



Sapphire Wind Farm

Five Year Annual Report on the Implementation of the Bird and Bat Adaptive Management Plan

**Prepared for Sapphire Wind Farm 1
Operations Pty Ltd**

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**Nature
Advisory**

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1. Introduction

1.1. Project Background

Sapphire Wind Farm (SWF) is located in the Kings Plain District, 24 kilometres west of Glen Innes and 28 kilometres east of Inverell in the northern tablelands of New South Wales (NSW) (Figure 1). The site has been mostly cleared of its original native vegetation and is predominately being utilised for grazing. The wind farm currently comprises 75 turbines and associated infrastructure.

The history of the SWF commenced in 2007, with the proposition of a 159-turbine wind farm. Development applications were approved in June 2013 and December 2014 by the NSW Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure, DPHI) and the former Commonwealth Department of the Environment (DotE) (now Department of Climate Change, Energy, Environment and Water (DCCEEW) respectively. In January 2016, Sapphire Wind Farm Pty Ltd requested a modification to the approval to reduce the number of turbines from 159 to no more than 109 turbines whilst increasing the maximum tip height to 200 metres above the ground and rotor diameter to 126 metres. The DPHI and the DCCEEW approved the modification request in June 2016. The project completed construction in late 2018 with a refined design which involved the construction of 75 turbines at locations approved in the modification.

Condition C6 of the DPHI approval required the preparation of a Bird and Bat Adaptive Management Program (BBAMP), these requirements have been outlined in the following section. Specifically, Condition C6(d) required the proponent to identify ‘at risk’ bird and bat groups, seasons and/or areas within the project site which may attract high levels of mortality. The BBAMP (BL&A 2017) was prepared by Brett Lane & Associates Pty Ltd, predecessor of Nature Advisory Pty Ltd and approved by the Director-General (now Secretary of Planning) of DPHI.

Sapphire Wind Farm Pty Ltd engaged Nature Advisory to implement the approved BBAMP for the SWF. Specifically, the scope of the work included:

- Operational bird and bat carcass (mortality) monitoring program;
- Monitoring ‘at risk’ groups of birds; and
- Bird utilisation surveys.

1.2. Previous monitoring and recommendations

The first phase of the monitoring program began during the partial-operational phase in July 2018. In total, this comprised 31 months of monitoring and 24 months of fully operational surveys, concluding in January 2021. The second year of the monitoring program was conducted from February 2020 to January 2021, the second annual report (Nature Advisory 2021) for this period is summarised below:

No management triggers occurred during the monitoring program. The results from the monitoring program and the mortality estimates suggested it was unlikely that mortalities of any species identified at the site would significantly impact these populations on a state level, regional level or overall. The report acknowledged that Wedge-tailed Eagle (*Aquila audax*) (WTE), nominated as an ‘at risk species’ in the BBAMP, had higher observed mortalities relative to other bird species during the monitoring period. The report concluded that the carcass monitoring program to date had provided a sufficient baseline of the impacts SWF has on birds and bats and further carcass searches should not be required as part of ongoing BBAMP implementation. Future BBAMP implementation would include:

- Incidental monitoring of carcasses and feather spots continue to be reported;
- Inclusion of any incidental finds in annual reporting for the first five years of operation;

- Continuation of carrion removal, limiting lambing and stock feeding close to turbines;
- Integration a rabbit control program (as appropriate); and
- Annual reporting.

The third-year annual report (Nature Advisory 2022a) reported on the above activities during February 2021 to January 2022. One WTE carcass was reported as an incidental find and the report recommended the program continue as described above and, in addition; included the proposed Addendum described below.

The fourth-year annual report (Nature Advisory 2023) reported on the above activities by finding two WTE carcasses across one full carcass search of 75 turbines, no incidental mortalities were reported and the report recommended the program continue as described in the Addendum described below.

1.3. Addendum to the BBAMP

The Biodiversity and Conservation Division (BCD) (now the Biodiversity, Conservation and Science Group (BCS) of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW), as the regulator to whom annual reporting is submitted under the BBAMP reporting obligations, provided response via letter on the 8th December 2022 to the fourth annual report on the requirements of the continued implementation of the BBAMP, and recommended:

“1. Two carcass searches under all 75 turbines at six monthly intervals.

2. A Wedge-tailed Eagle Breeding Survey.

3. In addition to the foregoing ‘core’ activities, the detection of impact triggers during the implementation of the BBAMP addendum (e.g., for threatened species) may require implementation of contingency investigation and mitigation measures.”

An Addendum to the BBAMP (Nature Advisory 2022b) was prepared (8th of December 2022) in response to the BCS letter. The addendum provided an adaptive monitoring program targeting WTE, as a high-risk species, consisting of a search of all 75 turbines at SWF, searched at six monthly intervals, as opposed to the initial monthly carcass searches outlined in the BBAMP. One search will take place after the breeding period (generally Oct-Dec) after the young have fledged; the second search would take place six months after the first. The methods and justification for this modified regime are provided in Section 2 below. A WTE breeding and flight activity survey was also undertaken as part of the monitoring effort.

In line with SWF Project Approval Condition C6, ongoing information should be collated and included in reports submitted to the Secretary of Planning and OEH (now BCS) on an annual basis for the first five years of operation. This report comprises the fifth annual report, covering all monitoring activities during the fifth year of official operation of SWF from February 2023 and January 2024.

As per Section 4.7 of the BBAMP, and the Addendum, the fifth annual report includes, but is not limited to:

- A brief description of the management prescriptions implemented and identification of any modifications made to the original management practices.
- The survey methods (including list of observers, dates and times of observations);
- Results of carcass searches and incidental carcass observations;
- Identification of any unacceptable impacts or impact triggers, and application of the decision-making framework and relevant adaptive management measures.
- A summary of livestock carcass removal for the purposes of predator reduction;

- Details of any landowner feral animal control programs and their timing;
- A discussion of the results, including:
 - Whether indirect impacts on bird and bat use of the site are of significance at a regional, state or national level, or if species of concern have been affected.
 - Bird risk reduction measures.
 - Any further recommendations for reducing mortality, if necessary.
 - Whether the level of mortality was unacceptable for affected listed ('at risk') species of birds or bats.
 - Recommendations for further monitoring.

This report is divided into the following sections:

Section 2 provides the methods of the fifth year of monitoring.

Section 3 presents the results of the fifth year of monitoring.

Section 4 discusses the conclusions of the fifth year of monitoring.

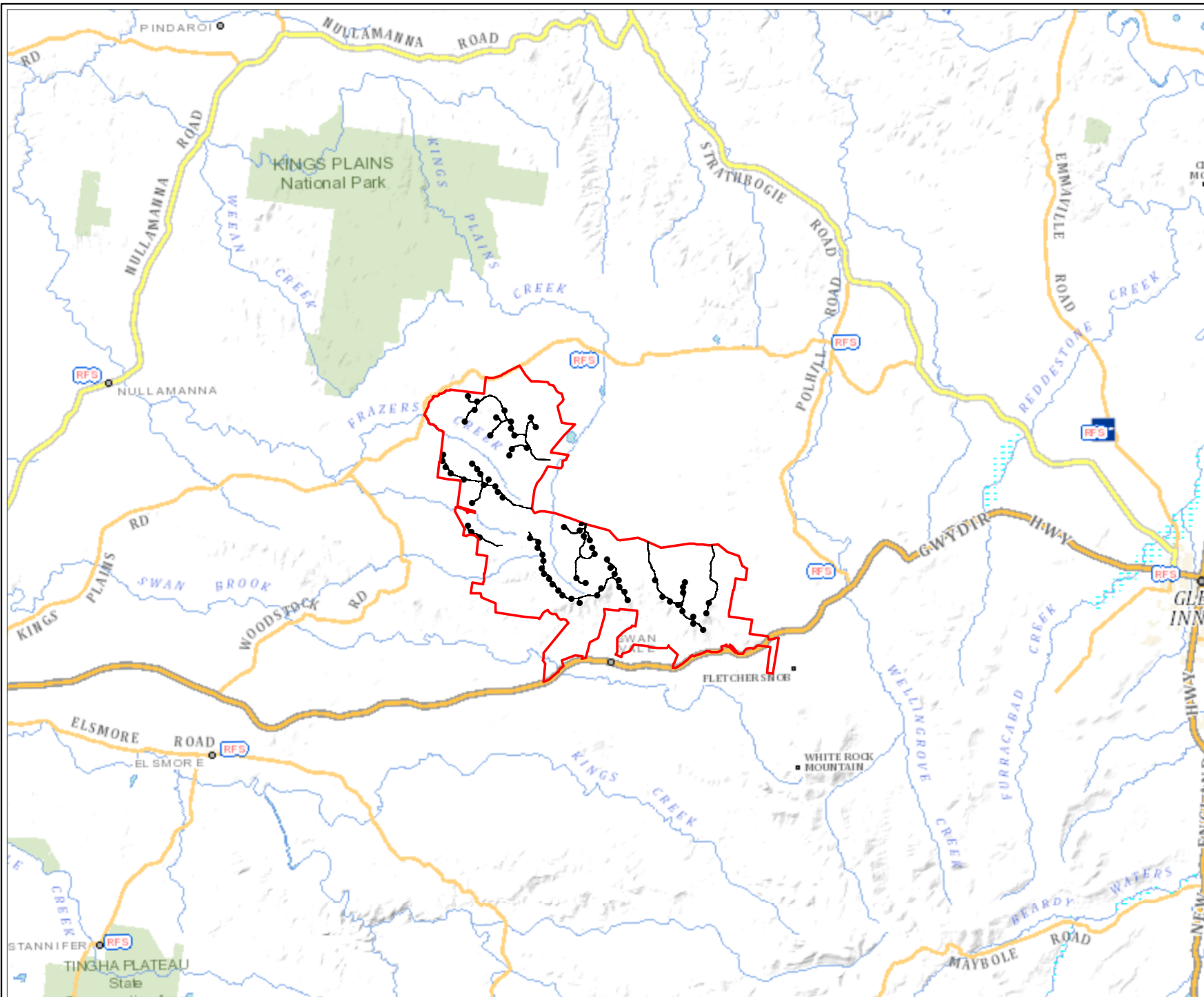
Section 5 provides recommendations for future monitoring.

This investigation was undertaken by a team from Nature Advisory, comprising Divyang Rathod (Zoologist), Emma Fitzsimmons (Zoologist), Jess Johnson (Zoologist), Philip Allen (Zoologist), Ahmad Barati (Zoologist), Gavin Thomas (Senior Ecologist), Jackson Clerke (Senior Zoologist and Project Manager), and Bernard O'Callaghan (Director).

Figure 1: Sapphire Wind Farm Location

Project: Sapphire Wind Farm BBAMP
Client: CWP Renewables Pty Ltd
Date: 29/02/2024

- Study area
- Turbines
- Access tracks



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2. Methods

2.1. Carcass search program

During the initial operational carcass monitoring program under the BBAMP and outlined in Section 1, carcass searches were conducted at 18 selected turbines at monthly intervals, with repeated searches ("pulse searches") occurring at each of these turbines within three days of the monthly search, in order to detect any rapidly scavenged species.

No carcass searches were undertaken during year three and the Year Three Annual Report, in consultation with BCD regarding the yet to be approved addendum methods, recommended that only WTE carcass searches would be carried out at all 75 turbines with no follow up pulse searches. One search would take place in the months following the breeding period (generally Oct-Dec) after the young have fledged. The second search would take place six months after the first.

Monitoring of other bird species would be recorded via incidental carcass finds reported by the Wind Farm site personnel.

Symbolix (2020) assessed combined scavenger rate data across 10 wind farms in Victoria which showed that WTE carcasses can persist on average for 287 days, meaning that WTE are typically not scavenged. Based on this information, it is expected that WTE carcasses would remain in situ and be detected prior to complete decomposition by searching all turbines at six monthly intervals.

A modified search method was adopted to target WTE; a 100-metre-radius zone surrounding each designated turbine was searched at 12-meter intervals walked on foot by human searchers from the base of the turbine. Given the large size of WTE ensuring they have a very high detectability for searchers, smaller intervals or an inner search zone were not considered necessary. All mortalities of other species were also recorded.

During the six-monthly carcass survey, mortalities were classed as either a bird carcass, a feather spot, or a bat carcass. If carcasses were found outside the scheduled search period (i.e., finds by wind farm personnel), these were recorded as an incidental find. It is likely that feather spots represent a bird that has collided with a turbine and has later been scavenged. When a dead bird or bat was recorded under a turbine, data from pro-forma was collected (BBAMP, appendix 2), carcass numbered, and an in-situ photograph of the carcass was taken.

On finding a bird carcass, feather-spot or bat carcass, the finder:

- Completed a casualty report;
- Removed it from the site to avoid re-counting; and
- Transferred fresh carcasses to a freezer at the site office for storage.

According to Section 6 of the BBAMP, an 'impact trigger' occurs when *"A threatened bird/bat species (or recognisable parts thereof) listed under the Commonwealth EPBC Act or NSW Threatened Species Conservation Act 1995, is found dead or injured under or close to a wind turbine during any mortality search or incidentally by wind farm personnel."*

In this situation, an investigation must be started within 10 days of the find to determine the cause of the impact, the likelihood of re-occurrence, the most effective mitigation measures to be implemented (if needed) and if any additional species-specific monitoring would be required.

In the case of non-threatened species carcass finds, an impact trigger is defined as:

“A total of four or more bird or bat carcasses, or parts thereof, of the same species in two successive searches at the same turbine of a non-threatened species (excluding ravens, magpies, White Cockatoos, corellas, pipits and introduced species.

Carcass searches were conducted by two zoologists from Nature Advisory between 23rd to the 30th of January 2023.

2.2. WTE activity and nest monitoring

Within the SWF boundary, WTE nest utilisation (including breeding activity) and general activity was assessed at SWF from 5th to the 8th of December 2023 (Figure 2), in accordance with the Year Four BBAMP recommendations and approved Addendum of November 2022.

WTE nests were searched in the treed habitat within the SWF boundary and identified via observing surrounding treed landscape from 20 vantage points and via transects walked through the large patches of woodland. The area surrounding the vantage points was surveyed (via binoculars once each for 15 minutes) to observe the presence of any WTE and their activity at any nests. Any nests identified were GPS located and will be monitored on an annual basis (with a review of monitoring requirements undertaken in each annual reporting) between October to December to record breeding activity and utilisation.

Observations of WTE flights were plotted on a map and the following data recorded:

- Species,
- numbers,
- start and end time of observations,
- date,
- flight heights,
- location and
- behaviour.

2.3. Incidental raptor observations

Incidental observations of raptors occurred whilst moving throughout the SWF and during the six-monthly carcass searches. These incidental observations were recorded and plotted on a map collecting the same data as outlined above.

2.4. Carrion removal program

Under the BBAMP, SWF is required to undertake carrion inspections and keep a log book of findings and actions undertaken to remove any deceased livestock from within 200 meters of turbines. The third annual report for BBAMP recommended revised risk reduction measures in regards to carrion removal, the fourth annual report had no reports of any carrions removed.

Monthly inspections/searches by site personnel for any stock, introduced or native mammal and bird carcasses (to be recorded as incidental finds) that may attract raptors (e.g., kangaroo, pigs, goats, foxes, rabbits, dead stock). This search will be undertaken via vehicle and visual checks in addition to using binoculars (if available) to look for large carcasses within 200 metres of each turbine. Results from inspections will be documented and the following information collected each month:

- Date of inspection,

- Person undertaking the inspection,
- Any carrion identified and location (e.g., Turbine ID),
- Any carrion still present from previous inspection,
- Action taken (e.g., consultation with landholders or removal of carrion)
- Pest animal activity or presence,
- Lambing activity (when applicable),
- Any incidental observations by landowners or SWF staff.

3. Results

3.1. Carcass search results

A total of 27 carcasses from 11 bird species and one bat species were recorded under turbines during the fifth year of the post-construction monitoring period. Detailed information on search activity and carcass finds are kept on file by Nature Advisory and can be made available on request. Table 1 summarises the carcass find results.

No incidental mortalities were reported during the monitoring program.

Year Four monitoring results have included two WTE mortalities detected across one full carcass search of all 75 turbines and no incidental mortalities reported.

Year Five monitoring results have included five WTE mortalities detected across two full carcass searches of all 75 turbines and no incidental mortalities reported. Further there were seven Eastern Rosella mortalities, two mortalities each for Australian Magpie, Australian Wood Duck, Crimson Rosella, Galah and one mortality each for Crested Pigeon, Magpie Lark, Noisy Miner, Pied Currawong, Sulphur-crested Cockatoo, an unknown bird species and White-striped Freetail bat.

Associated notes from a WTE carcass found on the 26th of January 2023 describe the presence of a skull and bones, indicating an advanced state of decomposition. This supports the findings of Symbolix (2020) in that WTE carcasses remain in situ until decomposition and supports the BBAMP addendums methods that such remains will be detectable during six monthly searches.

3.1.1. Limitations

Carcass searches were conducted across all 75 turbines. However, some searches were considered as “partial searches” due to steep, rocky, or otherwise dangerous terrain, along with barbed fencing, which presented high OHS risks to zoologists undertaking searches. Therefore, the full search radius of some turbines could not be safely completed. During the formal searches held in December there was a heatwave which may have impacted the carcass finding ability.

Areas not able to be searched were checked visually from a safe vantage point for WTE carcasses. It is not expected that some partial searches would significantly impact the viability of the monitoring across 75 searches.

3.2. WTE activity and nest monitoring results

A total of twelve WTE observations were recorded in flight during the survey, with a group of nine individuals being recorded in a single observation. Flight heights ranged from 30 meters above the ground to 500 meters.

The WTE nest with a juvenile present in it from previous WTE survey (Sapphire Wind Farm – 4th Report BBAMP Implementation) was no longer active and remained empty throughout the survey period. No new WTE nests were seen or observed during this survey period.

Geographically, majority of WTE observations were recorded in the southern section of the wind farm, particularly around the woodland adjacent to turbines numbered 63 through 73, and few observations were made in the central section of the windfarm. WTE observations are provided in Table 2 and observations and nest platform locations are provided in Figure 3.

3.3. Incidental raptor observations and Threatened Species

Three species of raptor were recorded flying at the wind farm during the carcass monitoring period, these were WTE, Black Kite and Nankeen Kestrel. Most incidental observations were WTE with a maximum number observed at one time being two individuals. Flight height ranged from 1 meter to 500 meters. Data collected for each raptor flight path is presented in Table 3 and presented Figure 3.

One threatened species, the Little Lorikeet (*Glossopsitta pusilla*) was observed in two different instances during the July searches. Data collected has been presented in Table 3 and Figure 4.

3.4. Carrion removal program

Monthly inspections by SWF staff were carried out by the operations manager and ad hoc by the technical team when doing maintenance at the wind farm. No carrion was observed during the reporting period. The visual checks are limited to the hardstand and visible areas of the land around the WTG. Under the lease agreement with the landowner, the monitoring responsibilities of SWF are restricted to the footprint of the lease area, and their ability to act on issues within the lease area, that would affect the land and grazing activities, is only with the permission of the landowner.

No landholder consultation was undertaken for carrion removal in the reporting period, as no issues with regards to carrion or grain feeding or lambing were raised.

No feral animal control was required or requested to be undertaken on the leased land during the reporting period. SFW notes that feral animal control by the wind farm operator is restricted to asset protection (hardstands and O&M). Any baiting, trapping or shooting of feral animals on the leased land can only be done by the landowner, at their discretion.

There are no feeding troughs located near the WTGs. There were no observations made of any grain feeding during the reporting period, as such no discussions with landowner on this issue in the reporting period.

Table 1: Carcass search results at Sapphire Wind Farm during year five

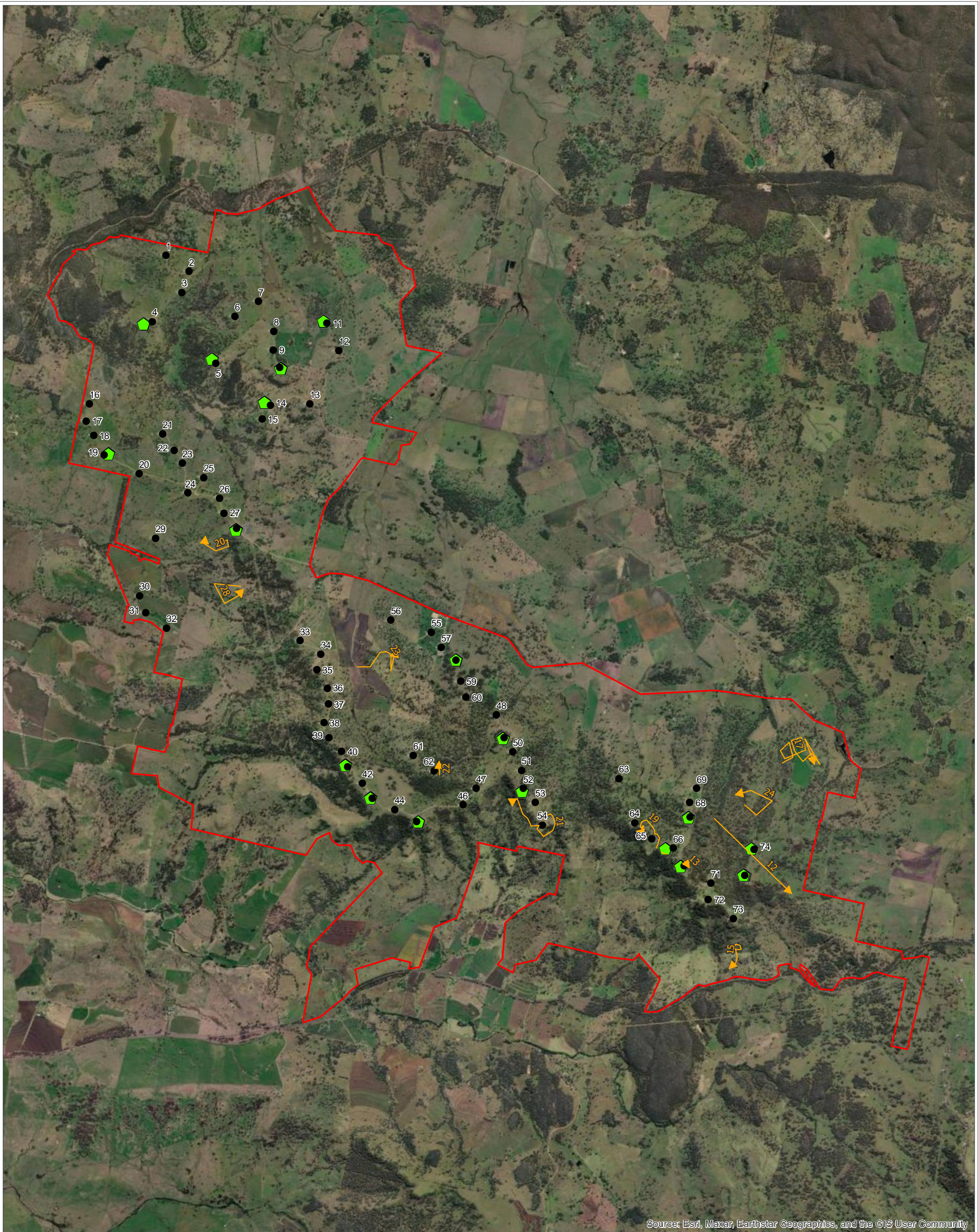
Date	Common name	Scientific Name	Turbine number	Distance from turbine (m)	Report (R)/	Notes
					Feather spot (FS)/ Incidental (INC)	
18/07/2023	Crimson Rosella	<i>Platycercus elegans</i>	74	24	FS	feather spot
18/07/2023	Australian Magpie	<i>Gymnorhina tibicen</i>	72	96	FS	feathery spot, adult bird plumage, fresh, approx. 2 days old
18/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	67	36	FS	feathery spot
18/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	64	70	FS	feathery spot
18/07/2023	Magpie Lark	<i>Grallina cyanoleuca</i>	63	48	FS	feathery spot, feathers few meters apart
19/07/2023	Pied Currawong	<i>Strepera graculina</i>	62	24	FS	feathery spot, feathers dispersed over few meters, scavenged at 24m
19/07/2023	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	57	60	FS	feathery spot
19/07/2023	Crested Pigeon	<i>Ocyphaps lophotes</i>	32	12	FS	feathery spot
20/07/2023	Australian Wood Duck	<i>Chenonetta jubata</i>	48	14	FS	feather spot
20/07/2023	Australian Wood Duck	<i>Chenonetta jubata</i>	50	4	FS	feathery spot
20/07/2023	Wedge-Tailed Eagle	<i>Aquila audax</i>	50	96	C	carcass, very old
20/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	51	82	FS	feathery spot
20/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	51	60	FS	feathery spot

Date	Common name	Scientific Name	Turbine number	Distance from turbine (m)	Report (R)/	Notes
					Feather spot (FS)/	
					Incidental (INC)	
20/07/2023	Unknown bird		47	72	FS	feather spot, 8 feathers, not enough information
20/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	43	12	FS	found few underbelly feathers
21/07/2023	Noisy Miner	<i>Manorina melanocephala</i>	40	96	FS	feathery spot
21/07/2023	Galah	<i>Eolophus roseicapilla</i>	37	55	FS	feathery spot
21/07/2023	Galah	<i>Eolophus roseicapilla</i>	37	48	FS	feathery spot
22/07/2023	Wedge-Tailed Eagle	<i>Aquila audax</i>	24	98	C	Old carcass remains, predominantly feathers, dispersed approx. 10m radius
23/07/2023	Wedge-Tailed Eagle	<i>Aquila audax</i>	4	57	C	old carcass, no feathers only bones remaining, approx. 6 months old
24/07/2023	Wedge-Tailed Eagle	<i>Aquila audax</i>	4	51	C	old carcass, no feathers only bones remaining, approx. 6 months old
25/07/2023	Australian Magpie	<i>Gymnorhina tibicen</i>	5	60	C	about a week old, adult

Date	Common name	Scientific Name	Turbine number	Distance from turbine (m)	Report (R)/	Notes
					Feather spot (FS)/	
					Incidental (INC)	
26/07/2023	Eastern Rosella	<i>Platycercus eximius</i>	8	100	FS	feathery spot
5/12/2023	Crimson Rosella	<i>Platycercus elegans</i>	68	72	FS	6-7 feathers seen
6/12/2023	Eastern Rosella	<i>Platycercus eximius</i>	53	21	FS	Feather spot, adult
7/12/2023	Wedge-tailed Eagle	<i>Aquila audax</i>	36	86	C	Adult, likely three weeks old carcass
11/12/2023	White-striped Freetail Bat	<i>Tadarida australis</i>	55	25	C	No age, head chopped off

Table 2: Wedge-tailed Eagle activity observations at Sapphire Wind Farm during year five surveys

Observation number	Species	Scientific name	Date	Start time	Finish time	No. of birds	Distance (m)	Min height (m)	Max height (m)	Flight direction	Flight behaviour	Comments
1	Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	10:11:38 AM	10:12:00 AM	1	700	200	400	Away	Gliding	Adult observed gliding into the woodlands.
4	Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	12:10:00 PM	12:12:12 PM	1	300	100	300	Away	Gliding	Adult observed circling and soaring initially and then lost elevation while gliding away
5	Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	2:28:00 PM	2:30:50 PM	9	2000	100	500	Circling	Gliding	Group seen circling together and scouting the area, observed it for two mins and looked like they were all together
6	Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	4:09:00 PM	4:10:55 PM	1	300	100	300	Toward	Gliding	Adult observed gliding and losing elevation, likely foraging.
7	Wedge-tailed Eagle	<i>Aquila audax</i>	6/12/2023	9:01:00 AM	9:03:00 AM	2	500	100	150			
8	Wedge-tailed Eagle	<i>Aquila audax</i>	6/12/2023	10:36:59 AM	11:15:00 AM	3	200	60	100	Away	Gliding	Observed gliding, likely a breeding pair, the pair was displaying
9	Wedge-tailed Eagle	<i>Aquila audax</i>	6/12/2023	1:14:00 PM	1:15:16 PM	1	500	80	100	Parallel to observer	Gliding	Caught a glimpse as it was gliding, lost vision because of woodland
10	Wedge-tailed Eagle	<i>Aquila audax</i>	7/12/2023	7:52:58 AM	7:53:00 AM	1	100	30	70	Away	Powered (flapping) flight	Individual was chased away by three magpies
12	Wedge-tailed Eagle	<i>Aquila audax</i>	9/12/2023	10:23:27 AM	10:24:00 AM	1	2000	150	200	Circling	Foraging (hunting)	Adult

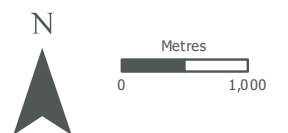


Source: Esri, Maxar, Earthstar Geographics, and the ©S User Community

Figure 2: Wedge-tailed Eagle activity and nests

Project: Sapphire Wind Farm **Client:** CWP Renewables Pty Ltd **Date:** 29/02/2024

- ▭ Study area
- Turbines
- ◀ Wedge-tailed Eagle Platform
- Flight path**
- ➔ Wedge-tailed Eagle



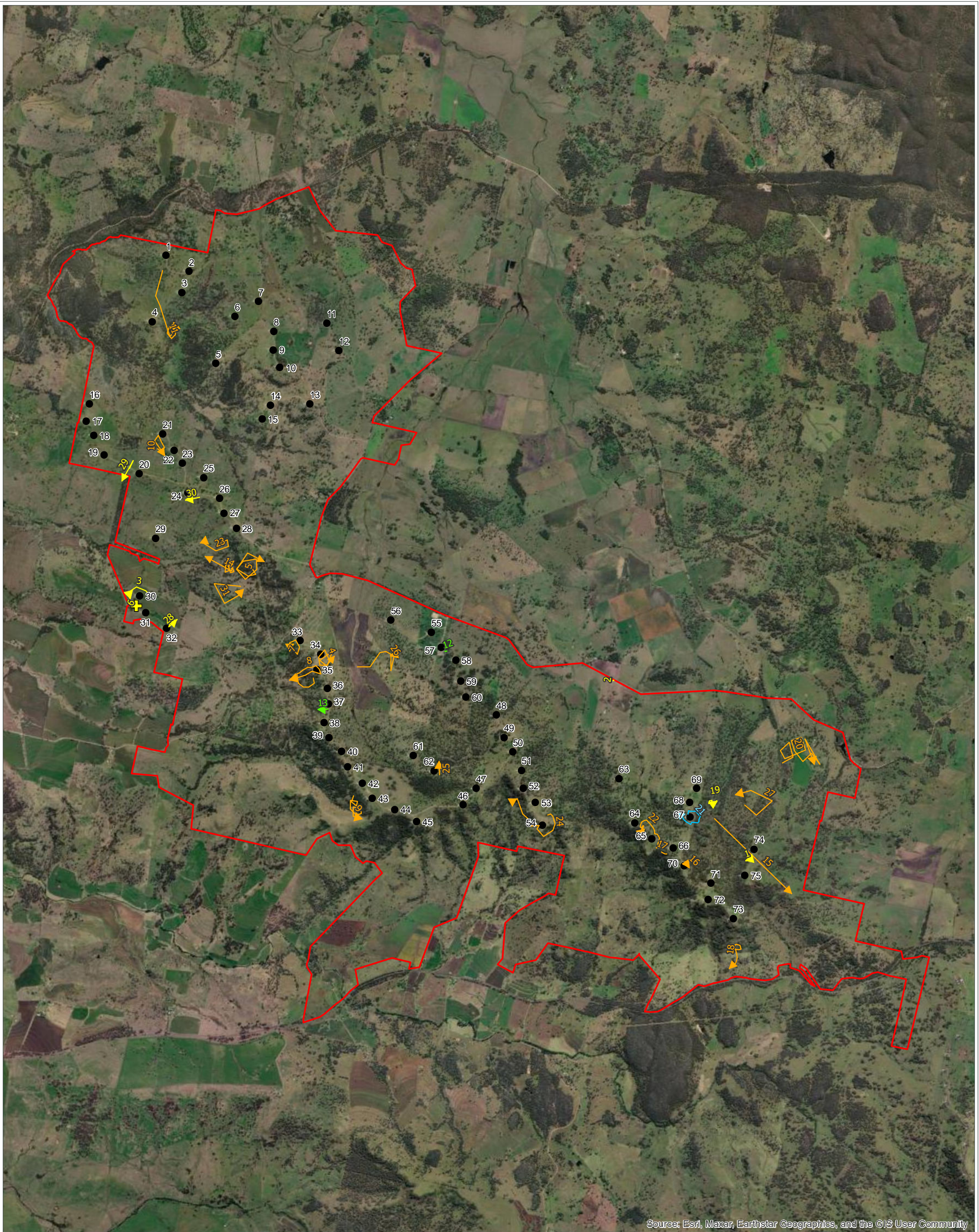
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Table 3: Incidental raptor and threatened species observations at Sapphire Wind Farm during year five surveys

Species	Scientific name	Date	Start time	Finish time	No. of birds	Distance (m)	Min height (m)	Max height (m)	Flight direction	Flight behaviour	Comments
Nankeen Kestrel	<i>Falco cenchroides</i>	18/07/2023	9:25:00 AM	9:27:44 AM	1	40	5	20	Toward	Hovering	
Nankeen Kestrel	<i>Falco cenchroides</i>	18/07/2023	10:50:00 AM	10:51:00 AM	1	10			Away	Hovering	Outside gate 6
Little Lorikeet	<i>Glossopsitta pusilla</i>	19/07/2023	11:55:00 AM	11:55:00 AM	5	20	10	10	Away	Powered (flapping) flight	20m away from observer, 100 m from turbine 57. Flying at 10m into woodland. Vocalising in flight, rapid wing beats, obvious red head and green body.
Wedge-tailed Eagle	<i>Aquila audax</i>	19/07/2023	12:38:00 PM	12:40:00 PM	1	500	150	200	Circling	Soaring	
Nankeen Kestrel	<i>Falco cenchroides</i>	19/07/2023	1:44:00 PM	1:48:00 PM	1	50	20	50	Away	Hovering	Gliding, hovering, soaring flew around T30
Nankeen Kestrel	<i>Falco cenchroides</i>	19/07/2023	2:13:11 PM	2:15:00 PM	1	150	100	100		Resting	Resting on one of the electric poles
Wedge-tailed Eagle	<i>Aquila audax</i>	19/07/2023	2:25:00 PM	2:30:30 PM	2	1000	100	150	Circling	Soaring	Near T33
Wedge-tailed Eagle	<i>Aquila audax</i>	19/07/2023	2:25:21 PM	2:30:00 PM	1	1000	100	150	Circling	Soaring	
Wedge-tailed Eagle	<i>Aquila audax</i>	20/07/2023	3:30:00 PM	3:33:22 PM	1	200	100	150	Away	Soaring	
Little Lorikeet	<i>Glossopsitta pusilla</i>	21/07/2023	1:00:00 PM	1:00:00 PM	8	50	10	10	Away	Powered (flapping) flight	Vocalising, quick flight, near T#37
Wedge-tailed Eagle	<i>Aquila audax</i>	21/07/2023	1:50:00 PM	1:55:00 PM	3	150	150	350	Away	Gliding	2 adults, 1 juv, displaying & soaring, mobbed by ravens. 1 adult flew over T35
Wedge-tailed Eagle	<i>Aquila audax</i>	22/07/2023	10:50:00 AM	10:52:00 AM	1	1000	150	200		Gliding	Near t21, gliding, chased by magpie and then rested
Wedge-tailed Eagle	<i>Aquila audax</i>	23/07/2023	10:31:00 AM	10:37:00 AM	1	200	150	300	Away	Gliding	

Species	Scientific name	Date	Start time	Finish time	No. of birds	Distance (m)	Min height (m)	Max height (m)	Flight direction	Flight behaviour	Comments
Wedge-tailed Eagle	<i>Aquila audax</i>	24/07/2023	12:10:00 PM	12:13:01 PM	2	1000	200	200	Toward	Soaring	Flew toward T28
Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	11:43:00 AM	11:47:00 AM	2	300	50	150	Circling		
Wedge-tailed Eagle	<i>Aquila audax</i>	5/12/2023	11:50:00 AM	11:55:47 AM	3	500	50	100			
Nankeen Kestrel	<i>Falco cenchroides</i>	5/12/2023	1:55:47 PM	1:56:00 PM	1	400	40	60	Away	Gliding	Observed circling and then lost vision
Black Kite	<i>Milvus migrans</i>	5/12/2023	2:42:00 PM	2:54:15 PM	1	100	60	100	Toward	Gliding	Observed going into the woodland, scouted the area and then took off
Nankeen Kestrel	<i>Falco cenchroides</i>	7/12/2023	12:39:00 PM	12:47:49 PM	1	100	20	70	Away	Powered (flapping) flight	Adult seen foraging, flapping and perched on a tree
Wedge-tailed Eagle	<i>Aquila audax</i>	7/12/2023	1:38:17 PM	1:38:21 PM	1	500	100	200			
Nankeen Kestrel	<i>Falco cenchroides</i>	9/12/2023	7:30:12 AM	7:31:00 AM	1	50	1	20	Away	Powered (flapping) flight	It was perched on the gate, and then took off as the car came closer
Nankeen Kestrel	<i>Falco cenchroides</i>	9/12/2023	10:20:42 AM	10:21:00 AM	1	1000	50	70	Parallel to observer	Powered (flapping) flight	

*Bold text represents threatened species

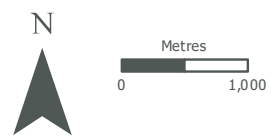


Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Figure 3: Incidental raptor and threatened species observations

Project: Sapphire Wind Farm **Client:** CWP Renewables Pty Ltd **Date:** 29/02/2024

- | | |
|---|----------------------------|
| □ Study area | Perched observation |
| ● Turbines | ⊕ Nankeen Kestrel |
| Species | |
| → Black Kite | |
| → Little Lorikeet | |
| → Nankeen Kestrel | |
| → Wedge-tailed Eagle | |



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4. Discussion

Years One and Two carcass monitoring results included two formal finds of WTE during targeted carcass searches and four incidental finds. Mortality estimates presented in the Year Two report also predicted an average potential impact, based on formal carcass search results, of approximately five mortalities during the first 12 months of monitoring and 12 during the second year of monitoring. Year Three incidental finds reported by SWF included one WTE mortality, and no formal WTE carcass finds.

The results obtained during the fourth year of monitoring appear consistent with the findings of the first three years of monitoring prior to the addendum being implemented, however as of July 2023 there appears to be an increase in mortality at SWF (Figure 4). This increase may be an artifact of no surveys being undertaken during 2022, providing more carcasses to find during the more recent search period. A recent study found that carcasses of WTE persist between 199 and 567 days (Elmoby Ecology Bennett 2019; 2020; 2021).

No observation of active WTE nest indicates that the juveniles were mature enough to fledge (minimum 4 months old) (Cherriman, 2007). Based on previous experience from a Nature Advisory zoologist, observation of nine WTE individuals together could possibly be because of an undetected carcass present or because of presence of a water body or a combination of both, out of nine individuals 2 of them were seen displaying and soaring at the same time. The 'active' WTE nest observed last year (in a gully to the east of and equidistant between T63 and T64) showed no current activity and appeared to be abandoned during this survey. The majority of the WTE activity occurred in the southern part of the wind farm with few observations made in the central section.

4.1. Analysis of WTE population dynamics and the significance of impacts at SWF

Losses of apex predators can have negative consequences for biodiversity and ecosystem function in the long-term (Colman et al., 2014), as they act to maintain populations of native and introduced prey species, including mesopredators such as cats or foxes (Wallach et al., 2015). During five years of monitoring at SWF, a total of 15 individual WTE carcasses were discovered below operational turbines. It is important to understand the significance of these numbers for the local and regional population of eagles. Mortality estimates (provided by Symbolix) show with 95% confidence that fewer than 27 individuals have been lost to turbine strike (Symbolix, 2021). This number represents an upper limit for what is potentially missed through survey effort, however the methods employed at SWF under the BBAMP addendum suggest that the results are accurate from our searches given the persistence of WTE carcasses in the field. The mortality estimate also works under the assumption that there is an endless source of carcasses to find, which is not always the case when put into ecological context.

The WTE is a long-lived (20 years or more (DELWP, 2018), reproductively conservative species, that takes six to seven years to mature to breeding age (Ridpath & Brooker, 1986). Juvenile birds are competent flyers at four months post-fledging, when they leave their home range to wander great distances (up to 1200km (Cherriman, 2007)) until they become of breeding age (Debus et al., 2007). Breeding pairs in south-eastern Australia have a success rate of 0.8 to 1.0 young per pair per year (Debus et al., 2007; Fuentes et al., 2007; Marchant & Higgins, 1993; Dennis, 2006) and the proportion of breeding-aged adults in a population ranges between 25% to 67% (Ridpath & Brooker, 1986). Characteristic of species with slow life histories such as this is low demographic resilience; the resistance of populations to change after disturbance. For example, recolonisation of an area takes far longer than it would for short-lived, rapidly breeding species

Eagles of the *Aquila* genus generally occupy a range of 29 to 42 km², with considerable variation based on available food resources and landscape topography (Cherriman, 2007). A breeding pair may have two up to ten nests within their territory which they alternate between each year (Cherriman, 2007).

SWF covers an area of approximately 89.231 km², and one active and one inactive nest were recorded in early 2023 (Nature Advisory, 2023), which have subsequently both become inactive. These two nests were 1160m apart and located in the southeast of the wind farm. A rough estimate of one (known) local resident breeding pair is proposed, which at any given time would comprise between two and not exceed three individuals (if each pair has one fledged young). However, on-ground observations of site utilisation by the species (Section 3.2), as well as mortality observations (Section 3.1) and estimations (Symbolix 2023), suggest sources from a greater local population. It is possible that a large proportion of individuals observed within the study area are wandering juveniles, or adults from other territories in the region congregating along ridgelines to soar, hunt, or socialise (display). Comparing the rate of collision observed at SWF with the known rate of breeding success for the species and the estimated home range occupation suggests potential for some impact to both the local and the regional population of WTE.

Consequently, the predicted mortality rate, based on actual detected rates, of WTE at SWF over 30 years has the potential to have low impacts on population stability and resilience locally (1-5 years), but it is unclear how those impacts would extend to a regional scale. The potential for further-reaching impacts, such as at a national scale, is difficult to quantify due to the dearth of research regarding long-distance movements of WTE on the mainland. Section 5 discusses the suggested progression from such findings and provides recommendations on possible mitigation measures to be implemented to prevent further significant impacts to local and regional WTE populations, as well as to biodiversity and ecosystem function.

4.2. Revised risk for WTE at SWF

In 2016 OEH (now BCS) recommended that the likelihood of a turbine strike for WTE be raised to ‘Certain’, from ‘Almost Certain’. The associated probability of a strike to these likelihood criteria were >95% and >50% respectively, that an event could occur in any year. In the response to the suggestion of increasing the likelihood of an event occurring, Nature Advisory advised at the time that the likelihood of an event was assessed correctly for this species at ‘Almost Certain’ (>50% likelihood).

Since the development of the SWF BBAMP in 2016, the risk assessment process has been revised within Nature Advisory, with some changes made to the names of criteria but not the probability ratings. The term ‘Certain’ was not in line with an objective assessment process, as we can only be statistically 95% confident in a result, rather than 100%. This likelihood rating was changed to read ‘Almost certain’, and the previous ‘Almost certain’ rating was changed to ‘Likely’. As stated, no probability ratings were altered in this revision, so all current work is compliant and in line with BBAMP requirements. The Consequence criteria were also revised, but only in document structure. The current consequence ratings are still compliant with the BBAMP. The most recent likelihood probabilities, consequence ratings and risk matrix are attached as appendix 1.

We recommend following the most recent versions of these tables to assess overall risk to a species. With this context, we advise that based on the current data, the likelihood of an impact be raised to Almost certain (probability of >95%) with a Consequence rating of Low, resulting in an overall risk rating of Low. This assessment and reduction in overall risk rating is based on the very low numbers of individuals found to be struck annually. This rating aligns with the risk rating applied to this species at similar locations.

WTE are not considered to meet the criteria of a vulnerable species under either state or federal legislation. The range of the species is extensive across the continent, but the population is not well understood. There is an assumption that the population is increasing, but there is little data to work from in this context. The impacts to local or regional populations of WTE, without adequate estimates are difficult to measure. The suggested continued survey effort may aid in further assessment of the risk posed to this species’ population.

5. Recommendations

5.1. Carcass search program

Incidental carcass monitoring will continue to take place by wind farm personnel. Any bird or bat carcasses identified will be reported and recorded in accordance with Section 4.4.5 of the BBAMP. We recommend that formal searches by Zoologist may optionally be concluded, as the increasing trend is potentially an artifact of the lack of survey effort in 2022. This increase in carcass detection may also be a result of the increased search effort, i.e., all 75 turbines were searched as opposed to only 18 turbines searched previously. Continued bi-annual searching would provide further information on whether the increase in strikes is an authentic representation of activity and incident at SWF or a result of data gap from 2022. Carcass finds of common birds like Eastern Rosella, Crimson Rosella, Australian Magpie, Galah are unlikely to be an issue as their distribution is Australia-wide, with their population number consistently increasing.

5.2. WTE activity and nest monitoring

A WTE nest and activity survey is proposed to be undertaken during Year Six and Year Seven at SWF during October – December 2024/2025 to monitor breeding activity at the active WTE nests identified. Searches will also be conducted for additional potential nests throughout the site. Activity surveys will include observations of WTE flights and activity recorded and plotted on maps capturing the data outlined in the methodology section 2.2.

The nests identified during this search will be recorded and monitored on an annual basis for two years (2024 and 2025) during October to December to record breeding activity and utilisation. The intention of this survey effort is to monitor habitat utilisation during nesting and breeding and to record flight behaviours displayed at SWF. Changes to breeding activity or site utilisation may provide additional insight into the impacts of SWF on WTE and the effectiveness of revised risk reduction measures, outlined below. The need for continued monitoring of WTE will be reviewed through reporting and in consultation with BCS.

5.3. Continued mitigation measures

The approved addendum to the BBAMP (Nature Advisory 2022b) provides revised mitigation measures to improve the implementation of the previous BBAMP measures and enable assessment and review in annual reporting. These are reiterated below and are the responsibility of SWF to implement and record.

The aim of the revised program is to track implementation of mitigation measures at SWF and their outcomes and then assess this against the findings of the revised monitoring program and potential impacts on WTE throughout the operation of SWF.

No carrion within 200m of a turbine was observed and therefore removed by SWF personnel. Considering turbine impacts on WTE increased in year five, and despite the risk reduction measures being enacted, it remains unclear what effect the carrion removal program is having, or whether it is required since there was no carrion detected to remove in year five. Recommendations are provided below.

Land-use and stock management underneath and around turbines can influence the presence and behaviour of native birds on site. Examples include:

- Grain feeding can be an “attractant” for parrots; and
- Carrion and rabbits can be an “attractant” to raptors in the area.

Thus, this section proposes possible mitigation measures to address these matters.

The WTE and other raptors forage for carrion (dead and decaying flesh of an animal) and on small mammals, rabbits etc. To reduce the risk of raptors colliding with turbines, a formalised carrion monitoring and removal program will be continued during operations. This will reduce the attractiveness of the site to raptors (specifically WTE) and therefore reduce the potential for fatal collisions by this group of birds. This program will focus on an area of a minimum of 200 metres around turbines, where safe, feasible and practical for SWF personnel. The procedures below will be adopted:

- The SWF Site Manager has been appointed to perform the function of Carrion Removal Coordinator who will undertake the activities described below. In the event the SWF Site Manager is not available, an alternative suitable person will be appointed to undertake this function.
 - Monthly inspections of the wind farm site to search for any stock, introduced or native mammal (e.g., kangaroo, pigs, goats, foxes, rabbits, dead stock). and bird carcasses (to be recorded as incidental finds) that may attract raptors. This search will be undertaken via vehicle and visual checks in addition to using binoculars (where available) to look for large carcasses within 200 metres of each turbine. Results from inspections will be documented and the following information collected each month:
 - Date of inspection,
 - Person undertaking the inspection,
 - Any carrion identified and location (e.g., Turbine ID),
 - Any carrion still present from previous inspection,
 - Action taken (e.g., consultation with landholders or removal of carrion)
 - Pest animal activity or presence,
 - Lambing activity (when applicable),
 - Any incidental observations by landowners or SWF staff.
 - Additional, opportunistic observations by operators during normal inspections and work routines and by landowners as they travel around their properties provides further opportunity to identify and report carcasses of stock or feral animals so that timely collection can be undertaken to remove them. This can be addressed by operator protocols and information included in monthly inspection data.
 - Any carcasses and/or remains found that are within 200 metres of turbines, will be collected and disposed of as soon as possible, in a manner that will avoid attracting raptors close to turbines. If a carcass is not removed, its visibility during the next monthly inspection should be recorded.
 - Carcasses should be disposed of at least 200 metres away from the closest turbine. Results of any consultations will be logged and the locations of any carrion dumps (active or planned) to be noted. This can be assessed against any potential WTE mortality locations.
 - Carcass occurrence and removal will be recorded in monthly inspection records maintained by SWF Project Manager.
- During lambing season (usually late autumn/winter) young lambs are susceptible to death. Therefore, if possible and subject to agreement of landowners, lambing will be restricted to paddocks at least 200 metres away from turbines, where practicable, to reduce the risk that raptors (WTE in particular) are attracted close to the turbines.

- In order to reduce collision risks to birds, where practical and with landowner agreement, the practice of grain feeding of stock within 200 metres of turbines should be minimised as it could draw additional parrots and other birds to the site.
- Any feral animal control on the wind farm site should involve the removal and appropriate disposal of resulting carcasses in a timely manner.
- If a large active presence of rabbits is observed during monthly inspections near turbines, subject to landholder approval, an integrated rabbit control program (to reduce site attractiveness to WTE) will be completed within 200 metres of turbines. Methods to control rabbits include burrow destruction and shooting. Any rabbit control program will require cooperation and agreement from the landowner.
- Monthly inspection data, covering the requirements above, will be reported on in accordance with the BBAMP reporting requirements and provided to BCS in annual reporting.

Using the information collected above, the efficacy of the mitigation measures implemented will also be assessed annually. This will include an assessment of WTE carcass search data and site utilisation data against carrion occurrence rates, removal requests, and removal undertaken.

The program will be reviewed in accordance with the BBAMP reporting requirements. If, for example, WTE mortality increases annually when compared to the initial 24-month operational monitoring period, then the need for continuation, refinement or additional mitigation measures will be discussed, in consultation with BCS.

5.4. Reporting

Findings of the revised and continued monitoring program will be reported in the 7th year biennial Report (year 6 and 7), at this time any further recommendations for amendments will be made in consultation with BCS.

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Appendix 1 Risk Matrices

Likelihood criteria

Across a 12 month period:		
Likelihood	Description	Approximate probability (%)
Very rare	Very improbable that impact could occur	<5
Less likely	Less probable than more probable that impact could occur	5 to < 50
Possible	Equally probable that impact could or could not occur	50
Likely	More probable than not that impact could occur	>50 to 95
Almost certain	Very probable that impact could occur	>95

Consequence criteria

Predicted to seriously disrupt an ecological significant proportion of the:		Consequence
<i>Total population annually</i>	<i>Population in the study area and surrounds for the life of the wind farm</i>	
No	None	Negligible
No	Short-term	Low
No	Medium-term	Moderate
Yes	Medium-term	High
Yes	Long-term	Severe

Risk ratings

		Consequence				
		Negligible	Low	Moderate	High	Severe
Likelihood	Very rare	Very low	Very low	Very low	Low	Low
	Less likely	Very low	Very low	Low	Medium	High
	Possible	Very low	Low	Medium	High	High
	Likely	Very low	Low	Medium	High	Very high
	Almost certain	Very low	Low	High	Very high	Very high