

12 June 2024

Peta Brunel
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L24/600 Bourke St, Melbourne
Victoria, Australia

Dear Peta,

As requested, please find attached 'Output 1 – Desktop analysis of black cockatoo tracking data to show movement and site utilisation of Carnaby's cockatoos in the Cataby Region with reference to the Waddi Wind Farm' on Harry Butler Institute and Murdoch University letterhead.

Sincerely



Professor Kris Warren

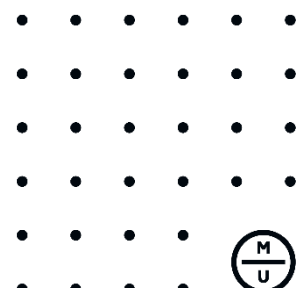
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Output 1 - Desktop analysis of black cockatoo tracking data to show movement and site utilisation of Carnaby's cockatoos in the Cataby Region with reference to the Waddi Wind Farm.

Professor Kris Warren and Dr Jill Shephard, Murdoch University Black Cockatoo Conservation Management Project

This report includes (a) Murdoch University's night roost location data and flock movement track data in the vicinity of the Waddi Wind Farm development, and (b) additional information to inform potential site utilisation within the Project Area.

(a) Flock night roost and movement data in the vicinity of Tilt Renewables' proposed Waddi Wind Farm

Although Murdoch University did not specifically track black cockatoos in the Waddi Wind Farm development area, we have incidental data from several flocks of Carnaby's cockatoos which contained telemetry tagged Carnaby's cockatoos, which serve as markers for these flocks, and which roosted and foraged in the vicinity of Waddi Wind Farm.

The Carnaby's cockatoo flock movement data presented below in Figure 1 (night roost locations) and Figure 2 (flock movement tracks) come from GPS and/or Argos satellite tags attached to 14 individual Carnaby's cockatoos, from five separate tag deployments (releases of rehabilitated black cockatoos with tags attached). Two tag deployments, in 2017 and 2022, took place at the Coomallo Creek breeding area for Carnaby's cockatoos, roughly 40km north of the Project Area boundary, and two further deployments, in 2021 and 2022, took place at the Cataby breeding area, roughly 9km south of the Project Area boundary. Another deployment took place in 2022 at Regan's Ford, 40km SE of the Project Area boundary, during the non-breeding season.

Each tagged bird joined a local flock of Carnaby's cockatoos and acted as a marker for the movements and activity of the flock it joined. Our data therefore represent the movement activity of up to fourteen individual flocks. Data are captured by each tag for as long as the tag remains operational and attached to the bird, which varies from several days to several months.

It is critical to recognise that these data represent 'snapshots' in time. That is, they describe flock activity only during the active tracking period and do not capture the activity of other flocks in the area. Therefore, a lack of movement or roost data in any area does not indicate a lack of habitat use or suitability for Carnaby's cockatoos.

Night roost locations identified by Murdoch University data

Figure 1 presents night roost locations for Carnaby's cockatoos captured by our data. Individual roost sites were differentiated by 500m, and where multiple roost night events occurred within 500m of each other, these were considered to be part of the same roost site. The figure includes buffers of 6km and 12km (red polygons) from the Project Area boundary. These distances represent, respectively, approximate mean daily and maximum daily foraging distances that Carnaby's cockatoos are known to forage from their roost and mark distances within which it is critical to retain sufficient food resources. Carnaby's cockatoos using roosts within the 12km buffer, and particularly within the 6km buffer, potentially use food resources within the Project Area. BirdLife Australia were contacted for additional data but did not have records of additional roosts in the vicinity beyond those already captured by our data. This should not be considered to indicate that other roosts are not present, given that BirdLife Australia's roost data come from the annual Great Cocky Count, which is conducted on a single night at known roosts in April each year. As with our data, BirdLife Australia's data represent snapshots in time of black cockatoo activity and do not capture roosts used at in other months of the year.

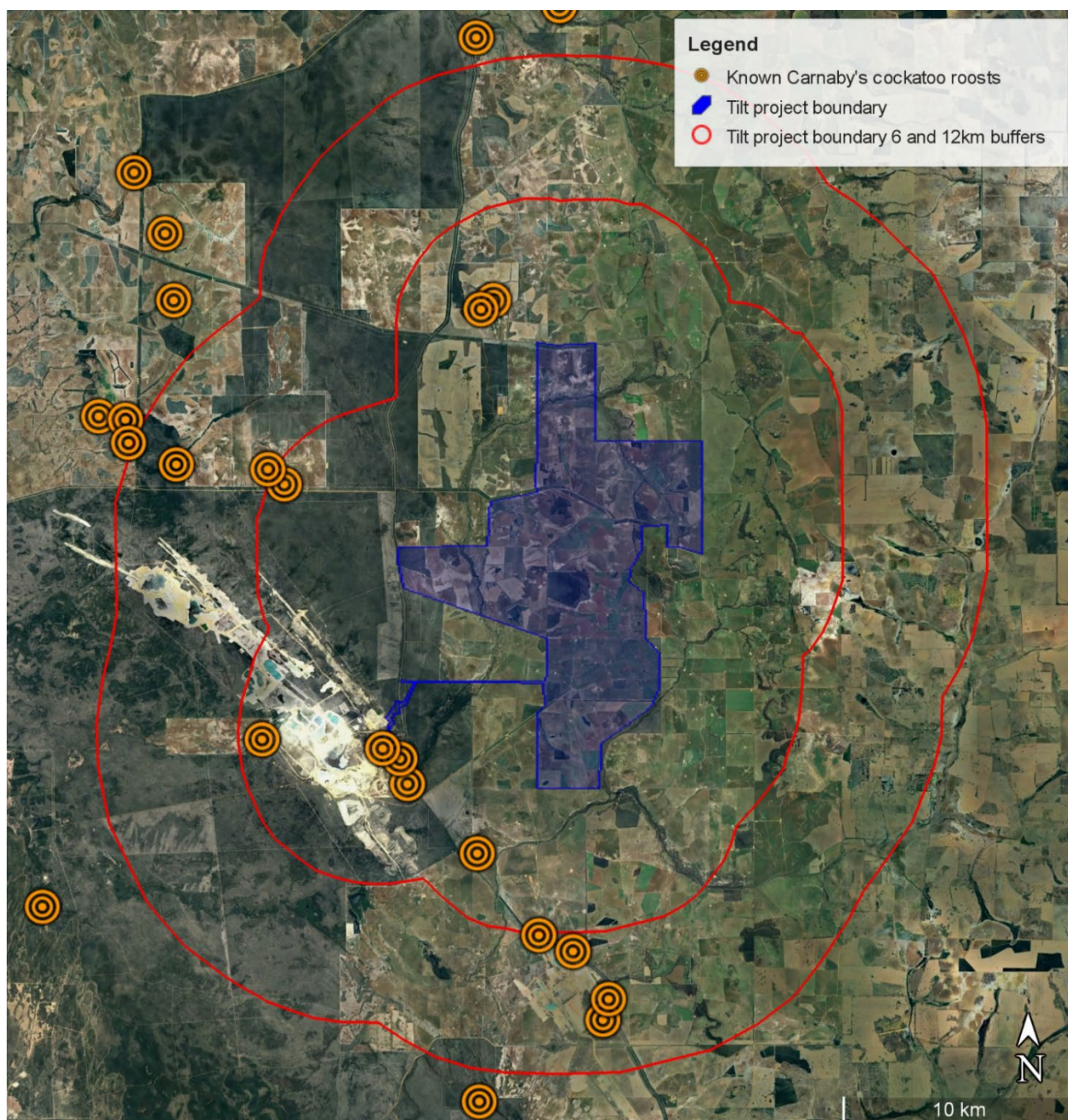


Figure 1. Night roost locations for Carnaby's cockatoo flocks for which Murdoch University has data, showing roosts within (a) approximate mean daily foraging distance (6km); and (b) approximate maximum daily foraging distance (12km) of the Waddi Wind Farm Project Area boundary. Roost locations were identified using data obtained from Argos satellite and/or GPS tags during the period that tags remained operational on 'marker birds' in each flock (typically a few weeks). Separate roost sites were defined using a distance of greater than 500m. That is, roost locations within 500m of each other were considered to be a single roost site. Note: Murdoch University did not undertake any tracking of Carnaby's cockatoo flocks specifically in the area of the development. Data presented here are incidental data, and represent a brief 'snapshot' in time for tracked flocks' use of night roosts in this area. There will be other Carnaby's cockatoo flocks in the area which were not tracked. Roost locations for these flocks are not represented above.

Flock movement tracks

Figure 2 presents flock movement tracks for Carnaby's cockatoos captured by our data. The data include a combination of GPS and Argos satellite data restricted largely to the Cataby breeding area. GPS data were collected up to every 2.5 minutes capturing foraging and other activity at a fine temporal scale. Few GPS data are available beyond the period of nestling provisioning at Cataby. In addition, Argos satellite data were collected from some of the adult birds tagged at the breeding areas for up to 6 months after fledging of their young. Post-fledging, the young dependent birds leave breeding areas with their parents and flock, and travel to post-breeding foraging areas. Argos satellite tags capture location data at a much courser scale than GPS tags (up to within 250m positional accuracy, compared to GPS tags' +/- 20m positional accuracy) and were programmed to capture data at ten-day intervals. Roughly 75% of Argos satellite data are captured at night, as the main purpose of these satellite tags was to capture night roost locations during long-distance dispersal (e.g. to post-breeding foraging areas). Most movement data north of the Cataby breeding area were captured by Argos satellite tags; therefore mainly indicating night roosting activity.

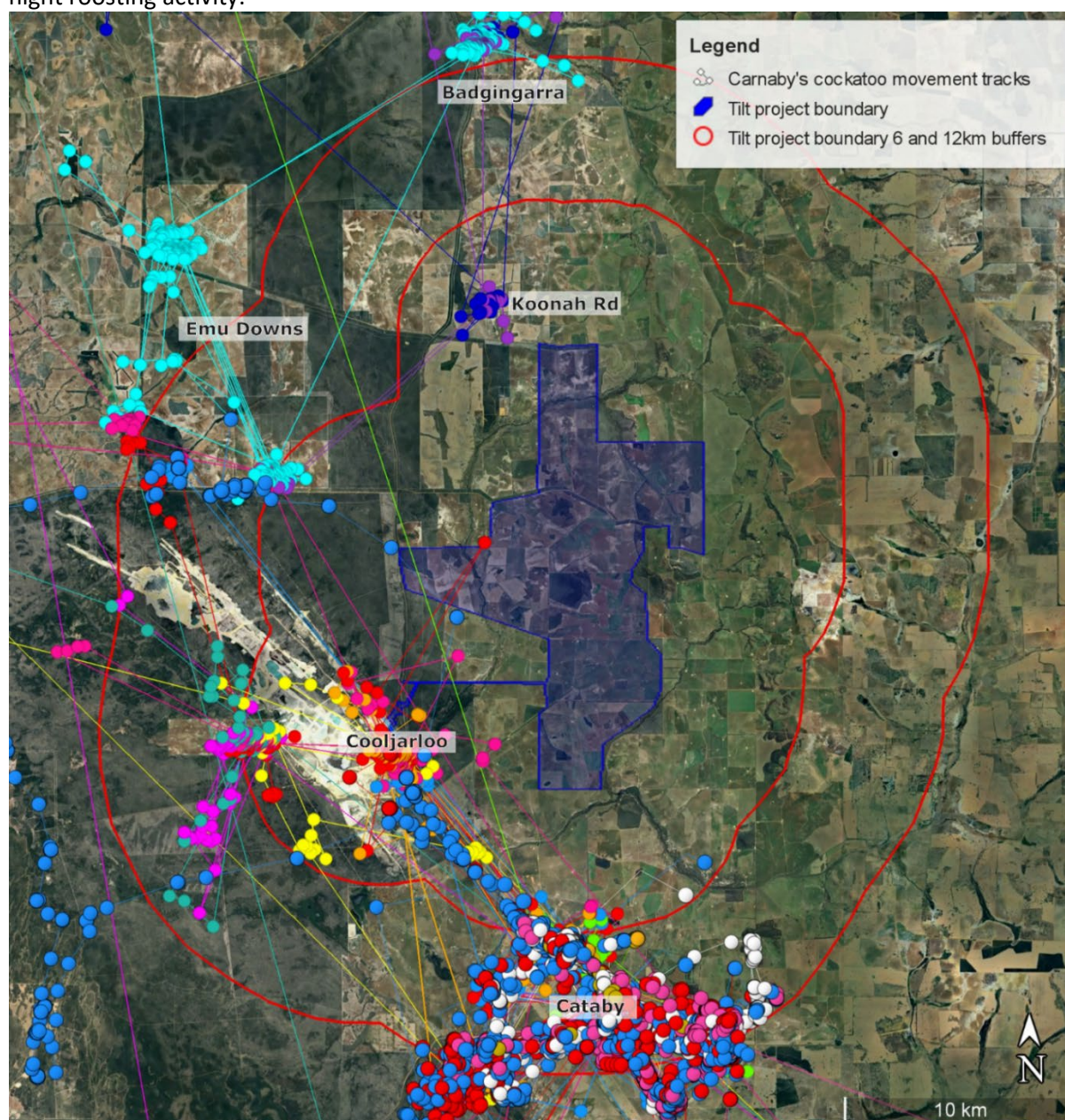


Figure 2. Flock movement tracks for Carnaby's cockatoos for which Murdoch University has data, including those within approximate mean daily foraging distance (6km) and approximate maximum daily foraging distance (12km) of Tilt Renewables Waddi Wind Farm project boundary. Data were obtained from satellite and/or GPS tags during the period that tags remained operational on 'marker birds' within each flock (typically a few weeks). Each coloured dot is an individual telemetry tagged bird. Note: Murdoch University did not track any Carnaby's cockatoo flocks specifically in the area of the development; these are incidental data and represent a brief 'snapshot' in time of tracked flock movement. There will also be other flocks in the area which did not contain tracked birds and for which movement data have not been captured.

General flock movements for the Cataby breeding area

GPS data from tags deployed at the Carnaby's cockatoo breeding area at Cataby, combined with real-time field observations at the breeding area, indicate that during the period of nestling provisioning, most foraging occurred in a southerly direction from the main breeding area, with the closest recorded foraging occurring within 6km of the proposed Waddi Wind Farm Project Area boundary. During this time, the Cataby flock consisted of around 40 birds, indicating that roughly 20 breeding pairs utilised this site. Birds were observed foraging on a combination of remnant native proteaceous vegetation in patches within the agricultural matrix and on road verges, as well as exotic foraging species such as canola and wild radish.

The Waddi Wind Farm Project Area has known breeding areas for Carnaby's cockatoos on three sides; the Cataby breeding site as discussed above, as well as breeding areas at Badgingarra, Coomallo Creek, Hill River and Moora. In addition to potentially providing foraging and roosting habitat for birds at the closest of these breeding areas (those within daily foraging range i.e. up to around 12km), the Project Area may function as a connectivity corridor for birds from the other breeding areas, as well as breeding populations further afield in the wheatbelt when those flocks move to the coastal banksia and other key foraging areas across the Swan Coastal Plain in the weeks after breeding, with their dependent fledglings. The satellite data and field observations for the Cataby breeding area during the post-fledging period show that black cockatoos continued to use the main roosts around the breeding area for up to several months after nestlings fledged (December through March), and significantly, over this time the number of birds increased to around 200, as birds arrived from other breeding areas with newly fledged young. The Moora breeding area (Figure 3) is one likely source of these additional birds, as it is located directly east of the Cataby breeding area, and research has found that inland breeding Carnaby's cockatoos generally move towards the coast to spend time at key foraging areas, once young have fledged. Breeding areas further south may also contribute to this flock size increase, including birds from the Regan's Ford breeding area. This too is supported by our data, which indicate connectivity between Regan's Ford flocks and the greater Cataby area.

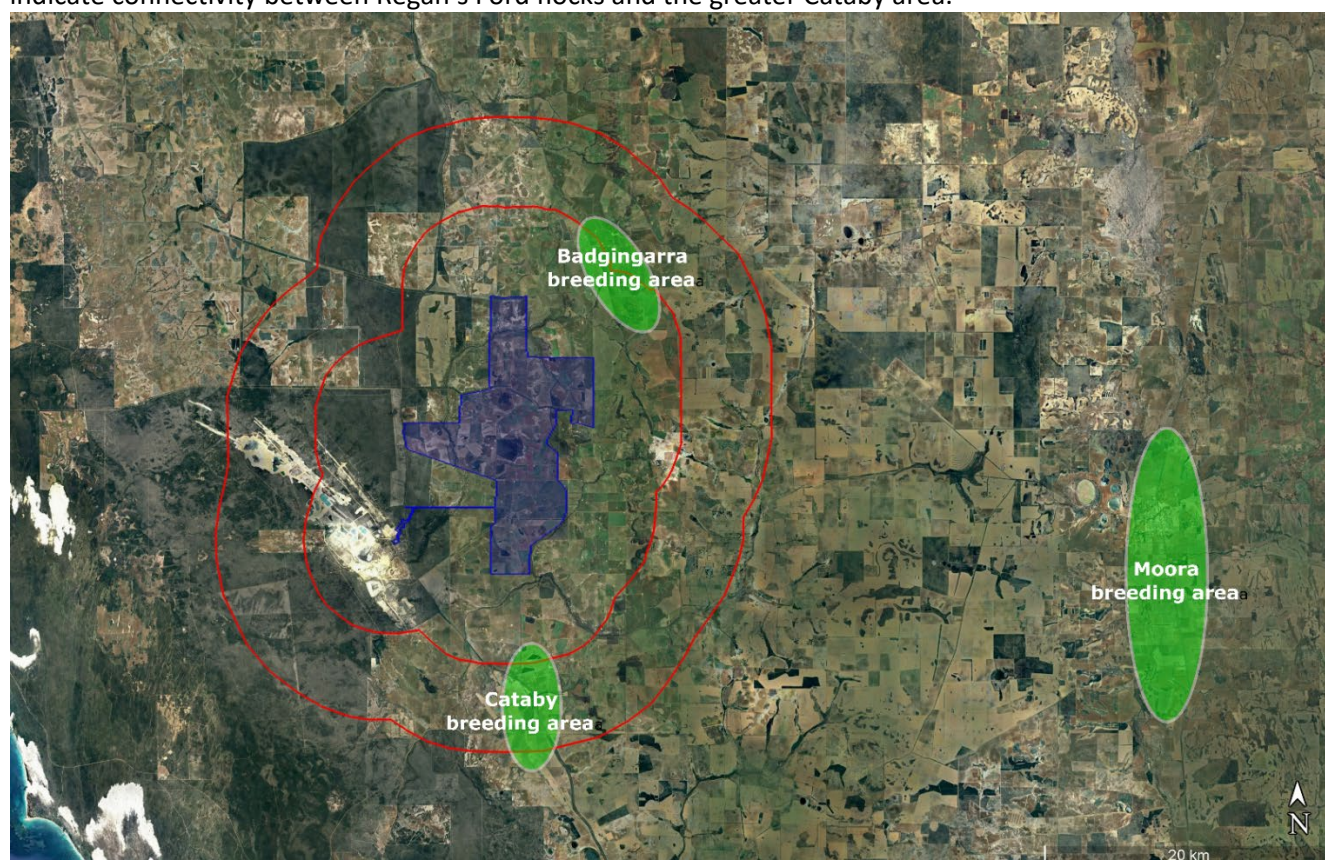


Figure 3. Locations of known Carnaby's cockatoo breeding areas in relation to the proposed Waddi Wind Farm development, sourced from data from Murdoch University's tracking project and BirdLife Australia. The Waddi Wind Farm Project Area is within daily foraging range of both the Badgingarra and Cataby breeding areas; indicating that the foraging habitat within the Project Area would be available for use by the breeding birds. The Project Area is also in the expected travel path of flocks breeding at Moora as they travel towards the coast with their dependent young at the conclusion of breeding. Inland breeding populations of Carnaby's cockatoos in this area generally move coastwards at the conclusion of breeding, and require foraging habitat and roosts along the way.

General flock movements in the Cooljarloo area

We have movement data available for tagged Carnaby's cockatoos and their flocks in the area around Cooljarloo, although these comprise Argos satellite data only. Carnaby's cockatoos that were tagged and released into wild flocks at Regan's Ford prior to the breeding season moved northwards (with their flocks) through the Cataby area shortly after their April release, and arrived in the Cooljarloo area in early May, where they remained roosting and foraging. As well, the area around Cooljarloo was used for foraging by four out of five adult breeding birds that were tagged at the Cataby breeding area. All four birds moved to the Cooljarloo area, with the flock, in either January or February and remained there for up to several months, provisioning any dependent young. Gaining access to this area was difficult for our field researchers, but a flock follow in May revealed a flock of around 100 birds utilising a roost to the west of the Tronox mine area.

Our data and observations showed that birds roosting in the Cooljarloo area were foraging on proteaceous shrubland. Our data for the east side of the mine include roost locations within 800m of the Waddi Wind Farm Project Area boundary. Our roost data include a total of over 80 roost nights spent by individual tagged birds, and their associated flocks, from flocks tracked in the Cooljarloo area. Vegetation within the Waddi Wind Farm Project Area boundary in this vicinity includes vegetation described in the Black Cockatoo Habitat Assessment document as 'Potential black cockatoo foraging habitat', including high quality Kwongan heath; which is preferred foraging habitat for Carnaby's cockatoos. The availability of this high-quality Kwongan heath foraging habitat inside the Project Area, and its proximity to the aforementioned highly-utilised Carnaby's cockatoo roosts, means that this foraging habitat within the Project Area is very likely used by the Carnaby's cockatoos that are roosting at those roosts.

General flock movements in the Emu Downs area

Further north, our data indicate at least five tagged birds and their flocks utilised roosts in the Emu Downs area between the months of December to April. This included birds from the Cataby and Coomallo Creek breeding areas, which moved to the Emu Downs area in the weeks post-breeding. Many of the roosts in the Emu Downs area are pine, with field observations indicating birds also made extensive use of pine for foraging, as well as foraging on remnant proteaceous vegetation, including along road verges and in remnant patches of native vegetation within the Emu Downs wind farm south of Bibby Road. Our field researchers did not have access to the Emu Downs wind farm, so observations of foraging within the wind farm area were made from a distance and it was impossible to tell what impacts these wind turbines had on these flocks.

General flock movements in the Koonah Road area

The Koonah Road area includes Argos satellite data (Figure 2) collected from two birds and their respective flocks, both tagged at the Coomallo Creek breeding area (in 2017 and 2020). The roosts identified in the Koonah Road area comprise pine trees on private property, and are located approximately 3km from the Project Area boundary; indicating that any food resources inside the Project Area at this point are well within the optimal daily foraging distance of 6km from those two roosts. No field observations were made at these roosts, so flock sizes are not known. Our data at these roosts indicate use of the roosts (and food resources within daily foraging distance i.e. ~6-12km of the roosts) across the months of December-March, and May.

(b) Insights into potential habitat use within the Waddi Wind Farm Project Area by Carnaby's cockatoos, from flock movement data

Murdoch University's flock movement data in the vicinity of the proposed Waddi Wind Farm can help inform potential use of habitat in the Project Area by Carnaby's cockatoos. The tracking data identify numerous roosts within daily foraging distance of the Project Area. As noted, there will also be other flocks in the area for which we do not have movement data.

A summary of key points regarding use of habitat in the area, as sourced from our tracking data, includes:

- Murdoch University tracking data identify eight separate night roost sites located within 6km (optimal daily foraging distance) of the Waddi Wind Farm Project Area boundary, and an additional six roost sites within 12km (upper limit of daily foraging range from roosts/nests).
- Lack of food resources is a limiting factor for black cockatoos in the Wheatbelt.
- Studies have shown that breeding populations of black cockatoos require sufficient foraging resources within 12km (ideally within 6km) from their roosts/nests to breed successfully and to maintain population numbers¹. This accords with DBCA advice, and is supported by recent analyses from our research team, which identify 6km as the mean daily distance Carnaby's cockatoos will travel from their nest to forage during the breeding season, with a daily maximum of up to ~12km. Similar findings for flocks during the non-breeding season also highlight the importance of retaining foraging habitat near roosts during the non-breeding season.
- The Waddi Wind Farm Project Area boundary is within daily foraging range of the Badgingarra breeding site for Carnaby's cockatoos (Figure 3). It is therefore expected that birds from this breeding site would use foraging habitat within the Project Area; as noted in the Black Cockatoo Habitat Assessment document. Our research team has not tracked birds in this area. BirdLife Australia holds nesting data for this breeding site, and can be contacted for the most recent breeding survey results.
- With respect to Carnaby's cockatoos that are breeding at the Cataby breeding area, although our GPS data for tagged birds using the Cataby breeding area did not show use of foraging habitat within the Waddi Wind Farm Project area, it is important to note that there are known breeding birds on land that was not accessible for study within 3km of the Cataby breeding sites and these flocks may forage within the development envelope. For example, at Coomallo Creek we observed that Carnaby's cockatoos from different parts of the same breeding area foraged in separate flocks, and each flock used distinct, non-overlapping foraging areas in different directions around the breeding site. This use of separate distinct foraging areas by different flocks of breeding birds may also occur at Cataby, given that the Cataby breeding area is spread across both sides of the Brand Highway, and all our tagged birds occupied only the western side of the breeding area. For birds occupying the eastern side of the highway, we have no data about which foraging area(s) are used.
- Our data identified eight separate night roost sites within daily foraging range of the Project Area that were used by flocks during the non-breeding season, between January and May. We have no data beyond May (no tags remained operational on the birds), but it is expected that the birds would pass through the same foraging area again when returning to their breeding sites later in the year. At that time, they may use the same roosts and foraging resources; it is also possible that other (as yet unidentified) roosts may be used, if the flocks are then accessing different seasonally-available resources in the same area.
- As part of the Waddi Wind Farm Black Cockatoo Habitat Assessment, both the field surveys were undertaken in October. However, in October new cones are only developing in the canopy, and the previous season's cones have all been consumed by Carnaby's cockatoos which occurs within weeks of the cones reaching maturity at the start of each year. Pine cones reach maturity around January, coinciding with when

¹ Saunders D, Mawson P, and Dawson R, 2014, One fledgling or two in the endangered Carnaby's Cockatoo (*Calyptorhynchus latirostris*): a strategy for survival or legacy from a bygone era? *Conservation Physiology*, 2(1), 10.1093/conphys/cou001

Carnaby's cockatoos are departing from their breeding grounds with their dependent fledglings. Our tracking work has shown that pine is a significant foraging resource as Carnaby's cockatoos disperse back into non-breeding areas following breeding. Pine stands are visited by post-breeding flocks at the same time each year, indicating the importance of these stands as a foraging resource for post-breeding flocks with dependent fledglings in the first weeks post-fledging when pine cones are most abundant, and offer a high-energy food resource. *Pine stands within the Project Area are likely known to flocks. The lack of feeding residue during field surveys is due to the (mis)timing of the survey.* All pine within foraging distance of the roosts identified by our data should be considered as critical foraging habitat that will be supporting the viability of these roosts and the flocks that use them.

- One other important note is that *Eucalyptus tottiana* within the Project Area was excluded from consideration as foraging habitat, but should not have been. Specifically, the Black Cockatoo Habitat Assessment document states:

“...there are small groves of trees (*Eucalyptus tottiana*) in the southern area that have a height of 6-10m and are used as shelter by the stock in those paddocks. These groves of trees contained species that do not typically form hollows nor provide a foraging resource for Black-Cockatoos, and trunks have often grown at oblique angles, so they are of little consequence in a Black-Cockatoo habitat assessment.”

Eucalyptus tottiana is a known foraging species for Carnaby's cockatoos (Groom, 2011). Our field researchers have observed Carnaby's cockatoos foraging on *E. tottiana* in the Geraldton Sandplain IBRA region; where this wind farm proposal is located. It will be important to communicate to regulators that *E. tottiana* is a valuable foraging resource for Carnaby's cockatoos and should not have been excluded from the assessment of foraging habitat within the Project Area. We hope this point can be accommodated as part of considering the potential impacts of this proposed clearing and associated offsets.