✓							
Convolvulus remotus	Grassy bindweed	1,2			✓							✓		✓
Crassula colorata	*Dense Crassula*	3		✓										
Cymbopogon ambiguus	Lemon-grass	1,2						✓						
Cyperus gymnocaulos	Spiny Flat-sedge	2						✓						
Cyperus sp.	Flat-sedge	2						✓		✓				
Dianella revoluta var. revoluta	Black-anther Flax-lily	1		✓										✓
Distichlis distichophylla	Emu-grass	1			✓			✓						
Drosera sp.	Sundew	1					✓							
Dysphania pumilio	Small Crumbweed	1,2		✓	✓									
Einadia nutans ssp.	Climbing Saltbush	1,2												✓
Eleocharis acuta	Common Spike-rush	2											✓	
Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush	2		✓										✓
Enneapogon nigricans	Black-head Grass	1,2		✓	✓		✓							✓
Eremophila longifolia	Weeping Emubush	1,2						✓						
Eucalyptus camaldulensis ssp. *camaldulensis*	River Red Gum	2												✓
Eucalyptus cladocalyx ssp.	Sugar Gum	1,2					✓							

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Eucalyptus gracilis	Yorrell									✓				
Eucalyptus leucoxylon ssp. *pruinosa*	Inland South Australian Blue Gum	1		✓	✓		✓				✓	✓	✓	✓
Eucalyptus odorata	Peppermint Box	2				✓	✓	✓	✓	✓		✓	✓	
Eucalyptus porosa	Mallee Box	1					✓			✓		✓	✓	
Euphorbia drummondii group	Spurge	1,2		✓	✓		✓	✓						✓
Galium sp.	Bedstraw				✓		✓							
Glycine canescens	Silky Glycine	2		✓										
Glycine clandestina	Twining Glycine	2		✓	✓									
Goodenia pinnatifida	Cut-leaf Goodenia	1												✓
Goodenia sp.	Goodenia	2		✓			✓							
Haloragis sp.	Raspwort	1,2						✓						
Hyalosperma semisterile	Orange Sunray	2		✓				✓						
Juncus pallidus	Pale Rush	1,2						✓						
Juncus sp.	Rush						✓	✓						
Lomandra effusa	Scented Mat-rush	1,2		✓	✓		✓	✓		✓				
Lomandra multiflora ssp.	Many-flower Mat-rush			✓	✓		✓							
Lomandra multiflora ssp. dura	Hard Mat-rush	1,2												✓
Lomandra sp.	Mat-rush													✓
Maireana brevifolia	Short-leaf Bluebush	1,2		✓							✓			✓
Maireana enchylaenoides	Wingless Fissure-plant	1,2		✓	✓		✓					✓		
Maireana sp.	Bluebush													
Muehlenbeckia florulenta	Tangled Lignum	1,2						✓						
Oxalis perennans	Native Sorrel	1,2		✓	✓		✓					✓	✓	✓
Phragmites australis	Common Reed	1,2						✓						
Pimelea curviflora var.	Curved Riceflower	2		✓	✓									
Plantago varia	Dark Plantain	2, 3		✓										✓

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Podolepis capillaris	Wiry Podolepis	2		✓	✓									
Ptilotus spathulatus	Pussy-tails	1,2		✓	✓		✓	✓				✓	✓	✓
Rhagodia parabolica	Mealy Saltbush	2						✓						✓
Rytidosperma caespitosum	Common Wallaby-grass	2										✓		
Rytidosperma carphoides	Short Wallaby-grass	2										✓		
Rytidosperma erianthum	Hill Wallaby-grass	2										✓		
Rytidosperma fulvum	Leafy Wallaby-grass	2			✓									
Rytidosperma sp.		1		✓	✓		✓							
Salsola kali	Buckbush	3			✓									
Setaria sp. (to be ID)	Wartego Summer Grass	3			✓									
Sida corrugata var.	Corrugated Sida	1,2		✓									✓	✓
Stackhousia monogyna	Creamy Candles	1,2			✓							✓		
Themeda triandra	Kangaroo Grass	3		✓										
Vittadinia blackii	Narrow-leaf New Holland Daisy	2					✓							
Vittadinia gracilis	Woolly New Holland Daisy	1,2		✓	✓		✓					✓		✓
Vittadinia megacephala	Giant new Holland Daisy	1		✓										
Vittadinia sp.	New Holland Daisy	2			✓							✓		
Wahlenbergia luteola	Yellow-wash Bluebell	1,2		✓	✓									
Wurmbea dioica ssp.		1		✓			✓							
Weeds														
Aira sp.	Hair-grass	2	*	✓	✓							✓		✓
Aloe maculata	Broad-leaf Aloe	1,2	*					✓						✓
Arctotheca calendula	Cape Weed	2	*					✓				✓	✓	✓
Artemisa tridentata	Wild Sage	2	*				✓	✓	✓					
Asparagus asparagoides f. *asparagoides*	Bridal Creeper	1,2	*				✓							

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Asteriscus spinosus	Golden Pallensis	1	*					✓						
Avena barbata	Bearded Oat	1	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brachypodium distachyon	False Brome	1	*									✓	✓	✓
Brassica sp.	Mustard species	1	*											✓
Bromus diandrus	Great Brome	2	*		✓			✓			✓	✓	✓	
Bromus hordeaceus ssp. *hordeaceus*	Soft Brome	1	*	✓	✓		✓				✓	✓	✓	
Bromus rubens	Red Brome	2	*		✓			✓				✓		
Bromus sp.	Brome	1	*	✓	✓		✓		✓		✓			
Calostemma purpureum	Pink Garland-lily	2	*											✓
Carthamus lanatus	Saffron Thistle	2	*	✓	✓									
Centaurea sp.	Centaury	2	*		✓									
Cirsium vulgare	Spear Thistle	1	*											✓
Cotula coronopifolia	Water Buttons	1,2	*					✓						
Crassula alata var. *alata*	Three-part Crassula	1,2	*	✓	✓		✓							
Cynara cardunculus ssp. *flavescens*	Artichoke Thistle	1	*	✓	✓	✓	✓	✓						
Echium plantagineum	Salvation Jane	1	*		✓						✓	✓		✓
Ehrharta longiflora	Annual Veldt Grass	1,2	*					✓	✓	✓	✓	✓	✓	✓
Ehrharta longiflora	Annual Veldt Grass	1	*											
Erodium cicutarium	Cut-leaf Heron's-bill	1,2	*	✓	✓	✓	✓	✓	✓	✓				
Euphorbia terracina	*False caper*	2	*											
Fumaria sp.	*Fumitory*	1,2	*							✓				
Gazania sp.	*Gazania*	2	*											✓
Geranium sp.	Geranium	2	*				✓							
Heliotropium europaeum	*Common Heliotrope*	2	*	✓							✓			
Holcus lanatus	Yorkshire Fog	2	*					✓						

Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Hordeum sp.	*Barley-grass*	1,2	*		✓		✓	✓			✓	✓	✓	
Hordeum vulgare	Barley	1	*	✓	✓	✓	✓	✓	✓	✓	✓			
Hypochaeris glabra	*Smooth Cat's Ear*	1,2	*	✓	✓									
Hypochaeris radicata	*Rough Cat's Ear*	1,2	*	✓	✓	✓	✓	✓			✓			✓
Juncus acutus	*Sharp Rush*	1	*		✓			✓						
Lepidium africanum	*Common Peppercress*	2	*										✓	
Lolium sp.	*Ryegrass*	2	*				✓	✓			✓	✓	✓	
Lycium ferocissimum	*African Boxthorn*	1,2	*				✓	✓						
Malva sp.	*Mallow*	2	*								✓	✓		
Marrubium vulgare	Horehound	1,2	*	✓	✓	✓	✓	✓	✓	✓	✓			
Medicago polymorpha var. *polymorpha*	*Burr-medic*	2	*	✓				✓				✓		
Medicago sp.	Medic	1	*	✓	✓	✓	✓	✓	✓	✓	✓			
Moraea setifolia	Thread Iris	1,2	*	✓	✓		✓	✓	✓	✓	✓		✓	✓
Nicotiana glauca	Tree Tobacco	1,2	*	✓	✓		✓	✓						
Olea europaea ssp.	*Olive*	2	*	✓				✓						✓
Opuntia sp.	*Prickly Pear*	1	*											
Petrorhagia dubia	*Velvet Pink*	1	*		✓									
Phalaris aquatica	Phalaris	*1*	*					✓						
Pinus radiata	Radiata Pine	*1,2*	*											
Pinus sp.	Pine	*1*	*			✓	✓							
Plantago lanceolata var.	Ribwort	*1,2*	*											✓
Reichardia tingitana	False Sowthistle	*1,2*	*	✓	✓									✓
Reseda lutea	Cut-leaf Mignonette	*1*	*		✓									
Rosa canina	Dog Rose	*1,2*	*				✓	✓						
Rostraria cristata	Annual Cat's-tail	***1,2***	*		✓									
Rumex crispus	Curled Dock	*2*	*								✓			

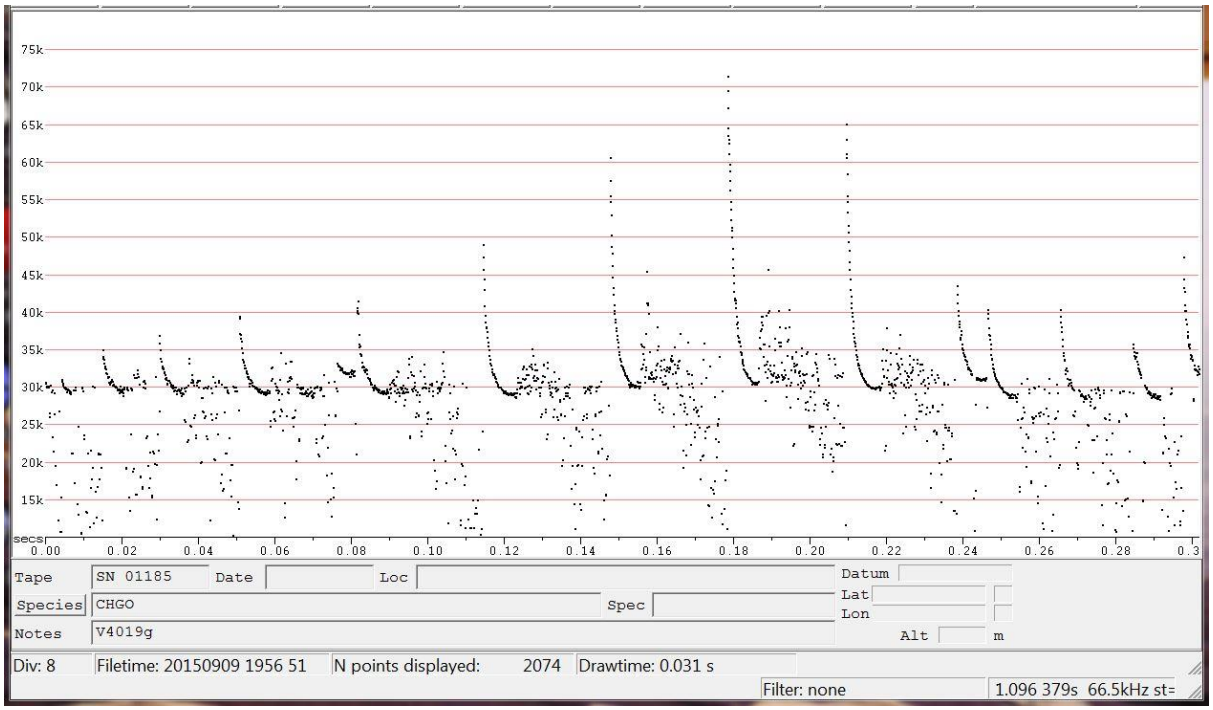
Scientific name	Common Name	Trip	Exotic	1	2	3	4	5	6	7	8	9	10	11
Rumex sp.	Dock	*2*	*				✓	✓						
Salvia verbenaca var.	Wild Sage	*2*	*	✓	✓									✓
Scabiosa atropurpurea	Pincushion	*2*	*											
Schinus molle	Pepper-tree	1,2	*					✓						
Silybum marianum	Variegated Thistle	*1*	*					✓						
Solanum elaeagnifolium	Silver-leaf Nightshade	1	*	✓	✓				✓					
Solanum nigrum	Black Nightshade	1	*	✓				✓	✓					
Sonchus oleraceus	Common Sow-thistle	2	*	✓				✓						
Sonchus sp.	Sow-thistle	*1*	*		✓							✓		✓
Taraxacum officinale	Dandelion	1	*	✓	✓	✓	✓	✓	✓	✓	✓			
Themeda triandra	Kangaroo Grass	*3*		✓										
Trifolium angustifolium	Narrow-leaf Clover	*1,2*	*	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Trifolium arvense var. *arvense*	Hare's-foot Clover	*2*	*	✓	✓		✓					✓		✓
Trifolium campestre	Hop Clover	*1*	*									✓		
Triticum aestivum	Wheat	*1,2*	*						✓					
Urtica dioica	Stinging Nettle	2	*				✓							
Urtica urens	Small Nettle	*1*	*								✓			
Vicia sp.	Vetch	*2*	*											
Vulpia myuros	Fescue	2	*	✓	✓	✓	✓	✓	✓	✓				
Vulpia sp.	Fescue	*1*	*	✓	✓		✓	✓				✓	✓	✓

Appendix 2.Location of bird point count sites.

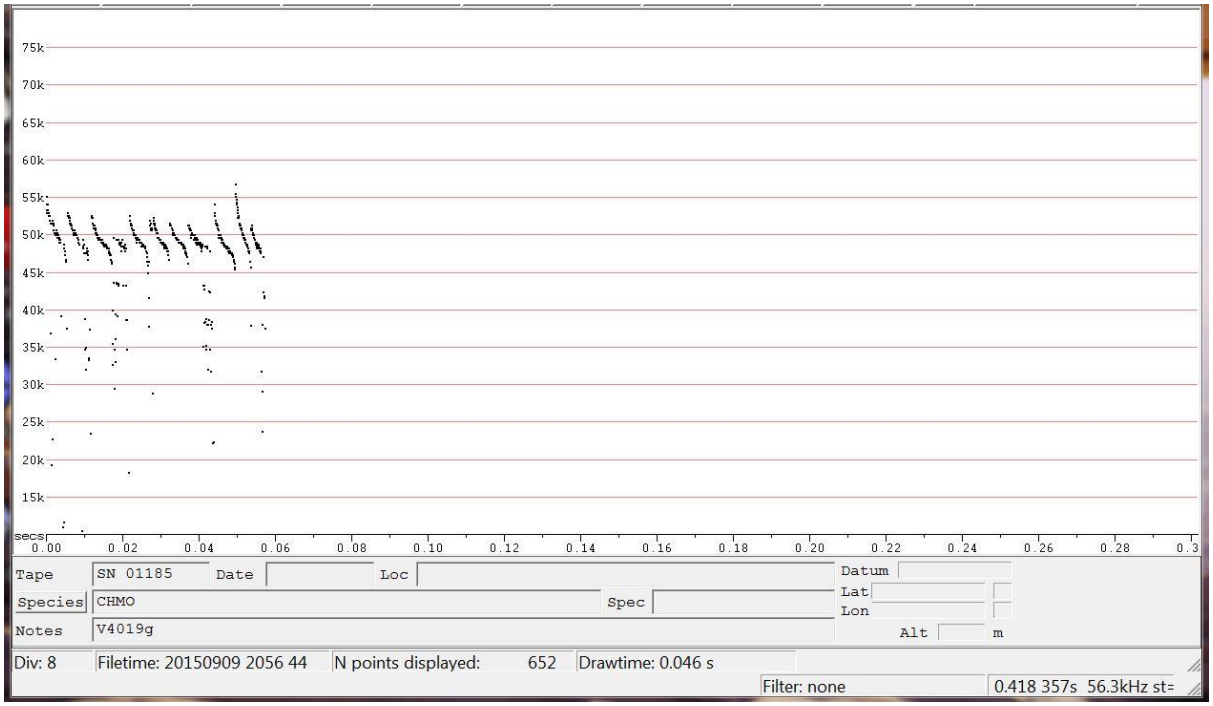
Point Count	Easting	Northing
1	322766	6199977
2	321545	6199867
3	322515	6201511
4	323819	6200037
5	324228	6202237
6	320175	6201167
7	318721	6200153
8	318945	6201156
9	323183	6205598
10	321708	6204405
11	320848	6205633
12	320771	6202801
13	321317	6203420
14	322762	6203617
15	324238	6203136
16	323529	6202719

Appendix 3.Sample AnaBat Files.

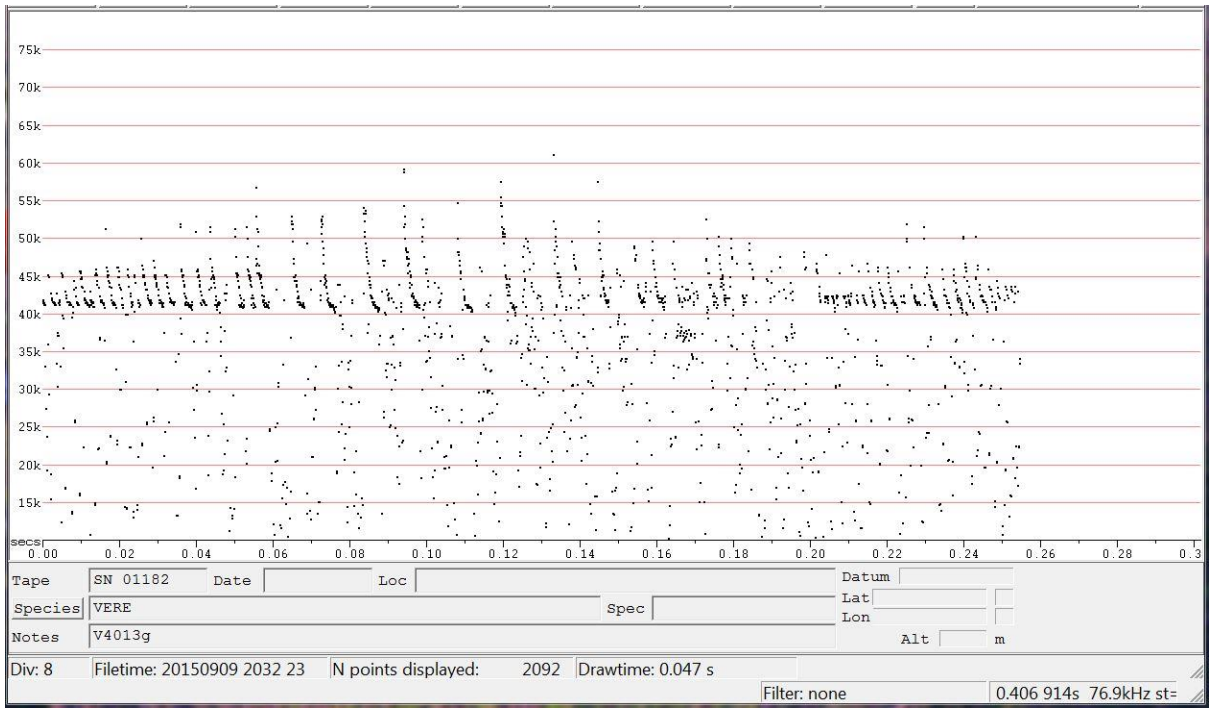
Chalinolobus gouldii



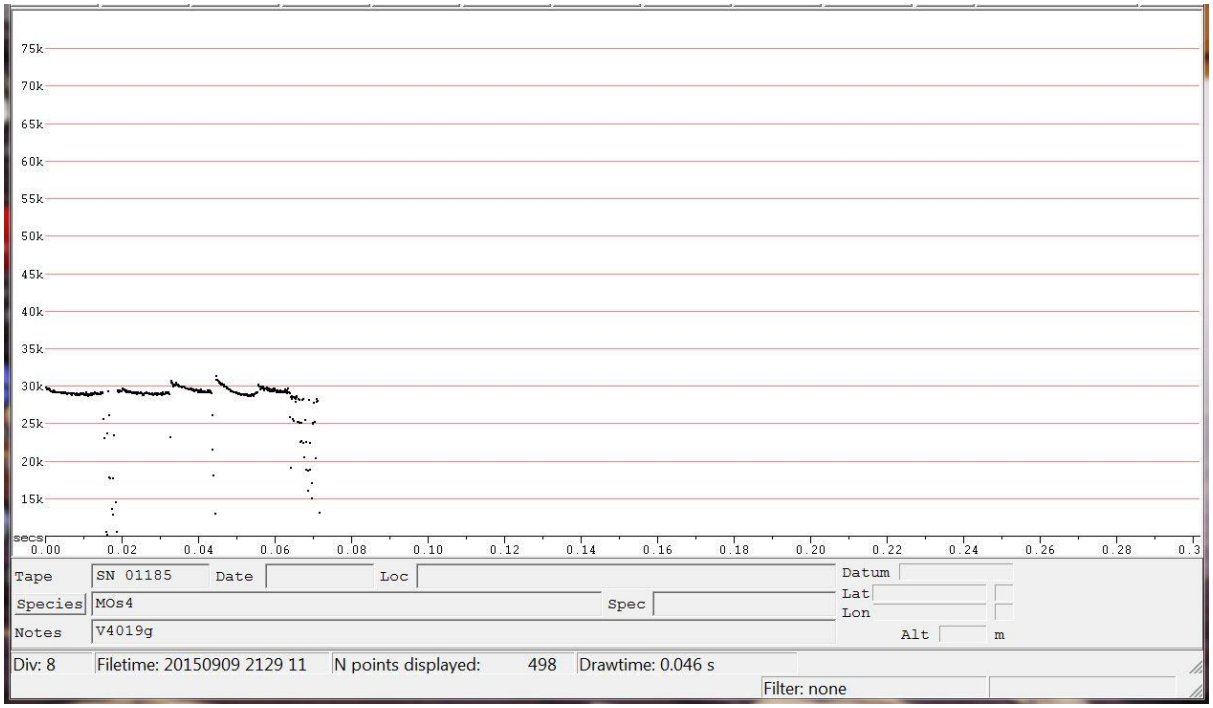
Chalinolobus morio



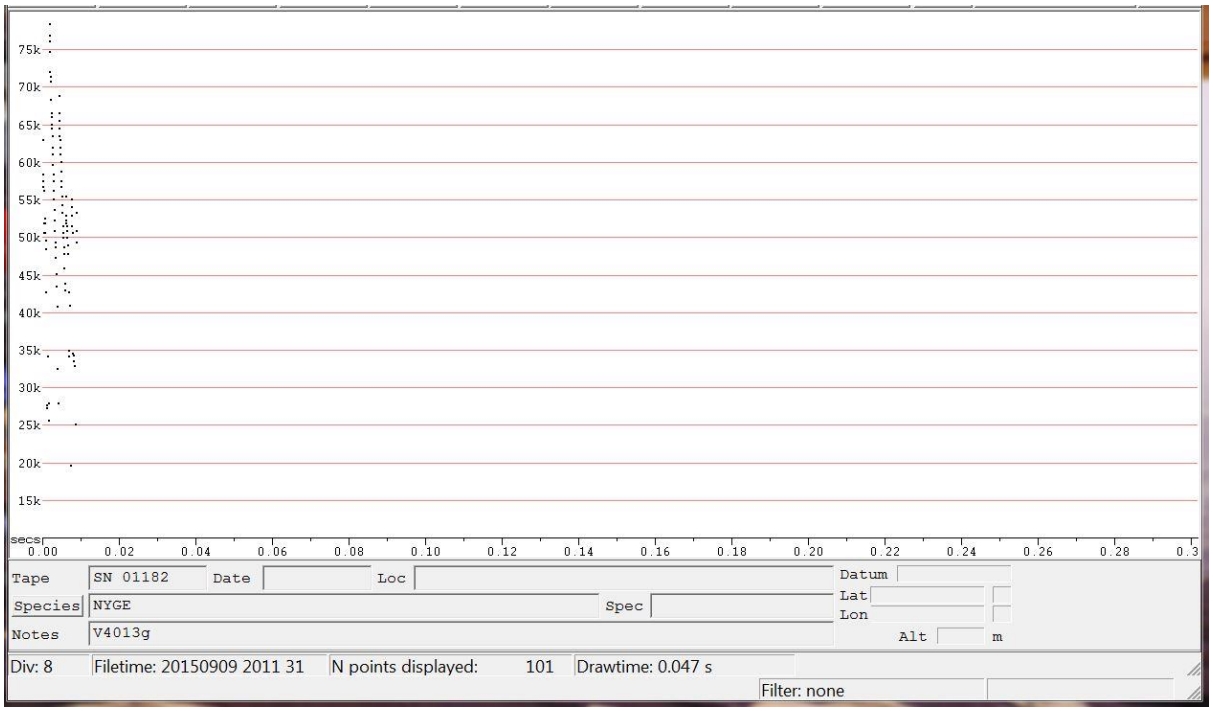
Vespadelus regulus



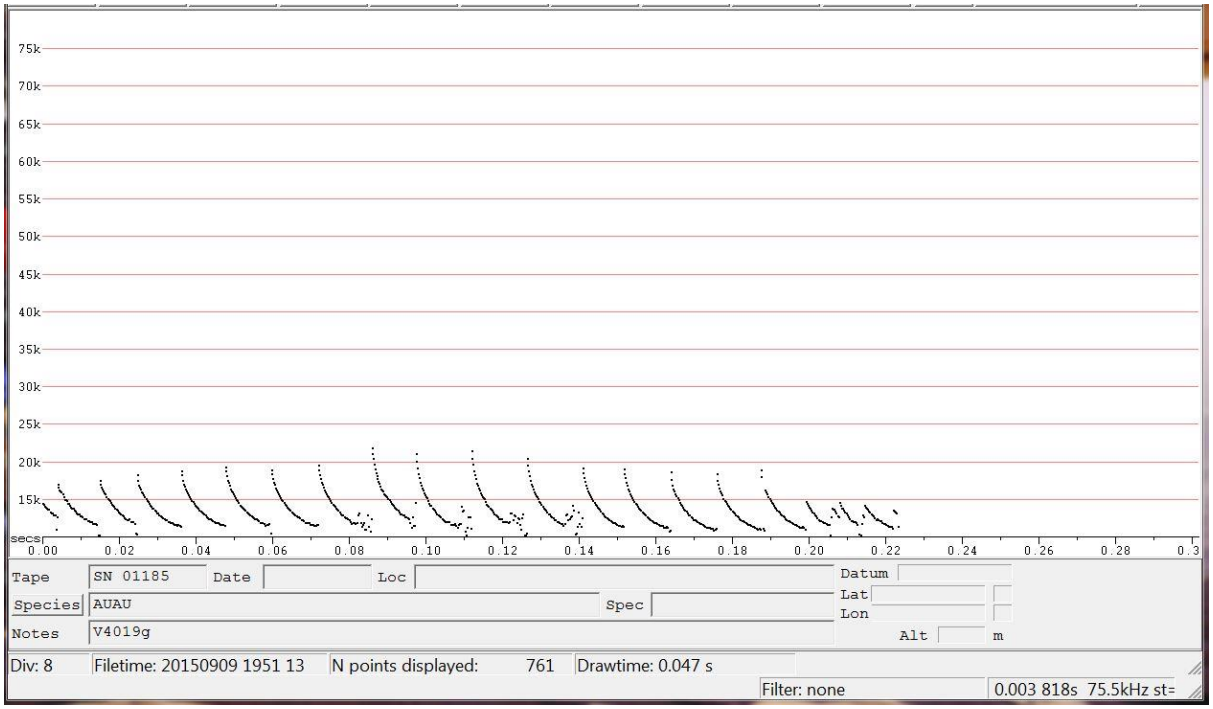
Mormopterus sp4



Nyctophilus geoffroyi



Austronomus australis



Appendix 4.BDBSA flora and fauna records from the 20km buffer.

Table 47. BDBSA Fauna records within 20km of the site.

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
AMPHIBIANS					
Crinia signifera	Common Froglet	Y			22/09/2002
Limnodynastes dumerilii	Banjo Frog	Y			20/09/2001
Limnodynastes	Spotted Marsh Frog	Y			16/09/1996
Litoria ewingii	Brown Tree Frog	Y			10/10/2002
Litoria peronii	Peron's Tree Frog	Y			19/04/2002
Neobatrachus pictus	Burrowing frog	Y			20/06/1971
AVES					
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	Y			17/09/2002
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Y			28/07/2000
Acanthiza lineata	Striated Thornbill	Y			1/03/1985
Acanthiza nana	Yellow Thornbill	Y			2/02/2012
Acanthiza reguloides	Buff-rumped Thornbill	Y			14/03/2004
Acanthiza uropygialis	Chestnut-rumped Thornbill	Y			1/11/2002
Acanthorhynchus	Eastern Spinebill	Y			23/12/1999
Accipiter cirrocephalus	Collared Sparrowhawk	Y			2/12/1985
Accipiter fasciatus	Brown Goshawk	Y			16/11/2012
Acrocephalus australis	Australian Reed Warbler	Y			1/12/1999
Aegotheles cristatus	Australian Owlet-nightjar	Y			17/11/1985
Anas castanea	Chestnut Teal	Y			8/04/1987
Anas gracilis	Grey Teal	Y			1/07/1985
Anas rhynchotis	Australasian Shoveler	Y		R	27/01/2006
Anas superciliosa	Pacific Black Duck	Y			27/06/2005
Anas superciliosa x anas	Pacific Black Duck/Mallard Hybrid	Y			18/05/1987
Anhinga novaehollandiae	Australasian Darter	Y		R	27/01/2003
Anthochaera carunculata	Red Wattlebird	Y			19/04/2000
Anthochaera chrysoptera	Little Wattlebird	Y			10/01/2004
Anthus australis	Australian Pipit	Y			14/10/1985
Aphelocephala leucopsis	Southern Whiteface	Y			1/06/1985
Aquila audax	Wedge-tailed Eagle	Y			26/12/2001
Ardea alba	Great Egret	Y			24/11/2001
Ardea pacifica	White-necked Heron	Y			9/12/2001
Ardeotis australis	Australian Bustard	Y		V	1/06/2005
Artamus cinereus	Black-faced Woodswallow	Y			1/10/1999
Artamus cyanopterus	Dusky Woodswallow	Y			1/02/2001
Artamus leucorynchus	White-breasted Woodswallow	Y			2/12/1985
Artamus personatus	Masked Woodswallow	Y			11/11/1999

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Artamus superciliosus	White-browed Woodswallow	Y			9/10/2001
Aythya australis	Hardhead	Y			1/11/1985
Barnardius zonarius	Australian Ringneck	Y			13/04/1999
Biziura lobata	Musk Duck	Y		R	27/01/2003
Cacatua galerita	Sulphur-crested Cockatoo	Y			18/08/2001
Cacatua sanguinea	Little Corella	Y			1/10/2001
Cacatua sp.		Y			3/08/2005
Cacatua tenuirostris	Long-billed Corella	Y			31/12/2004
Cacomantis flabelliformis	Fan-tailed Cuckoo	Y			6/04/2000
Cacomantis pallidus	Pallid Cuckoo	Y			1/11/1985
Calidris ruficollis	Red-necked Stint	Y			1/10/2000
Caligavis chrysops	Yellow-faced Honeyeater	Y			22/09/1985
Certhionyx variegatus	Pied Honeyeater	Y			1/10/1999
Chalcites basalis	Horsfield's Bronze Cuckoo	Y			1/08/1999
Chenonetta jubata	Maned (Australian Wood Duck)	Y			21/03/2005
Chlidonias hybrida	Whiskered Tern	Y			12/10/2004
Chroicocephalus	Silver Gull	Y			1/06/2002
Cincloramphus cruralis	Brown Songlark	Y			26/12/2001
Cincloramphus mathewsi	Rufous Songlark	Y			18/11/2001
Circus approximans	Swamp Harrier	Y			27/01/2003
Circus assimilis	Spotted Harrier	Y			23/07/2002
Cladorhynchus	Banded Stilt	Y		V	1/09/2000
Climacteris picumnus	Brown Treecreeper	Y			23/06/2011
Colluricincla harmonica	Grey Shrike-thrush	Y			18/07/2002
Coracina maxima	Ground Cuckoo-shrike	Y			1/02/2005
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Y			18/11/2001
Corcorax	White-winged Chough	Y		R	8/08/2013
Corvus coronoides	Australian Raven	Y			19/04/2001
Corvus mellori	Little Raven	Y			1/11/1985
Corvus sp.		Y			2/11/1999
Coturnix pectoralis	Stubble Quail	Y			16/06/2002
Cracticus torquatus	Grey Butcherbird	Y			1/07/1985
Cygnus atratus	Black Swan	Y			20/02/2002
Dacelo novaeguineae	Laughing Kookaburra	Y			1/07/1985
Daphoenositta	Varied Sittella	Y			9/08/2001
Dicaeum hirundinaceum	Mistletoebird	Y			1/11/1985
Dromaius novaehollandiae	Emu	Y			1/01/2003
Egretta novaehollandiae	White-faced Heron	Y			24/03/1985
Elanus axillaris	Black-shouldered Kite	Y			1/07/1985
Elseyornis melanops	Black-fronted Dotterel	Y			5/09/2005

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Eolophus roseicapilla	Galah	Y			10/01/2003
Epthianura albifrons	White-fronted Chat	Y			12/05/1985
Epthianura aurifrons	Orange Chat	Y			27/01/2003
Epthianura tricolor	Crimson Chat	Y			1/10/1999
Erythrogonys cinctus	Red-kneed Dotterel	Y			27/01/2006
Eurostopodus argus	Spotted Nightjar	Y			1/01/2000
Eurystomus orientalis	Oriental Dollarbird	Y			1/03/1999
Falco berigora	Brown Falcon	Y			23/06/2011
Falco cenchroides	Nankeen Kestrel	Y			25/10/2001
Falco longipennis	Australian Hobby	Y			12/09/2003
Falco peregrinus	Peregrine Falcon	Y		R	19/10/2012
Falco subniger	Black Falcon	Y			1/09/2000
Falcunculus frontatus	Crested Shrike-tit	Y		R	9/02/2012
Fulica atra	Eurasian Coot	Y			16/04/2005
Gallinula tenebrosa	Dusky Moorhen	Y			18/07/2003
Gallirallus philippensis	Buff-banded Rail	Y			1/10/2001
Gavicalis virescens	Singing Honeyeater	Y			24/03/1985
Geopelia cuneata	Diamond Dove	Y			9/02/2012
Geopelia placida	Peaceful Dove	Y			9/02/2012
Gerygone fusca	Western Gerygone	Y		R	2/12/1985
Glossopsitta concinna	Musk Lorikeet	Y			29/11/1999
Glossopsitta	Purple-crowned Lorikeet	Y			20/06/2003
Grallina cyanoleuca	Magpielark	Y			29/11/1999
Gymnorhina tibicen	Australian Magpie	Y			19/04/2000
Haliastur sphenurus	Whistling Kite	Y			27/01/2003
Hieraaetus morphnoides	Little Eagle	Y			30/12/1985
Himantopus	White-headed Stilt	Y			11/06/2005
Hirundo neoxena	Welcome Swallow	Y			1/07/1985
Hydroprogne caspia	Caspian Tern	Y			12/10/2004
Lalage tricolor	White-winged Triller	Y			9/02/2012
Lichenostomus cratitius	Purple-gaped Honeyeater	Y		ssp	1/05/1985
Malacorhynchus	Pink-eared Duck	Y			1/11/1985
Malurus cyaneus	Superb Fairy-wren	Y			1/05/1985
Malurus lamberti	Variegated Fairy-wren	Y			1/02/2001
Malurus leucopterus	White-winged Fairy-wren	Y			11/06/1985
Manorina flavigula	Yellow-throated Miner	Y			22/06/1985
Manorina melanocephala	Noisy Miner	Y			1/03/1985
Megalurus gramineus	Little Grassbird	Y			11/06/2003
Melanodryas cucullata	Hooded Robin	Y		ssp	2/03/2012
Melithreptus brevirostris	Brown-headed Honeyeater	Y			2/02/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Melithreptus gularis	Black-chinned Honeyeater	Y		ssp	28/11/2003
Melithreptus lunatus	White-naped Honeyeater	Y			1/11/2000
Melopsittacus undulatus	Budgerigar	Y			24/12/1999
Merops ornatus	Rainbow Bee-eater	Y			13/10/1985
Microcarbo melanoleucos	Little Pied Cormorant	Y			1/07/1985
Microeca fascinans	Jacky Winter	Y		ssp	17/10/2004
Milvus migrans	Black Kite	Y			1/07/1999
Mirafra javanica	Horsfield's Bush Lark	Y			27/01/1985
Myiagra inquieta	Restless Flycatcher	Y		R	1/07/2005
Neochmia temporalis	Red-browed Finch	Y			1/11/1985
Neophema chrysostoma	Blue-winged Parrot	Y		V	26/10/2011
Neophema elegans	Elegant Parrot	Y		R	1/01/2006
Nesoptilotis leucotis	White-eared Honeyeater	Y			1/06/2004
Ninox boobook	Southern Boobook	Y			1/03/2000
Northiella haematogaster	Bluebonnet	Y		ssp	5/05/2005
Nycticorax caledonicus	Nankeen Night Heron	Y			5/09/2005
Nymphicus hollandicus	Cockatiel	Y			1/07/1985
Ocyphaps lophotes	Crested Pigeon	Y			23/05/2005
Oreoica gutturalis	Crested Bellbird	Y			12/07/1999
Oxyura australis	Blue-billed Duck	Y		R	23/09/2004
Pachycephala inornata	Gilbert's Whistler	Y		R	9/02/2003
Pachycephala pectoralis	Australian Golden Whistler	Y			1/07/1985
Pachycephala rufiventris	Rufous Whistler	Y			1/07/1985
Pardalotus punctatus	Spotted Pardalote	Y			1/01/1985
Pardalotus sp.		Y			8/12/2011
Pardalotus striatus	Striated Pardalote	Y			15/08/2005
Pelecanus conspicillatus	Australian Pelican	Y			27/01/2003
Petrochelidon ariel	Fairy Martin	Y			1/05/1985
Petrochelidon nigricans	Tree Martin	Y			1/07/1985
Petroica boodang	Scarlet Robin	Y		ssp	1/11/1985
Petroica goodenovii	Red-capped Robin	Y			1/07/1985
Phalacrocorax carbo	Great Cormorant	Y			19/08/1984
Phalacrocorax sulcirostris	Little Black Cormorant	Y			1/01/1985
Phalacrocorax varius	[Australian] Pied Cormorant	Y			14/02/2005
Phaps chalcoptera	Common Bronzewing	Y			13/10/2003
Phylidonyris	New Holland Honeyeater	Y			27/06/2005
Platalea flavipes	Yellow-billed Spoonbill	Y			1/10/2001
Platycercus elegans	Crimson Rosella	Y			27/02/2001
Plectorhyncha lanceolata	Striped Honeyeater	Y		R	11/06/1985
Podargus strigoides	Tawny Frogmouth	Y			1/07/2002

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Poliocephalus	Hoary-headed Grebe	Y			22/06/2005
Polytelis anthopeplus	Regent Parrot	Y	ssp	V	21/11/1997
Pomatostomus ruficeps	Chestnut-crowned Babbler	Y			23/07/2002
Pomatostomus	White-browed Babbler	Y			13/01/2001
Porphyrio porphyrio	Purple Swamphen	Y			8/01/2005
Porzana fluminea	Australian Crake (Australian	Y			4/01/2006
Psephotus haematonotus	Red-rumped Parrot	Y			15/08/2003
Psephotus varius	Mulga Parrot	Y			13/01/2000
Ptilotula ornata	Yellow-plumed Honeyeater	Y			11/06/1985
Ptilotula penicillata	White-plumed Honeyeater	Y			24/01/2002
Purnella albifrons	White-fronted Honeyeater	Y			9/07/2002
Recurvirostra	Red-necked Avocet	Y			5/08/2005
Rhipidura albiscapa	Grey Fantail	Y			1/11/2002
Rhipidura leucophrys	Willie Wagtail	Y			27/02/2001
Smicrornis brevirostris	Weebill	Y			20/05/2001
Stagonopleura guttata	Diamond Firetail	Y		V	2/03/2012
Strepera versicolor	Grey Currawong	Y		ssp	25/06/2006
Struthidea cinerea	Apostlebird	Y			1/05/2005
Sugomel niger	Black Honeyeater	Y			10/12/1999
Tachybaptus	Australasian Grebe	Y			1/08/2000
Tadorna tadornoides	Australian Shelduck	Y			27/01/2003
Taeniopygia guttata	Zebra Finch	Y			26/12/2001
Threskiornis moluccus	Australian White Ibis	Y			5/01/2005
Todiramphus pyrrhopygius	Red-backed Kingfisher	Y			6/11/1999
Todiramphus sanctus	Sacred Kingfisher	Y			4/01/2001
Tribonyx ventralis	Black-tailed Native-hen	Y			28/03/2005
Trichoglossus	Rainbow Lorikeet	Y			28/07/2000
Tringa stagnatilis	Marsh Sandpiper	Y			27/01/2003
Turnix varius	Painted Buttonquail	Y		R	9/02/2012
Turnix velox	Little Buttonquail	Y			1/11/2003
Tyto delicatula	Eastern Barn Owl	Y			1/06/2001
Vanellus miles	Masked Lapwing	Y			1/11/1985
Vanellus tricolor	Banded Lapwing	Y			1/08/2005
Zoothera lunulata	Bassian Thrush	Y		R	1/11/1985
Zosterops lateralis	Silvereye	Y			1/07/1985
Alauda arvensis	Eurasian Skylark	N			17/08/1985
Anas platyrhynchos	Mallard (Northern Mallard)	N			23/08/2002
Carduelis carduelis	European Goldfinch	N			8/11/2002
Columba livia	Feral Pigeon [Rock Dove]	N			19/08/2001
Passer domesticus	House Sparrow	N			23/12/1999

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Spilopelia chinensis	Spotted Dove	N			1/11/1985
Sturnus vulgaris	Common Starling	N			6/11/2000
Turdus merula	Common Blackbird	N			23/12/1999
Mammals					
Bettongia lesueur	Burrowing Bettong	Y	EX	E	1/01/1922
Cercartetus concinnus	Western Pygmy-possum	Y			1/10/1933
Dasyurus viverrinus	Eastern Quoll	Y		E	18800101
Hydromys chrysogaster	Water Rat	Y			7/11/2011
Lasiorhinus latifrons	Southern Hairy-nosed Wombat	Y			16/03/2011
Macropus fuliginosus	Western Grey Kangaroo	Y			5/05/2011
Macropus robustus	Euro	Y			7/04/2004
Macropus rufus	Red Kangaroo	Y			21/10/2010
Macropus sp.		Y			19/10/2012
Tachyglossus aculeatus	Short-beaked Echidna	Y			2/10/1979
Trichosurus vulpecula	Common Brushtail Possum	Y		R	1/01/1988
Bos taurus	Cattle (European Cattle)	N			16/11/2012
Lepus sp.		N			19/10/2012
Oryctolagus cuniculus	Rabbit (European Rabbit)	N			1/01/2010
Ovis aries	Sheep (Feral Sheep)	N			5/01/2013
Vulpes vulpes	Fox (Red Fox)	N			2/03/2013
REPTILES					
Anilios bicolor	Southern Blind Snake	Y			1/01/1950
Anilios bituberculatus	Rough-nosed Blind Snake	Y			18/08/1908
Christinus marmoratus	Marbled Gecko	Y			1/01/1950
Ctenophorus decresii	Tawny Dragon	Y			1/12/1995
Ctenotus sp.		Y			2/03/2013
Ctenotus spaldingi	Eastern Striped Skink	Y			1/01/1950
Delma molleri	Adelaide Snake-lizard	Y			10/09/1996
Gehyra lazelli	Southern Rock Dtella	Y			1/01/1950
Hemiergis decresiensis	Three-toed Earless Skink	Y			5/06/1983
Lampropholis guichenoti	Garden Skink	Y			15/01/1981
Lerista bougainvillii	Bougainville's Skink	Y			19/10/2012
Menetia greyii	Dwarf Skink	Y			22/09/2000
Morelia spilota	Carpet Python	Y		R	8/07/1963
Morethia adelaidensis	Adelaide Snake-eye	Y			19/10/2012
Morethia obscura	Mallee Snake-eye	Y			29/11/1991
Parasuta nigriceps	Mitchell's Short-tailed Snake	Y			1/01/1950
Pogona barbata	Eastern Bearded Dragon	Y			19/10/2012
Pogona vitticeps	Central Bearded Dragon	Y			10/03/2011
Pseudonaja textilis	Eastern Brown Snake	Y			1/01/1950

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Pygopus lepidopodus	Common Scaly-foot	Y			1/01/1950
Tiliqua adelaidensis	Pygmy Bluetongue	Y	EN	E	27/03/2014
Tiliqua rugosa	Sleepy Lizard	Y			5/08/1987
Tiliqua scincoides	Eastern Bluetongue	Y			1/01/1950

Conservation status

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. ssp.: the conservation status applies at the sub-species level. Mi: listed as migratory under the EPBC Act. Ma: listed as marine under the EPBC Act.

Appendix 5

Table 48. Threatened flora species potentially occurring within the project area (20 km buffer).

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Acacia acinacea	Wreath Wattle	Y			13/05/2015
Acacia argyrophylla	Silver Mulga-bush	Y			14/06/2005
Acacia brachybotrya	Grey Mulga-bush	Y			8/05/2008
Acacia calamifolia	Wallowa	Y			15/11/2002
Acacia calamifolia (NC)	Wallowa	Y			15/11/2002
Acacia euthycarpa	Wallowa	Y			1/11/2006
Acacia glandulicarpa	Hairy-pod Wattle	Y	VU	E	8/05/2008
Acacia hakeoides	Hakea Wattle	Y			14/06/2005
Acacia iteaphylla	Flinders Ranges Wattle	Y		R	11/07/2002
Acacia ligulata	Umbrella Bush	Y			8/05/2008
Acacia montana	Mallee Wattle	Y		R	24/11/1975
Acacia notabilis	Notable Wattle	Y			13/04/2015
Acacia nyssophylla	Spine Bush	Y			27/03/1986
Acacia oswaldii	Umbrella Wattle	Y			25/05/1923
Acacia paradoxa	Kangaroo Thorn	Y			13/05/2015
Acacia pendula	Weeping Myall	Y		V	21/03/2001
Acacia pycnantha	Golden Wattle	Y			13/05/2015
Acacia retinodes	Wirilda	Y			8/05/2015
Acacia retinodes var. *(NC)*	Silver Wattle	Y			4/06/2002
Acacia salicina	Willow Wattle	Y			12/08/1999
Acacia sp.	Wattle	Y			8/05/2008
Acacia spilleriana	Spiller's Wattle	Y	EN	E	11/05/1982
Acacia spinescens	Spiny Wattle	Y			4/04/2011
Acacia wattsiana	Dog Wattle	Y			8/04/2011
Acaena echinata	Sheep's Burr	Y			5/10/2012
Acrotriche affinis	Ridged Ground-berry	Y			30/06/2000
Actinobole uliginosum	Flannel Cudweed	Y			19/10/2012
Agrostis sp.	Blown-grass/Bent Grass	Y			15/12/2001
Alectryon oleifolius ssp. *canescens*	Bullock Bush	Y			10/12/2013
Allocasuarina pusilla	Dwarf Oak-bush	Y			26/11/1887
Allocasuarina sp.	Sheoak/Oak-bush	Y			14/06/2005
Allocasuarina verticillata	Drooping Sheoak	Y			13/05/2015
Alternanthera denticulata	Lesser Joyweed	Y			30/04/1993
Alyxia buxifolia	Sea Box	Y			23/09/1961
Amphibromus archeri	Pointed Swamp Wallaby-grass	Y		R	24/11/1992
Amphibromus nervosus	Veined Swamp Wallaby-grass	Y			1/01/2005
Amphipogon caricinus var. *caricinus*	Long Grey-beard Grass	Y			19/10/2012
Amphipogon strictus	Spreading Grey-beard Grass	Y			25/01/1991
Amyema miquelii	Box Mistletoe	Y			11/05/2015
Amyema miraculosa ssp. *boormanii*	Fleshy Mistletoe	Y			25/05/1923
Amyema preissii	Wire-leaf Mistletoe	Y			1/01/2005

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Amyema sp.	Mistletoe	Y			10/12/2013
Anogramma leptophylla	Annual Fern	Y		R	1/11/1896
Anthosachne scabra	Native Wheat-grass	Y			11/05/2015
Apium prostratum var. *filiforme*	Native Celery	Y			8/01/1912
Apium prostratum var. *prostratum*	Native Celery	Y			8/01/1912
Arabidella trisecta	Shrubby Cress	Y			25/09/1971
Argentipallium blandowskianum	Woolly Everlasting	Y			1/11/1927
Aristida behriana	Brush Wire-grass	Y			13/05/2015
Aristida contorta	Curly Wire-grass	Y			16/11/2012
Aristida holathera var. *holathera*	Tall Kerosene Grass	Y			21/10/2011
Aristida sp.	Three-awn/Wire-grass	Y			12/04/2002
Arthropodium fimbriatum	Nodding Vanilla-lily	Y			10/12/2013
Arthropodium sp.	Vanilla-lily	Y			21/10/2011
Arthropodium strictum	Common Vanilla-lily	Y			13/05/2015
Asperula conferta	Common Woodruff	Y			5/10/2012
Asplenium flabellifolium	Necklace Fern	Y			01/10/1897
Astroloma conostephioides	Flame Heath	Y			1/11/2006
Astroloma humifusum	Cranberry Heath	Y			1/11/2006
Atriplex semibaccata	Berry Saltbush	Y			11/05/2015
Atriplex stipitata	Bitter Saltbush	Y			10/12/2013
Atriplex vesicaria	Bladder Saltbush	Y			19/10/1962
Austrodanthonia sp. *(NC)*		Y			8/05/2008
Austrostipa acrociliata	Graceful Spear-grass	Y			10/12/2013
Austrostipa blackii	Crested Spear-grass	Y			18/11/2012
Austrostipa breviglumis	Cane Spear-grass	Y		R	12/04/2002
Austrostipa curticoma	Short-crest Spear-grass	Y			7/12/2012
Austrostipa densiflora	Fox-tail Spear-grass	Y		R	20/10/1993
Austrostipa drummondii	Cottony Spear-grass	Y			10/12/2013
Austrostipa elegantissima	Feather Spear-grass	Y			8/05/2015
Austrostipa eremophila	Rusty Spear-grass	Y			18/11/2012
Austrostipa exilis	Heath Spear-grass	Y			25/10/1992
Austrostipa flavescens	Coast Spear-grass	Y			7/12/2012
Austrostipa gibbosa	Swollen Spear-grass	Y		R	10/12/2013
Austrostipa hemipogon	Half-beard Spear-grass	Y			1/11/2007
Austrostipa mollis	Soft Spear-grass	Y			1/12/2006
Austrostipa mollis group	Soft Spear-grass	Y			24/04/2015
Austrostipa nitida	Balcarra Spear-grass	Y			7/12/2012
Austrostipa nodosa	Tall Spear-grass	Y			11/05/2015
Austrostipa pilata	Prickly Spear-grass	Y		V	19/10/2012
Austrostipa platychaeta	Flat-awn Spear-grass	Y			8/04/2011
Austrostipa puberula	Fine-hairy Spear-grass	Y			10/12/2013
Austrostipa scabra ssp.	Rough Spear-grass	Y			15/04/2015

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Austrostipa scabra ssp. *falcata*	Slender Spear-grass	Y			16/11/2012
Austrostipa scabra ssp. *scabra*	Rough Spear-grass	Y			8/12/2011
Austrostipa semibarbata	Fibrous Spear-grass	Y			4/12/1993
Austrostipa setacea	Corkscrew Spear-grass	Y			21/10/2012
Austrostipa sp.	Spear-grass	Y			13/05/2015
Austrostipa tenuifolia		Y		R	30/11/2005
Banksia marginata	Silver Banksia	Y			15/11/2002
Baumea juncea	Bare Twig-rush	Y			12/06/1995
Beyeria lechenaultii	Pale Turpentine Bush	Y			24/10/1994
Blennospora drummondii	Dwarf Button-flower	Y			14/11/1996
Boerhavia dominii	Tar-vine	Y			18/04/1998
Boerhavia dominii (NC)	Tar-vine	Y			16/11/2012
Bolboschoenus caldwellii	Salt Club-rush	Y			14/02/1991
Bolboschoenus medianus	Marsh Club-rush	Y			8/01/1912
Bossiaea prostrata	Creeping Bossiaea	Y			23/09/1961
Bothriochloa macra	Red-leg Grass	Y		R	4/04/2000
Brachychiton gregorii	Desert Kurrajong	Y			9/12/2009
Brachyloma ericoides ssp.	Brush Heath	Y			14/11/1996
Brachyloma ericoides ssp. *ericoides*	Brush Heath	Y			21/05/2002
Brachyscome ciliaris var. *ciliaris*	Variable Daisy	Y			4/12/1996
Brachyscome ciliaris var. *subintegrifolia*		Y		R	1/08/2004
Brachyscome exilis	Slender Daisy	Y			25/10/1992
Brachyscome goniocarpa	Dwarf Daisy	Y			9/10/1996
Brachyscome lineariloba	Hard-head Daisy	Y			11/12/1996
Brachyscome perpusilla	Tiny Daisy	Y			18/09/1965
Brachyscome sp.	Native Daisy	Y			26/10/2011
Bromus sp.	Brome	Y			1/05/2015
Brunonia australis	Blue Pincushion	Y			27/04/1992
Bulbine bulbosa	Bulbine-lily	Y			21/10/2012
Burchardia umbellata	Milkmaids	Y			4/12/1993
Bursaria spinosa ssp.	Bursaria	Y			8/05/2015
Bursaria spinosa ssp. *spinosa*	Sweet Bursaria	Y			1/05/2015
Bursaria spinosa var. (NC)		Y			27/04/1992
Caesia calliantha	Blue Grass-lily	Y			8/05/2015
Caladenia argocalla	White Beauty Spider-orchid	Y	EN	E	1/09/1999
Caladenia behrii	Pink-lip Spider-orchid	Y	EN	E	20/09/1978
Caladenia cardiochila	Heart-lip Spider-orchid	Y			6/10/1918
Caladenia colorata	Coloured Spider-orchid	Y	EN	E	1/09/1979
Caladenia sp.	Spider-orchid	Y			23/09/2005
Caladenia tensa	Inland Green-comb Spider-orchid	Y	EN		31/08/1992
Caladenia tentaculata	King Spider-orchid	Y			14/11/1996
Calandrinia calyptrata	Pink Purslane	Y			11/11/1996

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Calandrinia eremaea	Dryland Purslane	Y			16/11/2012
Calandrinia sp.	Purslane/Parakeelya	Y			30/06/2000
Callistemon sp.	Bottlebrush	Y			8/05/2015
Callistemon teretifolius	Needle Bottlebrush	Y			30/11/1999
Callitris canescens	Scrubby Cypress Pine	Y			14/11/1959
Callitris glaucophylla	White Cypress-pine	Y			8/05/2008
Callitris gracilis	Southern Cypress Pine	Y			10/12/2013
Calocephalus citreus	Lemon Beauty-heads	Y			7/12/2012
Calostemma purpureum	Pink Garland-lily	Y			13/05/2015
Calytrix tetragona	Common Fringe-myrtle	Y			15/11/2002
Carex bichenoviana	Notched Sedge	Y			30/04/1993
Carex breviculmis	Short-stem Sedge	Y			30/09/1993
Carex inversa var. *major*	Knob Sedge	Y			8/11/2012
Carex sp.	Sedge	Y			8/11/2012
Carex tereticaulis	Rush Sedge	Y			3/04/1994
Carpobrotus modestus	Inland Pigface	Y			30/06/2000
Carpobrotus sp.	Pigface	Y			21/05/2002
Cassinia arcuata	Drooping Cassinia	Y			3/03/2011
Cassinia laevis	Curry Bush	Y			26/03/2000
Cassytha melantha	Coarse Dodder-laurel	Y			22/12/1987
Cassytha pubescens	Downy Dodder-laurel	Y			12/06/1995
Cassytha sp.	Dodder-laurel	Y			30/06/2000
Casuarina pauper	Black Oak	Y			30/04/1972
Casuarinaceae sp.	Sheaok Family	Y			21/04/2008
Centipeda crateriformis ssp. compacta	Desert Sneezeweed	Y			1/10/1912
Centipeda cunninghamii	Common Sneezeweed	Y			27/11/1965
Centipeda cunninghamii (NC)	Common Sneezeweed	Y			30/09/1993
Centrolepis aristata	Pointed Centrolepis	Y			9/10/1990
Centrolepis cephaloformis ssp. cephaloformis	Cushion Centrolepis	Y		R	14/11/1996
Centrolepis polygyna	Wiry Centrolepis	Y			14/11/1996
Centrolepis strigosa ssp. *strigosa*	Hairy Centrolepis	Y			14/11/1996
Chamaescilla corymbosa var. corymbosa	Blue Squill	Y			9/10/1990
Chamaesyce drummondii (NC)	Caustic Weed	Y			15/12/2001
Cheilanthes austrotenuifolia	Annual Rock-fern	Y			8/05/2015
Cheilanthes sieberi ssp. *sieberi*	Narrow Rock-fern	Y			5/04/2011
Cheilanthes sp.	Rock-fern	Y			23/09/2005
Cheiranthera alternifolia	Hand-flower	Y			1/11/2006
Chenopodium curvispicatum	Cottony Goosefoot	Y			28/04/1992
Chenopodium desertorum ssp.	Desert Goosefoot	Y			10/12/2013

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Chenopodium desertorum ssp. desertorum	Frosted Goosefoot	Y			1/08/2004
Chenopodium desertorum ssp. microphyllum	Small-leaf Goosefoot	Y			11/05/2015
Chloris truncata	Windmill Grass	Y			24/04/2015
Chorizandra enodis	Black Bristle-rush	Y			1/08/2004
Chrysocephalum apiculatum	Common Everlasting	Y			19/10/2012
Chrysocephalum apiculatum (NC)	Common Everlasting	Y			1/11/2006
Chrysocephalum baxteri	White Everlasting	Y			10/10/1924
Chrysocephalum semipapposum	Clustered Everlasting	Y			8/05/2015
Chthonocephalus pseudevax	Ground-heads	Y			19/10/2012
Cladonia cervicornis ssp. *verticillata*		Y			1/09/1964
Cladonia southlandica		Y			8/03/1966
Clematis microphylla	Old Man's Beard	Y			4/04/2011
Clematis microphylla var. *microphylla (NC)*	Old Man's Beard	Y			1/12/2006
Conospermum patens	Slender Smoke-bush	Y			10/11/1881
Convolvulus angustissimus ssp.		Y			26/10/2011
Convolvulus angustissimus ssp. angustissimus	Australian Bindweed	Y			1/05/2015
Convolvulus angustissimus ssp. peninsularum	Grassland Bindweed	Y			16/11/2012
Convolvulus erubescens (NC)	Australian Bindweed	Y			9/05/2002
Convolvulus remotus	Grassy Bindweed	Y			13/05/2015
Convolvulus sp.	Bindweed	Y			15/04/2015
Cotula australis	Common Cotula	Y			11/11/1996
Craspedia haplorrhiza	Billy-buttons	Y			1/09/2005
Craspedia variabilis	Billy-buttons	Y			5/10/2012
Crassula closiana	Stalked Crassula	Y			20/10/1992
Crassula colligata ssp. *colligata*		Y			10/12/2013
Crassula colorata var.	Dense Crassula	Y			1/08/2004
Crassula colorata var. *acuminata*	Dense Crassula	Y			11/12/1996
Crassula colorata var. *colorata*	Dense Crassula	Y			14/11/1996
Crassula decumbens var. decumbens	Spreading Crassula	Y			1/08/2004
Crassula peduncularis	Purple Crassula	Y		R	30/09/1993
Crassula sieberiana ssp. tetramera (NC)	Australian Stonecrop	Y			1/06/2000
Cryptandra amara var. amara (NC)	Spiny Cryptandra	Y			11/12/1996
Cryptandra campanulata	Long-flower Cryptandra	Y		R	13/05/2015

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Cryptandra sp.	Cryptandra	Y			12/11/1996
Cryptandra tomentosa	Heath Cryptandra	Y			1/08/2005
Cullen australasicum	Tall Scurf-pea	Y			16/11/2012
Cullen parvum	Small Scurf-pea	Y		V	1/10/1912
Cymbonotus preissianus	Austral Bear's-ear	Y			5/10/2012
Cymbopogon ambiguus	Lemon-grass	Y			26/11/2002
Cymbopogon sp.	Lemon Grass	Y			10/12/2013
Cynoglossum suaveolens	Sweet Hound's-tongue	Y			15/11/1996
Cyperus gunnii ssp. gunnii	Flecked Flat-sedge	Y			3/04/1994
Cyperus gymnocaulos	Spiny Flat-sedge	Y			15/04/2015
Cyperus laevigatus	Bore-drain Sedge	Y			27/03/1986
Cyperus sp.	Flat-sedge	Y			15/12/2001
Cyperus vaginatus	Stiff Flat-sedge	Y			10/12/2013
Dampiera dysantha	Shrubby Dampiera	Y			1/01/1980
Dampiera rosmarinifolia	Rosemary Dampiera	Y			14/06/2005
Danthonia sp. *(NC)*	Wallaby-grass	Y			14/06/2005
Daucus glochidiatus	Native Carrot	Y			5/10/2012
Daviesia arenaria	Sand Bitter-pea	Y			30/06/2000
Daviesia benthamii ssp.	Spiny Bitter-pea	Y			1/08/2004
Daviesia benthamii ssp. *humilis*	Mallee Bitter-pea	Y		R	1/08/2004
Daviesia brevifolia	Leafless Bitter-pea	Y			9/04/1969
Daviesia leptophylla	Narrow-leaf Bitter-pea	Y			
Daviesia ulicifolia ssp. incarnata		Y			9/04/1969
Dianella brevicaulis/revoluta var.	Black-anther Flax-lily	Y			11/12/1996
Dianella longifolia var. *(NC)*	Pale Flax-lily	Y			27/04/1992
Dianella longifolia var. *grandis*	Pale Flax-lily	Y		R	21/10/2012
Dianella revoluta (NC)		Y			2/10/1992
Dianella revoluta var.		Y			13/05/2015
Dianella revoluta var. *revoluta*	Black-anther Flax-lily	Y			13/05/2015
Dianella sp.	Flax-lily	Y			8/05/2008
Dichanthium sericeum ssp. *sericeum*	Silky Blue-grass	Y			26/11/2002
Dichelachne crinita	Long-hair Plume-grass	Y			10/11/1995
Dichondra repens	Kidney Weed	Y			1/08/2004
Digitaria ammophila	Spider Grass	Y			10/06/1884
Digitaria brownii	Cotton Panic-grass	Y			16/11/2012
Distichlis distichophylla	Emu-grass	Y			15/04/2015
Diuris behrii	Behr's Cowslip Orchid	Y		V	28/09/2010
Diuris pardina	Spotted Donkey-orchid	Y			1/01/1980
Dodonaea stenozyga	Desert Hop-bush	Y			10/06/1922
Dodonaea subglandulifera		Y	EN	E	13/09/1987
Dodonaea viscosa ssp.	Sticky Hop-bush	Y			23/02/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Dodonaea viscosa ssp. *angustissima*	Narrow-leaf Hop-bush	Y			26/11/2002
Dodonaea viscosa ssp. *spatulata*	Sticky Hop-bush	Y			21/10/2012
Drosera auriculata	Tall Sundew	Y			9/10/1990
Drosera glanduligera	Scarlet Sundew	Y			14/11/1996
Drosera macrantha ssp. *planchonii*	Climbing Sundew	Y			4/12/1996
Drosera peltata	Pale Sundew	Y			14/11/1996
Drosera peltata (NC)	Pale Sundew	Y			23/09/2005
Drosera whittakeri		Y			9/10/1990
Drosera whittakeri (NC)	Scented Sundew	Y			20/10/1992
Drosera whittakeri ssp. (NC)		Y			23/09/2005
Duma florulenta	Lignum	Y			15/05/2002
Dysphania pumilio	Small Crumbweed	Y			13/05/2015
Einadia nutans ssp.	Climbing Saltbush	Y			11/05/2015
Einadia nutans ssp. *nutans*	Climbing Saltbush	Y			5/10/2012
Elatine gratioloides	Waterwort	Y		R	25/10/1992
Eleocharis acuta	Common Spike-rush	Y			9/05/2002
Elymus scaber var. *scaber (NC)*	Native Wheat-grass	Y			12/04/2002
Enchylaena tomentosa var.	Ruby Saltbush	Y			11/05/2015
Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush	Y			18/11/2012
Enneapogon nigricans	Black-head Grass	Y			13/05/2015
Enneapogon sp.	Bottle-washers/Nineawn	Y			8/05/2008
Enteromorpha clathrata		Y			1/08/1981
Enteropogon acicularis	Umbrella Grass	Y			11/12/1996
Enteropogon acicularis (NC)	Umbrella Grass	Y			2/10/1992
Epilobium billardierianum ssp. cinereum	Variable Willow-herb	Y			24/04/1994
Epilobium billardierianum ssp. X intermedium	Variable Willow-herb	Y			30/09/1993
Epilobium hirtigerum	Hairy Willow-herb	Y			1/06/2000
Eragrostis infecunda	Barren Cane-grass	Y		R	12/02/2000
Eremophila alternifolia	Narrow-leaf Emubush	Y			1/11/1984
Eremophila behriana	Rough Emubush	Y			28/12/1981
Eremophila longifolia	Weeping Emubush	Y			10/12/2013
Eriochiton sclerolaenoides	Woolly-fruit Bluebush	Y			28/04/1992
Erodium sp.	Heron's-bill/Crowfoot	Y			13/05/2015
Eucalyptus behriana	Broad-leaf Box	Y		R	8/05/2015
Eucalyptus brachycalyx	Gilja	Y			8/05/2008
Eucalyptus camaldulensis ssp.	River Red Gum	Y			16/11/2012
Eucalyptus camaldulensis ssp. *camaldulensis*	River Red Gum	Y			15/04/2015

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Eucalyptus camaldulensis var. camaldulensis (NC)	River Red Gum	Y			14/06/2005
Eucalyptus cladocalyx (NC)	Sugar Gum	Y			14/06/2005
Eucalyptus dumosa	White Mallee	Y			2/04/2002
Eucalyptus gracilis	Yorrell	Y			10/12/2013
Eucalyptus incrassata	Ridge-fruited Mallee	Y			4/06/2002
Eucalyptus largiflorens	River Box	Y			4/04/2002
Eucalyptus leptophylla	Narrow-leaf Red Mallee	Y			15/11/2002
Eucalyptus leptophylla (NC)	Narrow-leaf Red Mallee	Y			14/06/2005
Eucalyptus leucoxylon (NC)	South Australian Blue Gum	Y			20/10/1992
Eucalyptus leucoxylon ssp.	South Australian Blue Gum	Y			8/11/2012
Eucalyptus leucoxylon ssp. *leucoxylon*	South Australian Blue Gum	Y			1/08/2004
Eucalyptus leucoxylon ssp. *pruinosa*	Inland South Australian Blue Gum	Y			13/05/2015
Eucalyptus leucoxylon ssp. *pruinosa (NC)*		Y			2/10/1992
Eucalyptus leucoxylon ssp. *stephaniae*	Scrubby Blue Gum	Y			8/05/2015
Eucalyptus odorata	Peppermint Box	Y			13/05/2015
Eucalyptus odorata (NC)	Peppermint Box	Y			8/11/2012
Eucalyptus oleosa ssp.		Y			8/05/2008
Eucalyptus oleosa ssp. oleosa	Red Mallee	Y			8/05/2008
Eucalyptus percostata	Ribbed White Mallee	Y		R	10/12/2013
Eucalyptus phenax (NC)	Sessile-fruit White Mallee	Y			28/04/1992
Eucalyptus phenax ssp.		Y			8/05/2008
Eucalyptus porosa	Mallee Box	Y			10/12/2013
Eucalyptus socialis (NC)	Beaked Red Mallee	Y			10/12/2001
Eucalyptus socialis ssp.		Y			8/05/2008
Eucalyptus sp.		Y			8/05/2008
Eucalyptus viminalis ssp. *cygnetensis*	Rough-bark Manna Gum	Y			4/03/2009
Euchiton involucratus	Star Cudweed	Y			15/11/1907
Euphorbia dallachyana	Caustic Weed	Y			13/04/2015
Euphorbia drummondii (NC)		Y			10/12/2013
Euphorbia sp.	Spurge	Y			13/05/2015
Euphrasia collina ssp. *osbornii*	Osborn's Eyebright	Y	EN	E	13/10/2010
Eutaxia diffusa	Large-leaf Eutaxia	Y			15/12/2001
Eutaxia microphylla	Common Eutaxia	Y			8/05/2015
Eutaxia microphylla var. *microphylla (erect) (NC)*	Common Eutaxia	Y			14/11/1996
Eutaxia microphylla var. microphylla (prostrate) (NC)	Common Eutaxia	Y			15/11/1996

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Eutaxia sp.	Eutaxia	Y			29/04/1992
Exocarpos aphyllus	Leafless Cherry	Y			10/12/2013
Exocarpos cupressiformis	Native Cherry	Y			8/04/2011
Exocarpos sp.	Native Cherry/Ballart	Y			8/05/2008
Galium gaudichaudii (NC)	Rough Bedstraw	Y			15/12/2001
Galium gaudichaudii ssp. *gaudichaudii*	Rough Bedstraw	Y			10/11/1995
Galium leptogonium	Reflexed Bedstraw	Y			25/10/1992
Galium migrans (NC)	Loose Bedstraw	Y			1/08/2004
Galium migrans ssp. migrans	Loose Bedstraw	Y			26/10/2011
Galium sp.	Bedstraw	Y			11/11/1993
Geijera linearifolia	Sheep Bush	Y			10/12/2013
Geranium retrorsum	Grassland Geranium	Y			5/10/2012
Geranium solanderi	Austral Geranium	Y			23/09/2005
Geranium sp.	Geranium	Y			1/05/2015
Glischrocaryon behrii	Golden Pennants	Y			18871027
Glossodia major	Purple Cockatoo	Y			9/10/1990
Glycine clandestina var. *(NC)*	Twining Glycine	Y			1/01/1980
Glycine rubiginosa	Twining Glycine	Y			11/12/1996
Gnaphalium indutum ssp. indutum	Tiny Cudweed	Y			14/11/1996
Gonocarpus elatus	Hill Raspwort	Y			8/05/2015
Gonocarpus mezianus	Broad-leaf Raspwort	Y			5/10/2012
Gonocarpus tetragynus	Small-leaf Raspwort	Y			19/10/2012
Goodenia albiflora	White Goodenia	Y			16/11/2012
Goodenia blackiana	Native Primrose	Y			1/11/2006
Goodenia geniculata	Bent Goodenia	Y			15/09/1987
Goodenia pinnatifida	Cut-leaf Goodenia	Y			11/05/2015
Goodenia pusilliflora	Small-flower Goodenia	Y			26/10/2011
Goodenia willisiana	Silver Goodenia	Y			1/01/1980
Gramineae sp.	Grass Family	Y			13/05/2015
Grevillea huegelii	Comb Grevillea	Y			8/05/2008
Grevillea ilicifolia ssp.		Y			1/08/2004
Grevillea ilicifolia ssp. *ilicifolia*	Holly-leaf Grevillea	Y			24/10/1984
Grevillea ilicifolia var. *ilicifolia (NC)*	Holly-leaf Grevillea	Y			4/06/2002
Grevillea lavandulacea ssp. lavandulacea	Spider-flower	Y			18871027
Grevillea lavandulacea var. *(NC)*	Spider-flower	Y			25/01/1991
Grevillea lavandulacea var. *lavandulacea (NC)*	Spider-flower	Y			30/06/2000
Hakea leucoptera ssp. *leucoptera*	Silver Needlewood	Y			4/12/1996
Hakea rostrata	Beaked Hakea	Y			8/05/2008
Hakea rugosa	Dwarf Hakea	Y			22/05/2002

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Halgania cyanea	Rough Blue-flower	Y			4/06/2002
Haloragis aspera	Rough Raspwort	Y			18/11/2012
Haloragis heterophylla	Variable Raspwort	Y			28/12/1992
Hardenbergia violacea	Native Lilac	Y			21/05/2002
Helichrysum bilobum ssp. (NC)		Y			27/04/1992
Helichrysum leucopsideum	Satin Everlasting	Y			1/11/2006
Helichrysum sp. *(NC)*		Y			12/02/1980
Heliotropium sp.	Heliotrope	Y			12/01/2004
Hibbertia australis	Stalked Guinea-flower	Y			15/08/1987
Hibbertia exutiacies	Prickly Guinea-flower	Y			14/11/1996
Hibbertia sericea	Silky Guinea-flower	Y			30/05/1964
Hibbertia virgata	Twiggy Guinea-flower	Y			15/11/2002
Hyalosperma demissum	Dwarf Sunray	Y			10/12/2013
Hyalosperma glutinosum ssp. glutinosum	Golden Sunray	Y			4/12/1996
Hyalosperma semisterile	Orange Sunray	Y			16/11/2012
Hydrocotyle callicarpa	Tiny Pennywort	Y			14/11/1996
Hydrocotyle foveolata	Yellow Pennywort	Y			14/11/1996
Hydrocotyle laxiflora	Stinking Pennywort	Y			5/10/2012
Imperata cylindrica	Blady Grass	Y			25/01/1987
Isoetes drummondii ssp. *drummondii*	Plain Quillwort	Y		R	9/10/1996
Isoetopsis graminifolia	Grass Cushion	Y			26/10/2011
Isolepis cernua	Nodding Club-rush	Y			27/03/1986
Isolepis congrua	Slender Club-rush	Y			20/10/1996
Isolepis fluitans	Floating Club-rush	Y			1/12/1992
Isolepis inundata	Swamp Club-rush	Y			9/09/2004
Ixodia achillaeoides ssp. *alata*	Hills Daisy	Y			1/02/1947
Juncus aridicola	Inland Rush	Y			18820103
Juncus bufonius	Toad Rush	Y			30/09/1993
Juncus caespiticius	Grassy Rush	Y			8/01/1912
Juncus flavidus	Yellow Rush	Y			12/11/1994
Juncus kraussii	Sea Rush	Y			13/04/2015
Juncus pallidus	Pale Rush	Y			9/05/2002
Juncus radula	Hoary Rush	Y		V	25/10/1992
Juncus sarophorus		Y			12/08/1999
Juncus sp.	Rush	Y			12/04/2002
Juncus subsecundus	Finger Rush	Y			5/10/2012
Kennedia prostrata	Scarlet Runner	Y			18930901
Kunzea pomifera	Muntries	Y			31/05/2003
Lachnagrostis aemula	Blown-grass	Y			18971101
Lachnagrostis perennis	Perennial Blown-grass	Y			12/02/2000
Lachnagrostis robusta	Tall Blown-grass	Y		R	12/02/2000
Lagenophora huegelii	Coarse Bottle-daisy	Y			24/04/2015
Leguminosae sp.		Y			19/10/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Leiocarpa tomentosa	Woolly Plover-daisy	Y			13/05/2002
Lepidium sp.	Peppercress	Y			1/12/2006
Lepidosperma canescens	Hoary Rapier-sedge	Y			1/07/2002
Lepidosperma carphoides	Black Rapier-sedge	Y			1/07/2002
Lepidosperma concavum	Spreading Sword-sedge	Y			13/06/1977
Lepidosperma concavum/congestum/laterale	Sword-sedge	Y			1/01/1980
Lepidosperma congestum (NC)	Clustered Sword-sedge	Y			12/02/1980
Lepidosperma curtisiae	Little Sword-sedge	Y			1/11/2006
Lepidosperma laterale (NC)	Sharp Sword-sedge	Y			27/04/1992
Lepidosperma sp.	Sword-sedge/Rapier-sedge	Y			15/05/2002
Lepidosperma viscidum	Sticky Sword-sedge	Y			18/11/2012
Leporella fimbriata	Fringed Hare-orchid	Y			21/04/1981
Leptomeria aphylla	Leafless Currant-bush	Y			1/12/2006
Leptorhynchos elongatus	Lanky Buttons	Y		R	18/09/1965
Leptorhynchos orientalis	Eastern Annual Buttons	Y		R	24/09/1938
Leptorhynchos squamatus ssp. squamatus	Scaly Buttons	Y			19/10/2012
Leptorhynchos tetrachaetus	Little Buttons	Y			16/11/2012
Leptospermum myrsinoides	Heath Tea-tree	Y			30/06/2000
Leucopogon sp.	Beard-heath	Y			14/06/2005
Leucopogon virgatus var. *virgatus*	Common Beard-heath	Y			9/04/1969
Levenhookia dubia	Hairy Stylewort	Y			4/12/1996
Levenhookia pusilla	Tiny Stylewort	Y			19/10/1996
Lichen sp.		Y			15/11/1996
Lilaeopsis polyantha	Australian Lilaeopsis	Y			12/02/2000
Limosella australis	Australian Mudwort	Y			1/06/2000
Linum marginale	Native Flax	Y			19/04/2011
Lobelia anceps	Angled Lobelia	Y			8/01/1912
Logania recurva	Recurved Logania	Y			9/04/1969
Logania saxatilis	Rock Logania	Y		R	24/08/1946
Lomandra collina	Sand Mat-rush	Y			4/12/1996
Lomandra densiflora	Soft Tussock Mat-rush	Y			13/05/2015
Lomandra effusa	Scented Mat-rush	Y			13/05/2015
Lomandra fibrata	Mount Lofty Mat-rush	Y			9/04/1969
Lomandra leucocephala ssp. robusta	Woolly Mat-rush	Y			22/05/2002
Lomandra micrantha ssp.	Small-flower Mat-rush	Y			13/05/2015
Lomandra micrantha ssp. *micrantha*	Small-flower Mat-rush	Y			19/10/2012
Lomandra micrantha ssp. *tuberculata*	Small-flower Mat-rush	Y			1/07/2003
Lomandra multiflora ssp.	Many-flower Mat-rush	Y			16/11/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Lomandra multiflora ssp. *dura*	Hard Mat-rush	Y			13/05/2015
Lomandra nana	Small Mat-rush	Y			16/11/2012
Lomandra sororia	Sword Mat-rush	Y			14/11/1996
Lomandra sp.	Mat-rush	Y			8/11/2012
Lotus australis	Austral Trefoil	Y			21/09/1964
Luzula meridionalis	Common Wood-rush	Y			5/10/2012
Luzula ovata	Clustered Wood-rush	Y		R	24/11/1992
Lysiana exocarpi ssp. *exocarpi*	Harlequin Mistletoe	Y			15/11/2002
Lythrum hyssopifolia	Lesser Loosestrife	Y			1/06/2000
Maireana aphylla	Cotton-bush	Y			27/04/2015
Maireana brevifolia	Short-leaf Bluebush	Y			13/05/2015
Maireana enchylaenoides	Wingless Fissure-plant	Y			13/05/2015
Maireana erioclada	Rosy Bluebush	Y			28/04/1992
Maireana excavata	Bottle Fissure-plant	Y		V	2/10/1992
Maireana pyramidata	Black Bluebush	Y			8/05/2008
Maireana rohrlachii	Rohrlach's Bluebush	Y		R	11/05/2015
Maireana sedifolia	Bluebush	Y			8/05/2008
Maireana sp.	Bluebush/Fissure-plant	Y			8/05/2008
Maireana trichoptera	Hairy-fruit Bluebush	Y			11/12/1996
Malvaceae sp.		Y			17/09/2002
Melaleuca brevifolia	Short-leaf Honey-myrtle	Y			27/03/1986
Melaleuca decussata	Totem-poles	Y			14/06/2005
Melaleuca lanceolata	Dryland Tea-tree	Y			8/05/2008
Melaleuca sp.	Tea-tree	Y			8/05/2008
Microlaena stipoides var. *stipoides*	Weeping Rice-grass	Y			1/12/2006
Microseris lanceolata	Yam Daisy	Y			14/11/1996
Microtis arenaria	Notched Onion-orchid	Y			22/11/2005
Microtis frutetorum		Y			22/11/2005
Microtis parviflora	Slender Onion-orchid	Y			1/12/2005
Microtis unifolia complex	Onion-orchid	Y			9/10/1990
Millotia myosotidifolia	Broad-leaf Millotia	Y			11/12/1958
Millotia tenuifolia var.	Soft Millotia	Y			10/12/2013
Millotia tenuifolia var. *tenuifolia*	Soft Millotia	Y			11/12/1996
Minuria leptophylla	Minnie Daisy	Y			15/11/1996
Moss sp.		Y			15/11/1996
Myoporum platycarpum ssp.	False Sandalwood	Y			13/04/2015
Myoporum platycarpum ssp. platycarpum	False Sandalwood	Y			1/06/1933
Myoporum viscosum	Sticky Boobialla	Y			15/11/1996
Myoporum viscosum (NC)	Sticky Boobialla	Y			15/11/1996
Myosotis australis	Austral Forget-me-not	Y			23/09/2005
Myriocephalus rhizocephalus	Woolly-heads	Y			18871027

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Myriophyllum integrifolium	Tiny Milfoil	Y		R	27/01/1993
Neurachne alopecuroidea	Fox-tail Mulga-grass	Y			24/04/2015
Nicotiana maritima	Coast Tobacco	Y			1/09/2005
Nitraria billardierei	Nitre-bush	Y			8/05/2008
Olearia decurrens	Winged Daisy-bush	Y			21/03/2001
Olearia floribunda	Heath Daisy-bush	Y			21/05/2002
Olearia pannosa ssp. pannosa	Silver Daisy-bush	Y	VU	V	28/09/2010
Olearia passerinoides ssp. *glutescens*	Sticky Daisy-bush	Y		R	5/04/1987
Olearia pimeleoides	Pimelea Daisy-bush	Y			14/06/2005
Olearia pimeleoides ssp. *(NC)*	Pimelea Daisy-bush	Y			27/04/1992
Olearia ramulosa	Twiggy Daisy-bush	Y			13/05/2015
Opercularia ovata	Broad-leaf Stinkweed	Y			18971101
Opercularia turpis	Twiggy Stinkweed	Y			18/09/1994
Ophioglossum lusitanicum	Austral Adder's-tongue	Y			18871027
Oxalis perennans	Native Sorrel	Y			13/05/2015
Oxalis perennans (NC)	Native Sorrel	Y			15/12/2001
Ozothamnus retusus	Notched Bush-everlasting	Y			1/11/2006
Ozothamnus sp.	Bush-everlasting	Y			21/03/2002
Panicum decompositum var. decompositum	Native Millet	Y			8/05/2015
Panicum effusum var. effusum	Hairy Panic	Y			2/04/2002
Panicum sp.	Panic/Millet	Y			8/05/2008
Pauridia glabella var. *glabella*	Tiny Star	Y			1/08/2004
Persicaria prostrata	Creeping Knotweed	Y			1/06/2000
Pheladenia deformis	Bluebeard Orchid	Y			31/08/1992
Phragmites australis	Common Reed	Y			13/04/2015
Phyllangium divergens	Wiry Mitrewort	Y			18800929
Pilularia novae-hollandiae	Austral Pillwort	Y		R	25/10/1992
Pimelea curviflora var. *gracilis (NC)*	Curved Riceflower	Y			27/03/2002
Pimelea glauca	Smooth Riceflower	Y			24/10/1994
Pimelea humilis	Low Riceflower	Y			18971101
Pimelea micrantha	Silky Riceflower	Y			16/11/2012
Pimelea serpyllifolia ssp. serpyllifolia	Thyme Riceflower	Y			4/06/2002
Pimelea stricta	Erect Riceflower	Y			1/11/2006
Pittosporum angustifolium	Native Apricot	Y			29/04/2015
Plantago gaudichaudii	Narrow-leaf Plantain	Y			5/10/2012
Plantago hispida	Hairy Plantain	Y			16/11/2012
Plantago sp.	Plantain	Y			8/05/2008
Plantago varia	Variable Plantain	Y			8/05/2015
Pleurosorus rutifolius	Blanket Fern	Y			1/06/2000
Poa clelandii	Matted Tussock-grass	Y			23/10/1966

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Poa crassicaudex	Thick-stem Tussock-grass	Y			16/11/2012
Poa labillardieri var. *labillardieri*	Common Tussock-grass	Y			8/11/2012
Poa sp.	Meadow-grass/Tussock-grass	Y			1/05/2015
Podolepis canescens	Grey Copper-wire Daisy	Y			19/10/2012
Podolepis tepperi	Delicate Copper-wire Daisy	Y			9/11/2010
Pogonolepis muelleriana	Stiff Cup-flower	Y			16/11/2012
Polygonum plebeium	Small Knotweed	Y			24/04/1994
Pomaderris paniculosa ssp. paniculosa	Mallee Pomaderris	Y			13/05/2002
Poranthera microphylla	Small Poranthera	Y			14/11/1959
Potamogeton crispus	Curly Pondweed	Y			18861029
Potamogeton tepperi	Tepper's Pondweed	Y			14/12/1939
Pottia sp.		Y			27/07/1963
Prasophyllum occidentale	Plains Leek-orchid	Y			1/09/1979
Prasophyllum odoratum	Scented Leek-orchid	Y			23/10/1966
Prasophyllum pallidum	Pale Leek-orchid	Y	VU	R	11/11/1981
Prasophyllum sp.	Leek-orchid	Y			23/09/2005
Prostanthera behriana	Downy Mintbush	Y			7/10/1993
Pseudoraphis spinescens	Spiny Mud-grass	Y			18871027
Pterostylis biseta	Two-bristle Greenhood	Y			14/11/1996
Pterostylis biseta (NC)	Two-bristle Greenhood	Y			14/11/1996
Pterostylis nana	Dwarf Greenhood	Y			31/08/1992
Pterostylis robusta	Large Shell-orchid	Y			1/06/2000
Pterostylis sp.	Greenhood	Y			30/06/2000
Ptilotus erubescens	Hairy-tails	Y		R	19/10/2012
Ptilotus nobilis ssp. *nobilis*	Yellow-tails	Y			11/12/1996
Ptilotus sp.	Mulla Mulla	Y			2/10/1992
Ptilotus spathulatus	Pussy-tails	Y			8/05/2015
Pultenaea largiflorens	Twiggy Bush-pea	Y			8/05/2015
Pultenaea pedunculata	Matted Bush-pea	Y			9/04/1969
Pultenaea tenuifolia	Narrow-leaf Bush-pea	Y			18871027
Pyrorchis nigricans	Black Fire-orchid	Y			1/01/1975
Ramaria gracilis		Y			3/07/1955
Ranunculus pachycarpus	Thick-fruit Buttercup	Y			18/09/1965
Ranunculus sessiliflorus var. sessiliflorus	Annual Buttercup	Y			1/08/2004
Rhagodia candolleana ssp. *candolleana*	Sea-berry Saltbush	Y			14/06/2005
Rhagodia parabolica	Mealy Saltbush	Y			11/05/2015
Rhagodia preissii ssp. *preissii*	Mallee Saltbush	Y			14/06/2005
Rhagodia spinescens	Spiny Saltbush	Y			1/05/1992
Rhodanthe corymbiflora	Paper Everlasting	Y			15/11/1996
Rhodanthe moschata	Musk Daisy	Y			3/10/1916
Rhodanthe polygalifolia	Milkwort Everlasting	Y			5/08/1969
Rhodanthe pygmaea	Pigmy Daisy	Y			19/10/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Rhodanthe troedelii	Small Paper-everlasting	Y			19/07/1955
Rumex brownii	Slender Dock	Y			8/12/2011
Rumex brownii (NC)	Slender Dock	Y			4/12/1996
Rumex dumosus	Wiry Dock	Y		R	21/10/2012
Rumex sp.	Dock	Y			8/05/2015
Rytidosperma auriculatum	Lobed Wallaby-grass	Y			7/12/2012
Rytidosperma caespitosum	Common Wallaby-grass	Y			15/04/2015
Rytidosperma carphoides	Short Wallaby-grass	Y			7/12/2012
Rytidosperma duttonianum	Brown-back Wallaby-grass	Y			14/11/1996
Rytidosperma erianthum	Hill Wallaby-grass	Y			10/12/2013
Rytidosperma fulvum	Leafy Wallaby-grass	Y			1/12/2006
Rytidosperma geniculatum	Kneed Wallaby-grass	Y			1/12/2006
Rytidosperma pilosum	Velvet Wallaby-grass	Y			1/06/2000
Rytidosperma racemosum var. racemosum	Slender Wallaby-grass	Y			7/12/2012
Rytidosperma setaceum	Small-flower Wallaby-grass	Y			10/12/2013
Rytidosperma sp.		Y			29/04/2015
Rytidosperma tenuius	Short-awn Wallaby-grass	Y		R	11/11/1993
Salsola australis	Buckbush	Y			11/05/2015
Samolus repens	Creeping Brookweed	Y			8/11/2012
Santalum acuminatum	Quandong	Y			4/06/2002
Scaevola albida	Pale Fanflower	Y			8/05/2015
Scaevola sp.	Fanflower	Y			10/11/1993
Schoenoplectus pungens	Spiky Club-rush	Y			8/11/2012
Schoenoplectus validus	River Club-rush	Y			1/02/2005
Schoenus apogon	Common Bog-rush	Y			1/08/2004
Schoenus breviculmis	Matted Bog-rush	Y			1/08/2004
Schoenus nanus	Little Bog-rush	Y			21/10/1995
Sclerolaena diacantha	Grey Bindyi	Y			10/12/2013
Sclerolaena obliquicuspis	Oblique-spined Bindyi	Y			28/04/1992
Sclerolaena patenticuspis	Spear-fruit Bindyi	Y			28/04/1992
Sebaea ovata	Yellow Sebaea	Y			9/10/1990
Selliera radicans	Shiny Swamp-mat	Y			20/01/2000
Senecio dolichocephalus	Woodland Groundsel	Y			30/09/1993
Senecio glossanthus	Annual Groundsel	Y			1/09/1964
Senecio glossanthus (NC)	Annual Groundsel	Y			30/06/2000
Senecio odoratus	Scented Groundsel	Y			26/11/1986
Senecio phelleus	Woodland Groundsel	Y			5/10/2012
Senecio picridioides	Purple-leaf Groundsel	Y			1/06/2000
Senecio quadridentatus	Cotton Groundsel	Y			18980301
Senecio spanomerus		Y			18/09/1965
Senecio tenuiflorus (NC)	Woodland Groundsel	Y			1/06/2000
Senna artemisioides ssp.	Desert Senna	Y			13/04/2015
Senna artemisioides ssp. *filifolia*	Fine-leaf Desert Senna	Y			8/05/2008
Senna artemisioides ssp. *petiolaris*		Y			14/06/2005

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Senna artemisioides ssp. *quadrifolia*	Four-leaf Desert Senna	Y			30/09/1993
Senna artemisioides ssp. X *coriacea*	Broad-leaf Desert Senna	Y			10/12/2013
Setaria constricta	Knotty-butt Paspalidium	Y			16/11/2012
Setaria jubiflora	Warrego Summer-grass	Y			15/04/2015
Sida corrugata var.	Corrugated Sida	Y			15/04/2015
Sida corrugata var. *angustifolia*	Grassland Sida	Y			16/11/2012
Sida corrugata var. *corrugata*	Corrugated Sida	Y			16/11/2012
Siloxerus multiflorus	Small Wrinklewort	Y			30/09/1993
Solanum simile	Kangaroo Apple	Y			1/07/1973
Solenogyne dominii	Smooth Solenogyne	Y			5/10/2012
Sonchus hydrophilus	Native Sow-thistle	Y			27/03/1986
Sonchus sp.	Sow-thistle	Y			21/04/2008
Sporobolus mitchellii	Rat-tail Couch	Y			26/03/2000
Sporobolus virginicus	Salt Couch	Y			5/04/2011
Spyridium parvifolium	Dusty Miller	Y			9/04/1969
Stackhousia monogyna	Creamy Candles	Y			21/10/2012
Stenopetalum lineare (NC)	Narrow Thread-petal	Y			11/12/1996
Stuartina muelleri	Spoon Cudweed	Y			11/12/1996
Swainsona behriana	Behr's Swainson-pea	Y		V	28/09/2010
Swainsona fissimontana	Broken Hill Pea	Y			19/07/1955
Swainsona tephrotricha	Ashy-haired Swainson-pea	Y			26/11/1986
Tecticornia pergranulata ssp. pergranulata	Black-seed Samphire	Y			21/05/2002
Teucrium racemosum	Grey Germander	Y			15/04/2015
Teucrium sessiliflorum	Mallee Germander	Y			24/10/1994
Thelymitra albiflora		Y			
Thelymitra antennifera	Lemon Sun-orchid	Y			23/10/1966
Thelymitra megcalyptra	Scented Sun-orchid	Y			23/09/1961
Thelymitra nuda		Y			1/10/2001
Thelymitra nuda (NC)	Scented Sun-orchid	Y			14/11/1996
Thelymitra pauciflora (NC)	Slender Sun-orchid	Y			9/10/1990
Themeda triandra	Kangaroo Grass	Y			13/05/2015
Thomasia petalocalyx	Paper-flower	Y			18871017
Thysanotus baueri	Mallee Fringe-lily	Y			11/12/1996
Thysanotus patersonii	Twining Fringe-lily	Y			1/11/2006
Trachymene cyanopetala	Purple Trachymene	Y			9/10/1990
Trachymene pilosa	Dwarf Trachymene	Y			14/11/1996
Tricoryne elatior	Yellow Rush-lily	Y			14/11/1996
Triglochin calcitrapum (NC)	Spurred Arrowgrass	Y			9/10/1990
Triglochin centrocarpum (NC)	Dwarf Arrowgrass	Y			14/11/1996
Triglochin isingiana	Spurred Arrowgrass	Y			31/08/1993
Triodia bunicola	Flinders Ranges Spinifex	Y			18871029
Triptilodiscus pygmaeus	Small Yellow-heads	Y			19/10/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Typha domingensis	Narrow-leaf Bulrush	Y			27/03/1986
Typha sp.	Bulrush	Y			15/12/2001
Unidentified sp.		Y			8/05/2008
Velleia arguta	Toothed Velleia	Y			16/11/2012
Velleia paradoxa	Spur Velleia	Y			19/10/2012
Vittadinia australasica var.	Sticky New Holland Daisy	Y			19/10/2012
Vittadinia australasica var. *australasica*	Sticky New Holland Daisy	Y			1/11/1992
Vittadinia blackii	Narrow-leaf New Holland Daisy	Y			27/04/2015
Vittadinia cervicularis var. *cervicularis*	Waisted New Holland Daisy	Y			10/12/2013
Vittadinia condyloides	Club-hair New Holland Daisy	Y			27/04/1992
Vittadinia cuneata var.	Fuzzy New Holland Daisy	Y			26/10/2011
Vittadinia cuneata var. *cuneata*	Fuzzy New Holland Daisy	Y			18/11/2012
Vittadinia cuneata var. *murrayensis*	Murray New Holland Daisy	Y			24/10/1984
Vittadinia gracilis	Woolly New Holland Daisy	Y			11/05/2015
Vittadinia megacephala	Giant New Holland Daisy	Y			16/11/2012
Vittadinia sp.	New Holland Daisy	Y			8/05/2015
Vulpia bromoides/myuros		Y			20/10/1992
Wahlenbergia communis	Tufted Bluebell	Y			5/04/2011
Wahlenbergia gracilenta	Annual Bluebell	Y			16/11/2012
Wahlenbergia littoricola	Coast Bluebell	Y			29/04/1992
Wahlenbergia luteola	Yellow-wash Bluebell	Y			18/11/2012
Wahlenbergia multicaulis	Tadgell's Bluebell	Y			12/11/1994
Wahlenbergia preissii		Y			18/11/2012
Wahlenbergia sp.	Native Bluebell	Y			11/05/2015
Wahlenbergia stricta ssp. stricta	Tall Bluebell	Y			21/10/2011
Walwhalleya proluta	Rigid Panic	Y			18/11/2012
Walwhalleya proluta (NC)	Rigid Panic	Y			8/12/2011
Wurmbea dioica ssp.		Y			19/10/2012
Wurmbea dioica ssp. *brevifolia*	Early Nancy	Y			27/03/1987
Wurmbea dioica ssp. *dioica*	Early Nancy	Y			19/10/2012
Wurmbea dioica ssp. *dioica (NC)*	Early Star-lily	Y			4/12/1996
Xanthorrhoea quadrangulata	Rock Grass-tree	Y			27/03/2002
Zygophyllum aurantiacum (NC)	Shrubby Twinleaf	Y			28/04/1992
Zygophyllum aurantiacum ssp.		Y			8/05/2008
Zygophyllum aurantiacum ssp. *aurantiacum*	Shrubby Twinleaf	Y			30/08/1984
Zygophyllum crenatum	Notched Twinleaf	Y			22/10/1967
Acacia baileyana	Cootamundra Wattle	N			11/07/2002

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			Aus	SA	
Acacia decurrens	Early Black Wattle	N			9/04/1969
Acacia longifolia ssp. longifolia	Sallow Wattle	N			9/04/1969
Acer sp.	Maple	N			14/06/2005
Acetosella vulgaris	Sorrel	N			1/05/2015
Adonis microcarpa	Pheasant's Eye	N			27/10/1970
Agave americana	Century Plant	N			9/12/2009
Agave americana var. (NC)	Century Plant	N			4/06/2002
Agrostis capillaris	Brown-top Bent	N			18971101
Agrostis gigantea	Red-top Bent	N			8/01/1912
Aira caryophyllea	Silvery Hair-grass	N			6/11/1984
Aira cupaniana	Small Hair-grass	N			5/10/2012
Aira elegantissima	Delicate Hair-grass	N			21/10/2012
Allium sp.		N			8/11/2012
Allium triquetrum	Three-cornered Garlic	N			2/10/2014
Allium vineale	Crow Garlic	N			28/05/2002
Aloe arborescens		N			6/08/1988
Aloe sp.	Aloe	N			15/05/2002
Amaranthus caudatus	Love-lies-bleeding	N			14/05/1993
Amaranthus retroflexus	Red-root Amaranth	N			29/02/1992
Amsinckia calycina	Hairy Fiddle-neck	N			12/11/1916
Anagallis arvensis	Pimpernel	N			5/10/2012
Anagallis minima	Chaffweed	N			14/11/1996
Arctotheca calendula	Cape Weed	N			13/05/2015
Artemisia absinthium	Wormwood	N			4/06/2002
Artemisia arborescens	Silver Wormwood	N			19/11/1999
Arundo donax	Giant Reed	N			22/06/2011
Asparagus asparagoides (NC)	Bridal Creeper	N			17/09/2002
Asparagus asparagoides f.		N			28/06/2011
Asparagus asparagoides f. *asparagoides*	Bridal Creeper	N			8/04/2011
Asparagus declinatus		N			28/06/2011
Asphodelus fistulosus	Onion Weed	N			13/04/2015
Asteriscus spinosus	Golden Pallensis	N			16/11/2012
Atriplex prostrata	Creeping Saltbush	N			20/03/1962
Avellinia michelii	Avellinia	N			14/11/1996
Avena barbata	Bearded Oat	N			10/12/2013
Avena fatua	Wild Oat	N			15/11/1996
Avena sativa	Cultivated Oat	N			17/08/1983
Avena sp.	Oat	N			13/05/2015
Bassia scoparia		N			18/03/1995
Brachypodium distachyon	False Brome	N			13/05/2015
Brassica sp.		N			13/01/2004
Brassica tournefortii	Wild Turnip	N			8/05/2015
Briza maxima	Large Quaking-grass	N			13/05/2015
Briza minor	Lesser Quaking-grass	N			23/09/2005

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Bromus alopecuros	Mediterranean Brome	N			11/11/1996
Bromus catharticus	Prairie Grass	N			19/11/1999
Bromus diandrus	Great Brome	N			1/05/2015
Bromus diandrus (NC)	Great Brome	N			21/04/2008
Bromus hordeaceus ssp. *hordeaceus*	Soft Brome	N			8/11/2012
Bromus madritensis	Compact Brome	N			10/12/2013
Bromus rubens	Red Brome	N			29/04/2015
Buglossoides arvensis	Sheepweed	N			29/07/1983
Bupleurum semicompositum	Hare's Ear	N			5/12/1996
Carduus tenuiflorus	Slender Thistle	N			5/10/2012
Carrichtera annua	Ward's Weed	N			28/04/1992
Carthamus lanatus	Saffron Thistle	N			27/04/2015
Catapodium rigidum	Rigid Fescue	N			11/11/1996
Cenchrus clandestinus	Kikuyu	N			8/11/2012
Cenchrus longisetus	Feather-top	N			14/06/2005
Cenchrus longispinus	Spiny Burr-grass	N			15/04/1940
Cenchrus macrourus	African Feather-grass	N			14/06/2005
Cenchrus setaceus	Fountain Grass	N			17/11/1999
Centaurea calcitrapa	Star Thistle	N			8/05/2008
Centaurea melitensis	Malta Thistle	N			13/01/2004
Centaurea solstitialis	St Barnaby's Thistle	N			4/04/2002
Centaurea sp.	Centaury	N			30/09/1993
Centaurium erythraea	Common Centaury	N			1/08/2004
Centaurium maritimum	Sea Centaury	N			26/10/2011
Centaurium sp.	Centaury	N			14/11/1996
Centaurium tenuiflorum	Branched Centaury	N			9/11/2010
Centaurium tenuiflorum (NC)	Branched Centaury	N			10/11/1993
Cerastium glomeratum	Common Mouse-ear Chickweed	N			14/11/1996
Cerastium sp.	Chickweed	N			30/09/1993
Ceratonia siliqua	Carob Tree	N			4/06/2002
Chamaecytisus palmensis	Tree Lucerne	N			1/01/2005
Chamaerops humilis	European Fan Palm	N			26/03/2000
Chenopodium album	Fat Hen	N			28/05/2002
Chenopodium glaucum	Glaucous Goosefoot	N			
Chenopodium murale	Nettle-leaf Goosefoot	N			5/04/2011
Chloris gayana	Rhodes Grass	N			18/03/2014
Chondrilla juncea	Skeleton Weed	N			1/12/2006
Chrysanthemoides monilifera ssp. monilifera	Boneseed	N			9/04/1969
Cirsium vulgare	Spear Thistle	N			5/04/2011
Conringia orientalis	Treacle Mustard	N			1/01/1936
Convolvulus arvensis	Field Bindweed	N			26/11/2002
Conyza bonariensis	Flax-leaf Fleabane	N			21/05/2002
Cotoneaster simonsii	Cotoneaster	N			4/06/2002

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Cotula bipinnata	Ferny Cotula	N			5/10/1992
Crassula tetragona ssp. *robusta*	Crassula	N			22/05/2002
Critesion murinum ssp. (NC)	Barley-grass	N			15/12/2001
Cucumis sp.	Melon	N			24/04/2015
Cydonia oblonga	Quince	N			22/05/2002
Cynara cardunculus ssp. flavescens	Artichoke Thistle	N			8/05/2015
Cynodon dactylon (NC)	Couch	N			14/06/2005
Cynodon dactylon var. *dactylon*	Couch	N			13/04/2015
Cynodon sp.	Couch	N			14/06/2005
Cynosurus echinatus	Rough Dog's-tail Grass	N			5/10/2012
Cyperus rotundus (NC)	Nut-grass	N			9/05/2002
Cyperus tenellus	Tiny Flat-sedge	N			14/11/1996
Cytisus scoparius	English Broom	N			22/05/2002
Cytisus sp.	Broom	N			19/11/1999
Dactylis glomerata	Cocksfoot	N			1/08/2004
Datura stramonium	Common Thorn-apple	N			25/04/1961
Delairea odorata	Cape Ivy	N			22/06/2011
Diplotaxis tenuifolia	Lincoln Weed	N			14/06/2005
Disa bracteata	South African Weed Orchid	N			21/11/2005
Dittrichia graveolens	Stinkweed	N			5/04/2011
Ecballium elaterium	Squirting Cucumber	N			16/04/2001
Echinochloa crus-galli	Common Barnyard Grass	N			28/02/1925
Echium plantagineum	Salvation Jane	N			13/05/2015
Echium sp.	Bugloss	N			27/04/1992
Ehrharta calycina	Perennial Veldt Grass	N			8/04/2011
Ehrharta longiflora	Annual Veldt Grass	N			5/10/2012
Ehrharta sp.	Veldt Grass	N			4/06/2002
Elytrigia repens	Twitch Grass	N			1/12/2006
Eragrostis barrelieri	Pitted Love-grass	N			1/02/2005
Eragrostis cilianensis	Stink Grass	N			21/04/2008
Eragrostis curvula	African Love-grass	N			17/05/2010
Eragrostis minor	Small Stink-grass	N			1/02/2005
Erodium botrys	Long Heron's-bill	N			26/10/2011
Erodium cicutarium	Cut-leaf Heron's-bill	N			1/05/2015
Erodium moschatum	Musky Herons-bill	N			17/09/2002
Eruca sativa	Purple-vein Rocket	N			8/01/1912
Euphorbia maculata	Eyebane	N			26/03/2000
Euphorbia terracina	False Caper	N			22/06/2011
Ficus carica	Edible Fig	N			4/04/2002
Foeniculum vulgare	Fennel	N			8/11/2012
Frankenia pulverulenta	Mediterranean Sea-heath	N			3/12/1993
Fraxinus angustifolia ssp. *angustifolia*	Desert Ash	N			2/10/2014

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Freesia cultivar	Freesia	N			8/04/2011
Fumaria capreolata	White-flower Fumitory	N			22/06/2011
Fumaria officinalis ssp. *officinalis*	Common Fumitory	N			4/12/1993
Fumaria parviflora var. *parviflora*	Small-flower Fumitory	N			2/10/1992
Fumaria sp.	Fumitory	N			30/09/1993
Galenia sp.	Galenia	N			29/04/2015
Galium aparine	Cleavers	N			9/12/2009
Galium divaricatum	Slender Bedstraw	N			4/12/1996
Galium murale	Small Bedstraw	N			19/10/2012
Gastridium phleoides	Nit-grass	N			28/02/1925
Gazania linearis	Gazania	N			13/05/2015
Gazania sp.	Gazania	N			1/08/2004
Genista monspessulana	Montpellier Broom	N			12/08/1999
Geranium dissectum	Cut-leaf Geranium	N			27/10/1993
Geranium molle var. molle	Soft Geranium	N			20/10/1993
Gladiolus undulatus	Wild Gladiolus	N			8/11/2012
Glycyrrhiza glabra	Liquorice	N			9/12/2009
Gomphocarpus cancellatus	Broad-leaf Cotton-bush	N			13/05/2015
Gomphocarpus fruticosus	Narrow-leaf Cotton-bush	N			30/11/1977
Heliotropium supinum	Creeping Heliotrope	N			6/03/1967
Helminthotheca echioides	Ox-tongue	N			1/08/2004
Holcus lanatus	Yorkshire Fog	N			1/08/2004
Hordeum glaucum	Blue Barley-grass	N			19/10/2012
Hordeum leporinum	Wall Barley-grass	N			8/04/2011
Hordeum marinum	Sea Barley-grass	N			8/11/2012
Hordeum sp.		N			29/04/2015
Hyparrhenia hirta	Tambookie Grass	N			12/06/2000
Hypericum perforatum	St John's Wort	N			8/11/2012
Hypochaeris glabra	Smooth Cat's Ear	N			1/05/2015
Hypochaeris radicata	Rough Cat's Ear	N			8/05/2015
Hypochaeris sp.	Cat's Ear	N			10/12/2013
Iris germanica	Flag Iris	N			8/11/2012
Iris germanica (NC)	Flag Iris	N			11/07/2002
Iris sp.	Iris	N			13/01/2004
Isolepis marginata	Little Club-rush	N			15/11/1996
Ixia maculata	Yellow Ixia	N			1/07/1959
Juncus acutus	Sharp Rush	N			13/04/2015
Juncus articulatus	Jointed Rush	N			1/12/1992
Juncus capitatus	Dwarf Rush	N			14/11/1996
Koelreuteria paniculata		N			4/03/2009
Lactuca serriola (NC)	Prickly Lettuce	N			14/06/2005
Lactuca serriola f.		N			8/12/2011
Lactuca serriola f. *integrifolia*	Prickly Lettuce	N			20/01/2000
Lactuca serriola f. *serriola*	Prickly Lettuce	N			8/05/2008

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Lagurus ovatus	Hare's Tail Grass	N			17/11/1999
Lamarckia aurea	Toothbrush Grass	N			4/12/1993
Lamium amplexicaule var. *amplexicaule*	Deadnettle	N			11/11/1996
Lathyrus latifolius	Perennial Pea	N			30/09/1993
Leontodon rhagadioloides	Cretan Weed	N			5/10/2012
Lepidium africanum	Common Peppercress	N			11/05/2015
Lepidium draba	Hoary Cress	N			1/04/1981
Lepidium latifolium	Perennial Peppercress	N			14/06/2005
Lepidium sativum	Garden Cress	N			1/10/1946
Leptospermum laevigatum	Coast Tea-tree	N			12/06/1995
Ligustrum vulgare	European Privet	N			21/05/2002
Limonium companyonis	Sea-lavender	N			5/04/2011
Logfia gallica	Narrow Cudweed	N			24/10/1992
Lolium loliaceum	Stiff Ryegrass	N			11/11/1996
Lolium perenne	Perennial Ryegrass	N			2/10/1992
Lolium perenne X Lolium rigidum	Hybrid Ryegrass	N			27/10/1993
Lolium rigidum	Wimmera Ryegrass	N			19/10/2012
Lolium sp.	Ryegrass	N			13/04/2015
Lycium barbarum	Chinese Boxthorn	N			1/01/2005
Lycium ferocissimum	African Boxthorn	N			13/05/2015
Malcolmia flexuosa		N			18/03/1995
Malus pumila	Apple	N			12/04/2002
Malva parviflora	Small-flower Marshmallow	N			14/06/2005
Malva sp.	Mallow	N			8/05/2015
Marrubium vulgare	Horehound	N			1/05/2015
Medicago minima var. minima	Little Medic	N			5/12/1996
Medicago polymorpha var. polymorpha	Burr-medic	N			5/10/2012
Medicago sp.	Medic	N			15/12/2001
Medicago truncatula	Barrel Medic	N			13/04/2015
Melia azedarach	White Cedar	N			4/04/2002
Melilotus indicus	King Island Melilot	N			2/08/1992
Minuartia mediterranea	Slender Sandwort	N			5/12/1996
Moenchia erecta	Erect Chickweed	N			1/08/2004
Moraea miniata	Two-leaf Cape Tulip	N			25/09/1988
Moraea setifolia	Thread Iris	N			13/05/2015
Moraea vegeta		N			16/10/1962
Neatostema apulum	Hairy Sheepweed	N			19/10/2012
Nicotiana glauca	Tree Tobacco	N			21/10/2012
Not naturalised in SA sp.		N			13/01/2004
Nothoscordum borbonicum		N			3/12/1978
Oenothera glazioviana		N			18/03/1995
Oenothera stricta ssp. *stricta*	Common Evening Primrose	N			26/11/2002

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Olea europaea ssp.	Olive	N			1/05/2015
Olea europaea ssp. *europaea*	Olive	N			19/10/2012
Onopordum acaulon	Horse Thistle	N			4/06/2002
Onopordum illyricum	Illyrian Thistle	N			15/01/1975
Opuntia puberula		N			30/09/2005
Opuntia sp.		N			1/05/2015
Opuntia sp. (NC)	Prickly Pear	N			4/06/2002
Opuntia spp.	Prickly Pear	N			1/01/2010
Opuntia stricta	Erect Prickly Pear	N			9/12/2009
Ornithogalum arabicum	Star Of Africa	N			13/11/1966
Oxalis flava	Finger-leaf Oxalis	N			22/05/2002
Oxalis hirta	Hairy Wood-sorrel	N			21/05/2002
Oxalis pes-caprae	Soursob	N			13/05/2015
Panicum capillare var. *brevifolium*	Witch-grass	N			8/04/2011
Panicum miliaceum	Broom Millet	N			15/06/2005
Papaver hybridum	Rough Poppy	N			13/11/1966
Parapholis incurva	Curly Ryegrass	N			8/11/2012
Parentucellia latifolia	Red Bartsia	N			10/12/2013
Paronychia argentea	Silver Whitlow	N			7/09/1996
Paspalum dilatatum	Paspalum	N			13/01/2004
Paspalum sp.		N			21/05/2002
Pentameris airoides ssp. *airoides*	False Hair-grass	N			24/04/2015
Pentameris pallida	Pussy Tail	N			1/08/2004
Petrorhagia dubia	Velvet Pink	N			1/08/2004
Petrorhagia nanteuilii		N			22/10/1993
Petrorhagia sp.	Pink	N			10/12/2013
Phalaris aquatica	Phalaris	N			8/05/2008
Phalaris minor	Lesser Canary-grass	N			10/12/2001
Phalaris sp.	Canary Grass	N			8/05/2008
Phoenix canariensis	Canary Island Palm	N			9/12/2009
Phoenix dactylifera	Date Palm	N			12/01/2004
Phyla canescens	Lippia	N			21/05/2002
Phyllopodium cordatum		N			14/11/1996
Picnomon acarna	Soldier Thistle	N			11/07/2002
Pinus halepensis	Aleppo Pine	N			22/06/2011
Pinus pinaster	Maritime Pine	N			1/02/1947
Pinus radiata	Radiata Pine	N			8/05/2008
Pinus sp.	Pine	N			13/01/2004
Piptatherum miliaceum	Rice Millet	N			15/04/2015
Plantago bellardii	Hairy Plantain	N			11/12/1996
Plantago coronopus ssp. coronopus	Bucks-horn Plantain	N			26/10/2011
Plantago lanceolata var.	Ribwort	N			5/10/2012

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Plantago lanceolata var. lanceolata	Ribwort	N			14/11/1996
Plantago major	Greater Plantain	N			23/09/2005
Poa bulbosa	Bulbous Meadow-grass	N			11/05/2015
Polycarpon tetraphyllum	Four-leaf Allseed	N			1/08/1906
Polygonum aviculare	Wireweed	N			15/04/2015
Polygonum aviculare (NC)	Wireweed	N			4/06/2002
Polypogon monspeliensis	Annual Beard-grass	N			1/03/1925
Populus sp.	Poplar	N			4/06/2002
Prunus dulcis	Almond	N			11/07/2002
Prunus persica var.	Peach	N			2/04/2002
Prunus sp.	Plum	N			27/11/2002
Psilocaulon granulicaule	Match-head Plant	N			13/04/2015
Psilurus incurvus	Bristle-tail Grass	N			14/11/1996
Puccinellia fasciculata	Borrer's Saltmarsh-grass	N			6/12/1970
Pyrus communis	Pear	N			21/05/2002
Ranunculus muricatus	Pricklefruit Buttercup	N			30/09/1993
Raphanus raphanistrum	Wild Radish	N			12/04/2002
Rapistrum rugosum ssp. *rugosum*	Turnip Weed	N			21/10/2012
Reichardia tingitana	False Sowthistle	N			16/11/2012
Reseda luteola	Wild Mignonette	N			12/04/2002
Ricinus communis	Castor Oil Plant	N			27/03/2002
Romulea minutiflora	Small-flower Onion-grass	N			2/10/2014
Romulea rosea var. australis	Common Onion-grass	N			21/10/2012
Romulea sp.	Onion-grass	N			13/05/2015
Rosa canina	Dog Rose	N			8/05/2015
Rosa rubiginosa	Sweet Briar	N			1/12/2006
Rosa sp.	Wild Rose/Briar	N			15/04/2015
Rosmarinus officinalis	Rosemary	N			22/05/2002
Rostraria cristata	Annual Cat's-tail	N			11/12/1996
Rostraria pumila	Tiny Bristle-grass	N			10/12/2013
Rubus leucostachys	Blackberry	N			10/12/2009
Rubus sp.	Blackberry	N			1/08/2004
Rubus ulmifolius var. *anoplothyrsus*	Thornless Blackberry	N			4/03/2009
Rubus ulmifolius var. *ulmifolius*	Blackberry	N			10/12/2009
Rumex conglomeratus	Clustered Dock	N			8/11/2012
Rumex crispus	Curled Dock	N			14/06/2005
Rumex obtusifolius	Broad-leaf Dock	N			27/04/1992
Salvia verbenaca var.	Wild Sage	N			13/05/2015
Salvia verbenaca var. *verbenaca*	Wild Sage	N			19/10/2012
Sanguisorba minor ssp. *muricata*	Sheep's Burnet	N			19/11/1999
Scabiosa atropurpurea	Pincushion	N			13/05/2015

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Schinus molle	Pepper-tree	N			13/05/2015
Schismus barbatus	Arabian Grass	N			10/12/2013
Sclerochloa dura	Hard Meadow-grass	N			10/11/1995
Secale cereale	Rye	N			18/08/1954
Senecio pterophorus	African Daisy	N			5/10/2012
Setaria verticillata	Whorled Pigeon-grass	N			14/06/2005
Setaria viridis	Green Pigeon-grass	N			26/03/2000
Sherardia arvensis	Field Madder	N			10/11/1993
Silene apetala	Sand Catchfly	N			7/09/1992
Silene gallica var.	French Catchfly	N			29/04/1992
Silene nocturna	Mediterranean Catchfly	N			26/10/2011
Silene sp.	Catchfly	N			10/12/2013
Silene vulgaris	Bladder Campion	N			13/11/1966
Silybum marianum	Variegated Thistle	N			28/05/2002
Sisymbrium erysimoides	Smooth Mustard	N			11/12/1996
Sisymbrium officinale	Hedge Mustard	N			21/03/2001
Sisymbrium sp.	Wild Mustard	N			28/05/2002
Solanum elaeagnifolium	Silver-leaf Nightshade	N			13/04/2015
Solanum marginatum	White-edged Nightshade	N			26/05/1964
Solanum nigrum	Black Nightshade	N			27/04/2015
Solanum physalifolium var. *nitidibaccatum*		N			15/02/1989
Solanum rostratum	Buffalo Burr	N			26/03/2000
Sonchus oleraceus	Common Sow-thistle	N			8/05/2015
Sonchus oleraceus (NC)	Common Sow-thistle	N			15/06/2005
Sorghum halepense	Johnson Grass	N			13/01/2004
Sparaxis sp.	Sparaxis	N			1/12/2006
Sparaxis tricolor	Tricolor Harlequin Flower	N			4/10/1986
Spergula arvensis	Corn Spurrey	N			9/07/1915
Spergularia bocconei	Red Sand-spurrey	N			25/10/1992
Spergularia diandra	Lesser Sand-spurrey	N			26/10/2011
Spergularia rubra	Red Sand-spurrey	N			29/04/1992
Spergularia rubra (NC)	Red Sand-spurrey	N			11/12/1996
Spergularia sp.	Sand-spurrey	N			10/12/2013
Stachys arvensis	Stagger Weed	N			13/11/1966
Stellaria media	Chickweed	N			14/11/1996
Symphyotrichum subulatum	Aster-weed	N			5/04/2011
Tamarix aphylla	Athel Pine	N			15/06/2005
Tamarix aphylla (NC)	Athel Pine	N			21/05/2002
Tamarix ramosissima		N			9/12/2009
Thinopyrum elongatum	Tall Wheat-grass	N			9/05/2002
Thymelaea passerina	Thymelaea	N			4/04/2000
Tragopogon porrifolius	Salsify	N			9/05/2002
Trifolium angustifolium	Narrow-leaf Clover	N			11/05/2015
Trifolium arvense var. *arvense*	Hare's-foot Clover	N			10/12/2013

Scientific name	Common name	Native	Conservation status		Last sighting (year)
			Aus	SA	
Trifolium campestre	Hop Clover	N			10/12/2013
Trifolium fragiferum var.	Strawberry Clover	N			20/10/1992
Trifolium fragiferum var. *fragiferum*	Strawberry Clover	N			19/10/2012
Trifolium glomeratum	Cluster Clover	N			1/12/2006
Trifolium hirtum	Rose Clover	N			1/01/1977
Trifolium scabrum	Rough Clover	N			10/12/2013
Trifolium sp.	Clover	N			13/05/2015
Trifolium subterraneum	Subterranean Clover	N			1/08/2004
Trifolium tomentosum	Woolly Clover	N			12/11/1996
Triticum aestivum	Wheat	N			26/11/2002
Ulex europaeus	Gorse	N			8/11/2012
Verbascum virgatum	Twiggy Mullein	N			28/05/2002
Veronica persica	Persian Speedwell	N			1/08/2004
Vicia sativa ssp.	Common Vetch	N			5/10/2012
Vicia sativa ssp. sativa	Common Vetch	N			1/09/1964
Vicia sp.	Vetch	N			22/12/1987
Vinca major	Blue Periwinkle	N			22/06/2011
Vitis vinifera	Grape Vine	N			27/11/2002
Vulpia bromoides	Squirrel-tail Fescue	N			19/10/2012
Vulpia fasciculata	Sand Fescue	N			14/11/1996
Vulpia muralis	Wall Fescue	N			4/12/1996
Vulpia myuros f.	Fescue	N			19/11/1999
Vulpia myuros f. *megalura*	Fox-tail Fescue	N			21/10/2012
Vulpia myuros f. *myuros*	Rat's-tail Fescue	N			9/11/2010
Vulpia sp.	Fescue	N			15/04/2015
Yucca gloriosa	Yucca	N			4/06/2002
Zaluzianskya divaricata	Spreading Night-phlox	N			1/08/2004
Heliotropium europaeum	Common Heliotrope	?			24/04/2015
Isolepis trachysperma	Grassy Club-rush	?			25/10/1992
Pseudognaphalium luteoalbum	Jersey Cudweed	?			30/09/1993

Conservation status

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. ssp.: the conservation status applies at the sub-species level. An asterisk denotes ratings that need to be qualified for a variety of reasons, such as changes to taxonomy or nomenclature since listing or because a species assessed as 'presumed extinct' had to be listed under the Endangered category. Further details are available from the Vascular Plant Metadata document on the DEWNR website.

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