

# 1 INTRODUCTION

---

## 1.1 Background

Ecology and Heritage Partners Pty Ltd were commissioned by Delburn Wind Farm Pty Ltd (part of the OSMI Australia group) to prepare a Biodiversity Assessment report for the proposed Delburn Wind Farm in the Strzelecki Ranges, Gippsland, Victoria (the study area).

This assessment looks at the ecological values, potential impacts and mitigation measures for the broader study area, as well as the more immediate impact area directly affected by the infrastructure and operations - primarily the wind turbine hardstands, expansion of existing roads and access tracks, creation of new access tracks, installation of underground cabling, battery storage facility, operations and maintenance centre, meteorological masts, and temporary construction facilities throughout the study area. The project will also require a new terminal station to access the existing transmission network, which has been assessed in a separate Biodiversity Assessment report.

Several ecological investigations associated with the proposed development have been undertaken between 2018 and 2020 (Ecology and Heritage Partners 2020a). The purpose of the investigations was to determine the ecological values, including the extent and quality of native vegetation, the known or potential presence of significant flora and fauna species, and/or ecological communities within the study area. An assessment of the likely or potential impacts to ecological values, and the provision of avoidance and mitigation measures undertaken, or that will be undertaken as part of the proposed development, are provided.

Included in the ecological investigations was an assessment of native vegetation within the study area to determine the biodiversity offsets required for any permitted removal of native vegetation as part of the project (i.e. under Clause 52.17 of the Baw Baw, Latrobe and South Gippsland Planning Schemes). The report also discusses any additional ecological and legislative implications / considerations associated with the project and provides recommendations to address or further reduce impacts to ecological values associated with the proposed development.

Targeted surveys were also undertaken in 2018-2019 for significant flora and fauna species known to or considered likely to occur within the study area (Ecology and Heritage Partners 2020a). The project was referred to the Commonwealth Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 10 January 2020. A Matters of National Environmental Significance report accompanied the referral (Ecology and Heritage Partners 2019). The proposed development was deemed 'not a controlled action' by the Minister on 17 July 2020.

The Delburn Wind Farm Project was referred under the *Environmental Effects Act 1978* on 11 May 2020. On 16 July 2020, the Minister for Planning determined that an Environmental Effects Statement (EES) is not required, subject to the following conditions:

- a) *An environment report must be prepared in consultation with DELWP and completed to the satisfaction of the Minister for Planning. The report needs to examine and document:*
  - i) *the predicted impacts (direct and indirect), on native vegetation and biodiversity values, particularly associated with:*

*Growling Grass Frog and Strzelecki Gum and listed flora and fauna species under the Flora and Fauna Guarantee Act 1988 and Environment Protection and Biodiversity Conservation Act 1999;*

*endangered ecological vegetation classes*

*wetlands, waterways and waterbodies; and,*

*large trees and large hollow-bearing trees.*

- ii) *the assessment of alternatives, including project layout refinements and siting of infrastructure, as well as mitigation measures, to avoid and minimise adverse environmental effects on matters listed in condition (a.i).*
- b) *A flora and fauna management plan must be prepared in consultation with DELWP and completed to the satisfaction of the Secretary of DELWP, prior to the commencement of any works. The flora and fauna management plan needs to be informed by the assessments included within the final environment report (under condition a)) and must include specific measures to avoid, minimise and mitigate potential impacts on flora and fauna within the project site during construction and operation of the project, including but not limited to:*
  - i) *measures to further minimise and mitigate impacts to retained vegetation, in particular endangered ecological vegetation classes;*
  - ii) *measures to further minimise and mitigate the removal of large trees and large hollow-bearing trees;*
  - iii) *measures to further minimise and mitigate impacts on native fauna during construction and habitat clearance;*
  - iv) *measures to prevent and control pathogens, weeds (non-native species) and pest (non-native) animals;*
  - v) *a program for on-going monitoring and adaptive management of listed communities and listed species of flora and fauna within the project site; and,*
  - vi) *measures to avoid pollutants, contaminated run-off and sediment from entering waterways and waterbodies.*
- c) *If the proposal requires upgrades to Nursery Track, the design of the waterway crossing needs to be completed to the satisfaction of the Secretary of DELWP and be consistent with the design guidelines specified within the Melbourne Strategic Assessment publication "Growling Grass Frog Crossing Design Standards" (DELWP, 2017).*
- d) *The environment report is to be completed to inform the proposed project that is subsequently considered through planning and approval processes, particularly under the Planning and Environment Act 1987.*

The conditions of the Minister for Planning's decision under the EE Act have been addressed separately in the Environment Report and a Flora and Fauna Management Plan (Ecology and Heritage Partners 2020b, 2020c).

## 1.2 Study Area

The study area is located in the Strzelecki Ranges, Central Gippsland region and is approximately 5,000 hectares in area. It is located south of Moe and the Princess Freeway and north of Boolarra-Mirboo North Road, and within the plantation land centred in the Delburn area, covering the HVP Plantations Thorpdale Tree Farm. The study area is bound by Hernes Oak to the north, Coalville, Narracan and Thorpdale to the west, Darlimurla to the south, and Driffield, Boolarra and Yinnar to the east. It is approximately 150 kilometres east of Melbourne's CBD (Figure 1) and intersects the Gippsland Plain and Strzelecki bioregions and is applicable to the West Gippsland Catchment Management Authority (CMA).

The study area comprises a mosaic of native vegetation, pine and blue gum plantations. Private agricultural land surrounds the study and project areas. The mapped native vegetation within the study area represents seven Ecological Vegetation Classes (EVCs) from two bioregions. Patches of native vegetation adjacent to the study area includes Sayers Trig Bushland Reserve (north), Darlimurla Forest Block (east), and Mirboo North Regional Park (west). Darlimurla Forest Block (340 hectares) supports high quality vegetation and fauna habitat represented by seven EVCs, including Herb Rich Foothill Forest, Lowland Forest, Dry Valley Forest, Heathy Woodland, Riparian Forest, Swampy Riparian Complex and Swamp Scrub (Biosis 1998). Tributaries of the Morwell River, Ten Mile Creek, and associated wetlands intersect the study area, while artificial waterbodies (e.g. farm dams, fire dams) are scattered throughout.

## 1.3 Impact Area

The proposed Delburn Wind Farm involves the installation of up to 33 turbines and associated infrastructure: primarily the expansion of existing roads and access tracks, throughout the study area (Figure 1). The infrastructure layout (impact area) is approximately 210 hectares in size. Of this, 12.344 hectares of native vegetation is proposed to be impacted across the WEF development footprint (Section 5.2.1). Given the size of the study area, the native vegetation assessment (including the detailed habitat hectares assessment) was undertaken within or directly adjacent to the impact area.

## 2 METHODS

---

### 2.1 Desktop Assessment

Relevant literature, online-resources and databases were reviewed to provide an assessment of flora and fauna values associated with the study area. The following information sources were reviewed:

- The DELWP NVIM Tool (DELWP 2020a) and NatureKit Map (DELWP 2020b) for:
  - Modelled data for location risk, remnant vegetation patches, scattered trees and habitat for rare or threatened species;
  - The extent of historic and current Ecological Vegetation Classes (EVCs);
  - Previously documented flora and fauna records within the project locality
- EVC benchmarks (DELWP 2020c) for descriptions of EVCs within the Strzelecki Ranges and Gippsland Plain bioregions;
- The Victorian Biodiversity Atlas (VBA) for previously documented flora and fauna records within the project locality (DELWP 2020d);
- Birdline Victoria archives (multiple dates) for previous documented records of birds within the local area, including significant species (e.g. White-bellied Sea-eagle, Freckled Duck and Australasian Bittern);
- The Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DAWE 2020);
- Relevant listings under the *Flora and Fauna Guarantee Act 1988* (FFG Act), including the latest Threatened and Protected listings (DSE 2009, 2013a; DEPI 2014; DELWP 2019a, 2019b);
- VicPlan (DELWP 2020e) and Planning Schemes Online (DELWP 2020f) to ascertain current zoning and environmental overlays in the project area;
- Aerial photography of the study area; and,
- Previous ecological assessments relevant to the study area and other relevant documents, including:
  - Existing conditions report (Ecology and Heritage Partners 2020a);
  - Matters of National Environmental Significance report (Ecology and Heritage Partners 2019);
  - Flora and Fauna Assessment of Darlimurla Forest Block (Biosis 1998);
  - Development of Wind Energy Facilities in Victoria: Policy and Planning Guidelines (DELWP 2017a); and,
  - Developing a science-based approach to defining key species of birds and bats of concern for wind farm developments in Victoria. Arthur Rylah Institute for Environmental Research Technical Report Series No. 301. Department of Environment, Land, Water and Planning, Heidelberg, Victoria (Lumsden *et al.* 2019).

## 2.2 Consultation

The ecological assessments also involved consultation with relevant Government agencies, stakeholders, landowners, and species experts, including, but not limited to:

- DELWP Gippsland regarding key ecological values and relevant legislation and Government policy that need to be considered as part of the project; and,
- Five community open days (1, 2 and 3 August 2019, and 13 and 14 March 2020) where there was an opportunity to meet members of the local community, and discuss the project and how ecological values have been assessed and considered as part of the design and assessment of the project. Valuable information was obtained from several local residents who have an interest in the project and the ecology within the study area and throughout the local area; and,
- The Delburn Wind Farm has a project office and information centre where community members have provided useful information regarding the local flora and fauna species in the region, and this information has been used as part of the project planning and assessment.

## 2.3 Summary of Field Surveys

Detailed field assessments over multiple survey periods, and during different seasons and conditions were undertaken to determine the extent and quality of native vegetation (including mapping of large trees), to record flora and fauna species, and to assess fauna habitats within the study area (note: different survey types were undertaken concurrently). A summary of the field surveys is provided (Table 1).

**Table 1.** Summary of field surveys completed within the study area as part of the detailed ecological investigations.

Category	Survey dates	Number of survey days and approximate hours
Native vegetation and Large Tree assessments, general fauna assessments	<ul style="list-style-type: none"> <li>- 17-19 July 2018</li> <li>- 18-20 March 2019</li> <li>- 5-7 August 2019</li> <li>- 19-20 February 2020</li> </ul>	11 survey days (2 surveyors), 176 hours (average 8 hour day)
Arboricultural assessment (Homewood 2020) (Appendix 6)	<ul style="list-style-type: none"> <li>- 25-26 June 2020 and 30 June 2020</li> </ul>	3 survey days (2 surveyors), 48 hours (average 8 hour day),
Significant flora species surveys	<ul style="list-style-type: none"> <li>- 12-16 November 2018 (Strzelecki Gum <i>Eucalyptus strzeleckii</i>, Matted Flax-lily <i>Dianella amoena</i> and other significant species)</li> <li>- 18-20 March 2019</li> <li>- 5-7 August 2019</li> <li>- 19-20 February 2020 (Strzelecki Gum)</li> </ul>	13 survey days (2 surveyors), 208 hours (average 8 hour day)
Arboreal Mammals and Forest Owl surveys	<ul style="list-style-type: none"> <li>- 12-16 November 2018</li> <li>- 2-4 October 2019</li> <li>- 30-31 October 2019 and 1 November 2019</li> </ul>	8 nights (2 surveyors), 144 hours (average 9 hour day)

Category	Survey dates	Number of survey days and approximate hours
Ground-dwelling mammal surveys	<ul style="list-style-type: none"> <li>- 12-16 November 2018</li> <li>- Between 2 October 2019 and 1 November 2019</li> </ul>	29 days cameras were recording (15 hours to set up and pick up camera traps)
Targeted Growling Grass Frog <i>Litoria raniformis</i> surveys	<ul style="list-style-type: none"> <li>- 12-16 November 2018</li> <li>- 2-4 October 2019</li> </ul>	8 days and 6 nights (2 surveyors), 144 hours (average 9 hour day)
Bird Utilisation Surveys (winter and spring)	<ul style="list-style-type: none"> <li>- 4-6 June 2019</li> <li>- 11-13 June 2019</li> <li>- 2-4 October 2019</li> <li>- 30-31 October 2019 and 1 November 2019</li> <li>- 6-8 November 2019</li> </ul>	15 survey days (2 surveyors), 540 hours (average 9 hour day)
Bats surveys	<ul style="list-style-type: none"> <li>- 2 October 2019 to 1 November 2019</li> </ul>	29 days (15 hours Anabat set up and pick up)

**Note:** Some of the field surveys for each category were undertaken concurrently (e.g. targeted forest owl surveys and Growling Grass Frog surveys).

Given the size of the study area and the type and extent of the proposed development (i.e. only a very small proportion of the study area is proposed to be disturbed), vegetation surveys and targeted surveys primarily focused in areas within or adjacent to the infrastructure layout. Native vegetation, scattered trees and large trees within 50 meters of each iteration of the infrastructure design disturbance areas were assessed to ensure that all indirect impacts of the project footprint alignments could be fully assessed. Surveyors also undertook a broad ecological assessment (i.e. not detailed vegetation mapping or habitat hectares assessments) outside of the infrastructure layout (Figure 2, Figure 3).

The study area was walked and/or driven. All observed vascular flora and fauna species within or adjacent to the impact area were recorded, any observations of significant species were mapped and the overall condition of vegetation and habitats noted. Ecological Vegetation Classes were determined with reference to DELWP pre-1750 and extant EVC mapping and their published descriptions (DELWP 2020c).

Where remnant vegetation was identified within the revised infrastructure layout (Layout v2.2 referred for the EES) (and also the former 53 turbine layout – Layout 1.5) a habitat hectare assessment was undertaken using the methodology described in the Vegetation Quality Assessment Manual (DSE 2004) (see habitat zones in Figure 2). Native vegetation was classified in accordance with the definitions provided in Table 2, as defined in the ‘*Guidelines for the removal, destruction or lopping of native vegetation*’ (the Guidelines) (DELWP 2017b). Further refinements to the infrastructure layout to prepare the Preliminary Layout (up to v3.5) have not warranted additional vegetation assessment as no new patches or trees were identified as being impacted (other than those already assessed and classified).

All fieldwork was carried out under the appropriate licences, including a Research Permit (10008283) and Scientific Procedures Fieldwork Licence (SPFL 20005) issued by DELWP under the *Wildlife Act 1975*, and an Animal Research permit issued by the Wildlife and Small Institutions Animal Ethics Committee (05.17).

## 2.4 Removal, Destruction or Lopping of Native Vegetation (the Guidelines)

Under the *Planning and Environment Act 1987*, Clause 52.17 of the respective Planning Scheme requires a planning permit from the Baw Baw Shire, Latrobe City and South Gippsland Shire Councils to remove native vegetation. The assessment process for the clearing of vegetation follows the 'Guidelines for the removal, destruction or lopping of native vegetation' (Guidelines) (DELWP 2017b). The 'Assessor's handbook – applications to remove, destroy or lop native vegetation' (Assessor's handbook) (DELWP 2018) provides clarification regarding the application of the Guidelines.

### 2.4.1 Assessment Pathway

The Guidelines manage the impacts on biodiversity from native vegetation removal using an assessment-based approach. Two factors – extent and location – are used to determine the assessment pathway associated with an application for a permit to remove native vegetation. The location category (1, 2 or 3) has been determined for all areas in Victoria and is available on DELWP's Native Vegetation Information Management (NVIM) Tool (DELWP 2020a), with the higher category used where the native vegetation to be removed includes more than one location category.

- Location 3 – includes locations where the removal of less than 0.5 hectares of native vegetation could have a significant impact on habitat for a rare or threatened species.
- Location 2 – includes locations that are mapped as endangered EVCs and/or sensitive wetlands and coastal areas and are not included in Location 3.
- Location 1 – includes all remaining locations in Victoria.

Determination of the assessment pathway is summarised below (Table 2).

**Table 2.** Assessment pathways for applications to remove native vegetation (DELWP 2017b).

Extent		Location		
		1	2	3
Native Vegetation	< 0.5 hectares, and not including any large trees	Basic	Intermediate	Detailed
	Less than 0.5 hectares, and including one or more large trees	Intermediate	Intermediate	Detailed
	0.5 hectares or more	Detailed	Detailed	Detailed

**Notes:** For the purpose of determining the assessment pathway of an application to remove native vegetation the extent includes any other native vegetation that was permitted to be removed on the same contiguous parcel of land with the same ownership as the native vegetation to be removed, where the removal occurred in the five year period before an application to remove native vegetation is lodged.

### 2.4.2 Vegetation Assessment

Native vegetation (as defined in (Table 3) is assessed using two key parameters: extent (in hectares) and condition. For the purposes of this assessment, both condition and extent were determined as part of the habitat hectare assessment (Appendix 1.3).

In addition, all mapped wetlands [based on the DELWP 'Current Wetlands' layer (Figure 8)] was included as native vegetation, with the modelled condition score assigned to them (DELWP 2017b).



**Table 3.** Determination of remnant native vegetation (DELWP 2017b).

Category	Definition	Extent	Condition
Remnant patch of native vegetation	<p>An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native.</p> <p>OR</p> <p>An area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy.</p> <p>OR</p> <p>Any mapped wetland included in the <i>Current wetlands map</i>, available in DELWP systems and tools.</p>	<p>Measured in hectares.</p> <p>Based on hectare area of the remnant patch.</p>	<p>Vegetation Quality Assessment Manual (DSE 2004)</p> <p>OR</p> <p>Modelled condition for <i>Current Wetlands</i>.</p>
Scattered tree	<p>A native canopy tree that does not form part of a remnant patch.</p>	<p>Measured in hectares.</p> <p>Each Large scattered tree is assigned an extent of 0.071 hectares (30m diameter).</p> <p>Each Small scattered tree is assigned a default extent of 0.31 hectares (10 metre diameter).</p>	<p>Scattered trees are assigned a default condition score of 0.2 (outside a patch).</p>

**Notes:** Native vegetation is defined in the Victoria Planning Provisions as ‘plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses’.

### 2.4.3 Arboricultural Assessment

Following the native vegetation assessment, a targeted arboricultural assessment was completed for areas of indirectly impacted native vegetation patches and trees adjacent to the existing forestry roads, with the existing roads already located within the Tree Protection Zone (TPZ) (Homewood 2020) (Appendix 6).

This assessment determined whether patches of trees identified as being impacted under the Guidelines (DELWP 2017b) would remain viable or not given the proposed extent of new works, considering the existing impacts on TPZs due to the existing road compaction and permeability. Not all areas of modelled indirect impacts across the study area were assessed.

### 2.4.4 Hollow-bearing Tree Assessment

An assessment was undertaken in August 2020 and December 2020 to determine the presence of hollows in trees that have been identified as being impacted by the project. All large trees and small scattered trees that are proposed to be impacted were assessed for hollows. Observations were also made about the prevalence or otherwise of hollows in trees adjacent to and outside the direct or indirect impact area.

Site observations were broadly consistent with the fact that large trees have a greater propensity to contain hollows and provide suitable habitat for a range of fauna species. Small trees rarely contained hollows, with small fissures in bark, likely to provide suitable habitat for microbats, occasionally present.



## 2.5 Targeted Flora Surveys

Based on the outcomes of the desktop assessment, targeted surveys for significant flora species (principally Strzelecki Gum and Matted Flax-lily), including species listed as threatened under the EPBC Act and/or FFG Act were undertaken during the vegetation assessments to determine their presence or absence within the study area. To maximise the likelihood of detecting significant flora species identified as having the potential to occur within or directly adjacent to the impact area, incidental records of the target species were undertaken during the initial vegetation and large tree assessments and bird utilisation surveys.

Targeted surveys were undertaken by a team of Ecologists and involved systematically walking road reserves and tracks in areas where significant species (e.g. Strzelecki Gum and Matted Flax-lily) had the highest potential to occur within the impact area. Handheld GPS units were used to record the location of any significant flora species encountered.

## 2.6 Terrestrial Fauna Surveys

Fauna surveys were undertaken concurrently with the vegetation assessment and large tree assessments between 17 July 2018 and 20 February 2020, as well as during the bird utilisation surveys (Table 1). The study area was visually assessed and active searching under and around ground debris for reptiles, frogs and small mammals was undertaken. Binoculars were also used to scan the area for birds, and observers listened for calls and searched for other signs of fauna such as nests, remains of dead animals, droppings and footprints. Potential habitat for fauna was assessed, with a particular emphasis on waterbodies and other habitats that may provide shelter, food or other resources for significant species (e.g. hollow-bearing trees).

At most locations, assessment was made on foot by walking into the areas considered likely to support the highest-quality and representative habitat (judgement based on aerial imagery and prior field experience). Zoologists remained adaptable in the field, and opportunistically included other nearby areas in the investigation if those areas were thought to provide higher quality habitat or help provide information on fauna that might use the project boundary. Observations of threatened species were recorded at locations if seen/heard.

A summary of the fauna survey techniques and a description of the survey methods is provided below (Table 4). Targeted surveys for significant fauna were undertaken in November 2018 and October - November 2019 to maximise the likelihood of detecting significant fauna identified as having the potential to occur within the impact area.

**Table 4.** Summary of fauna survey techniques and total survey effort.

Survey technique	Target species	Sites	Survey effort
Habitat assessments and incidental observations of fauna	Southern Brown Bandicoot <i>Isodon obesulus obesulus</i> , Greater Glider <i>Petauroides Volans</i> , Powerful Owl, Sooty Owl Masked Owl and Growling Grass Frog.	Within suitable habitats across the entire the study area.	Eight separate survey periods between 17 July 2018 and 20 February 2020.

Survey technique	Target species	Sites	Survey effort
<b>Spotlighting – arboreal mammals and forest owls</b>	Greater Glider, Koala <i>Phascolarctos cinereus</i> , Powerful Owl, Sooty Owl and Masked Owl.	Spotlighting transects undertaken in suitable forested habitats across the study area.	Four nights of spotlighting (12-16 November 2018). Two nights of surveys (2-4 October 2019). Two nights spotlighting (30-31 October 2019 and 1 November 2019).
<b>Nocturnal call playback</b>	Koala, Powerful Owl, Sooty Owl and Masked Owl.	Call playback occurred at beginning of spotlighting transects in suitable forested habitats across the study area.	Four nights of spotlighting (12-16 November 2018). Two nights of surveys (2-4 October 2019). Two nights spotlighting (30-31 October 2019 and 1 November 2019).
<b>Bat detectors</b>	Common Bent-wing Bat	Four sites (three within and one outside the study area) in a selection of habitat types.	Bat detectors deployed 2-4 October 2019 and retrieved 1 November 2019.
<b>Motion detecting cameras to detect ground-dwelling mammals</b>	Significant mammal species principally Southern Brown Bandicoot.	Five sites at selected native vegetation remnants within the study area. 12 sites in total (11 within the study area and one south of the study area).	Four nights of motion detecting camera surveys (12-16 November 2018). Cameras deployed 2-4 October 2019 and retrieved 1 November 2019.
<b>Targeted Growling Grass Frog surveys - Diurnal and nocturnal call playback and active searching. Spotlighting at potentially suitable waterbodies</b>	Growling Grass Frog	At least 13 waterbodies across the study area that are known to (e.g. Luxford Pond), or that have potential to support Growling Grass Frog.	Four nights of survey (12-16 November 2018). Two nights of surveys (2-4 October 2019).

#### 2.6.1.1 Arboreal Mammals

Survey methods (i.e. spotlighting and active searching for den trees) for arboreal mammals followed the Commonwealth *Survey Guidelines for Threatened Mammals* (SEWPaC 2011a) and targeted surveys for Greater Glider *Petauroides Volans* (DSE 2011a). Targeted surveys were undertaken over eight nights 12-16 November 2018, 2-4 October 2019, and 30-31 October 2019. Although, surveys targeted arboreal mammals and forest owls, observers also opportunistically recorded other fauna species, including any significant species such as Southern Brown Bandicoot *Isodon obesulus obesulus*.

Spotlight transects (200-500 metres) were undertaken within remnant native vegetation and along roadsides adjacent to patches of potentially suitable forest habitat in the study area (DSE 2011a). Surveys were conducted well after dark, as Greater Gliders may not emerge from their hollows as early as some other species. Stag watching, to identify arboreal mammals emerging from tree stag hollows at dusk, was also conducted at selected sites.

Field personnel used LED hand-held spotlights (up to 1020 lumens/8.4 volts) and traversed the spotlighting transects on foot to increase the detection of animals in closed or thick vegetation. As well as direct observation, other signs of site use were also noted, such as scratch marks on tree trunks or around hollows, audible calls or scats on the ground.

Koala, although not a significant species (i.e. not listed as threatened under the EPBC Act, FFG Act or on DELWP's threatened fauna advisory list), was also targeted during spotlighting surveys given the importance of the population (i.e. likely to be genetically distinct from all other populations across Victoria) throughout the Strzelecki Ranges bioregion.

#### **2.6.1.2 Ground-dwelling Mammals**

Mammal surveys were undertaken in accordance with Commonwealth *Survey Guidelines for Australia's threatened mammals* (SEWPaC 2011a) and the *Survey Guidelines for endangered Southern Brown Bandicoot (eastern), *Isodon obesulus obesulus** (SEWPaC 2011b). Daytime searches were undertaken to determine the presence of potentially suitable habitat resources for nests or burrows such as boulders, crevices in the ground or between rocks, as well as signs of the species' presence such as tracks, nests, burrows or scats.

Surveys for ground-dwelling mammals were undertaken using motion detecting cameras, which is one of the most effective methods of detecting species at low or moderate densities (Vine *et al.* 2009). Initial surveys were undertaken across four consecutive nights between 12 and 16 November 2018 to determine mammal activity across native forest remnants within the study area. Cameras were positioned within suitable habitat with the focal points aimed at bait stations. Motion detecting cameras were also deployed 2-4 October 2019 and retrieved 1 November 2019 (29 days of survey), to target significant species such as Southern Brown Bandicoot (SEWPaC 2011b). Once the cameras were collected the images were download onto a computer and then analysed.

#### **2.6.1.3 Growling Grass Frog Surveys**

Targeted surveys for the nationally significant Growling Grass Frog were undertaken over six nights in Spring (12-16 November 2018, and 2-4 October 2019), when Growling Grass Frog is most active. The survey was conducted with reference to the prescribed methods detailed in the following guidelines:

- *Significant Impact Guidelines for the Vulnerable Growling Grass Frog (*Litoria raniformis*) EPBC Act Policy Statement 3.14* (DEWHA 2009a); and
- *Commonwealth Survey Guidelines for Australia's Threatened Frogs* (DEWHA 2010a).

Survey methodology is outlined below:

- Nocturnal surveys (spotlighting, active searching, call play-back) were undertaken by two qualified zoologists visiting each site on three occasions, targeting both adults and metamorphs;
- Nocturnal surveys were conducted on still nights when air temperatures were above 15°C, and within 24 hours of rain;
- An initial period of five minutes was spent recording any calling frogs (all species) in and adjacent to wetlands;
- The advertisement call was broadcast to elicit a response from any adult males present;
- Experienced personnel used "Olight" LED hand-held spotlights (up to 1020 lumens/8.4 volts) to locate any calling males on floating vegetation in the waterbody and around the perimeter of wetlands; and,
- Surveyors actively searched ground-level habitat including surface rocks, underneath hard litter, and at the base of vegetation for frogs.

## 2.7 Avifauna and Bat Surveys

### 2.7.1 Bird Utilisation

Bird utilisation surveys are the most commonly used method for generating quantitative data on bird use of a potential wind farm site. Bird utilisation surveys were conducted over Winter (4-6 June and 11-13 June 2019) and Spring (2-4 October 2019, 30 and 31 October 2019, 1 November 2019, and 6-8 November 2019).

The bird utilisation surveys were designed to comply with the guidelines described in *AusWEA – Wind Farms and Birds: Interim Standards for Risk Assessment* (2005). According to these guidelines, bird utilisation surveys are undertaken to ascertain:

- The species composition of birds that use the study area;
- The frequency with which each of those species use the study area;
- The height at which each of these species fly in the study area; and,
- The distribution of these species across the landscape.

Bird utilisation surveys are a minimum requirement for proposed wind farm sites and are used to inform the design of higher-level investigations, if required. The total number of point counts was determined based on both the habitat conditions of the study area and the number of turbines proposed, in addition to any existing data that has already been collected (e.g. detailed significant species data).

#### 2.7.1.1 *AusWEA Wind Farms and Birds: Interim Standards for Risk Assessment*

The Australian Wind Energy Association (AusWEA 2005) has developed interim standards for risk assessment of birds for wind farm developments in Australia. This document outlines the type of investigations required, the order in which they should be undertaken and a systematic approach for assessing risk of bird impact at wind farms. This process allows for more detailed studies should a potentially significant risk be identified during preliminary studies.

The AusWEA (2005) interim standards recommend three levels of investigations, with each level involving increasing levels of detail. These levels include:

- **Level 1** investigations provide an initial assessment of the risk of significant bird impacts from the operation of the proposed wind farm; Level One investigations involve a regional overview, review of existing data, an indicative bird utilisation survey and roaming surveys.
- **Level 2** investigations refine the risk assessment from the Level One investigation, using more intensive methods. Level Two investigations involve roaming surveys and risk modelling.
- **Level 3** investigations are initiated if the results of the Level Two investigations indicate a greater than low level of residual risk of significant bird impacts from the operation of the proposed wind farm. Level Three investigations involve population assessment and population viability analysis.

For the proposed wind farm development a Level One investigation was undertaken.

The interim standards also recommend consultation with the wind farm developer and key representatives of agencies that assess and approve development to:

- Agree on the issues, questions and objectives of bird impact risk assessment studies;
- Agree on the consequence and, where relevant, likelihood criteria that apply to the results of the studies; and,
- Where required, agree on the nature and effectiveness of mitigation measures.

#### 2.7.1.2 **Fixed Point Bird Counts**

Zoologists, experienced in bird identification, undertook the fixed-point count surveys to the specifications outlined below. 10 × 42 binoculars were used to identify the bird to species, or for some species, generic level (e.g. non-calling Raven species).

The following was undertaken as part of the fixed-point bird counts:

- Eight locations were established at which to undertake fixed point counts. The locations chosen were to ensure that a range of habitat types were represented in the sample, including two outside of the study area near waterbodies (Figure 7);
- The search radius from the point was at least 100 metres for small birds and up to 800 metres for large birds (e.g. birds of prey, waterbirds), or further, if accurate identification to species level was achievable, using prominent landmarks;
- The duration of each fixed-point count was 20 minutes;
- The height at which each bird flew through the survey area was estimated to the nearest 10 metres;
- The direction of flight of each bird was recorded to the nearest 45 degrees of the compass;
- Each point was surveyed at different times of day (e.g. early morning, late morning, early afternoon and late afternoon) to account for diurnal differences in bird activity; and,
- Each point was surveyed eight times over the course of the survey period.

In addition to bird species recorded during the fixed-point count surveys, incidental observations of bird species were recorded while travelling between point counts and during other field-based activities. Birds seen adjacent to the study area were also recorded. Where suitable habitat for wading birds (principally Chradriiformes) and other waterbirds (ducks and herons) was observed, this habitat was surveyed for these species as per the '*Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*' (DoEE 2017).

Two fixed-point bird counts were taken outside of the study area (Figure 7). Site X was located north of the study area, along Narracan Creek. Site Z was located south of the Darlimurla Forest Block to the south-east of the study area, adjacent to a wetland. Both sites were selected, to detect the presence of water-dependent species, including the potential for migratory birds. This approach was also taken to detect 'Species of Concern', including significant species and/or species with specialised habitat requirements (Lumsden *et al.* 2019).

To detect the presence of Wedge-tailed Eagles *Aquila audax* in the study area, searches for nests were undertaken during bird utilisation surveys.

### 2.7.2 Bat Surveys

Bat surveys were undertaken in accordance with Commonwealth *Survey Guidelines for Australia's threatened bats* (DEWHA 2010b). To detect the presence of microbat species bat detectors (Songmeter SM4BAT FS) were deployed across three days in October (2-4 October 2019) and retrieved on 1 November 2019 (i.e. left out for 29 days). Bat detector locations (both on ground and met mast) were chosen, based on geography and habitat type to capture a representative sample of the study area. Weller and Zabel (2002) found detectors placed at a height of 1.4 metres recorded 30% more calls than those placed on the ground. This method will be adopted, at selected locations within the study area.

Targeted Grey-headed Flying-fox surveys were also conducted at dusk during the Spring bird utilisation surveys.

### 2.7.3 Forest Owls

Nocturnal surveys were undertaken in accordance with Commonwealth *Survey Guidelines for Australia's threatened birds* (DEWHA 2010c), the survey standards for Powerful Owl, Sooty Owl and Masked Owl (DSE 2011b, 2011c, 2011d), and broadly in accordance with Wintle *et al.* (2005). Target species included Powerful Owl *Ninox strenua*, Masked Owl *Tyto novaehollandiae*, Barking Owl *Ninox connivens* and Sooty Owl *Tyto tenebricosa*. Sites were selected based on the presence of remnant vegetation and/or hollow-bearing trees, and the location of previous records (Figure 7). Survey involved call playback, spotlighting and active searching for nest and roosting trees.

The calls of each species were broadcast through a hand-held speaker to attract them to the survey site or to elicit a response. This was followed by listening and spotlighting in the immediate area to locate any owls attracted to the site. This technique relies on the fact that most species of owl are territorial and use calls as a method of defending their territory from individuals of their own species. Call-playback for owls was undertaken over eight nights of spotlighting (12-16 November 2018, 2-4 October 2019 and 30-31 October 2019), during a suitable season and weather conditions conducive to detect the targeted species. Survey methods are outlined below:

- Nocturnal call playback surveys were conducted under clear and still weather conditions (avoiding windy, rainy conditions).
- Call-play back was undertaken in areas of potentially suitable habitat for forest owls (Powerful Owl, Sooty Owl and Masked Owl) to maximise detection. Approximately 20 minutes of call-playback was undertaken at each site as follows:
  - 5 minutes initial passive listening;
  - 2-minutes of call playback;
  - 2-minutes of listening;
  - Repeat method for each species

Note: if a bird responded to call-playback, call-playback for that species was ceased to avoid disturbance.