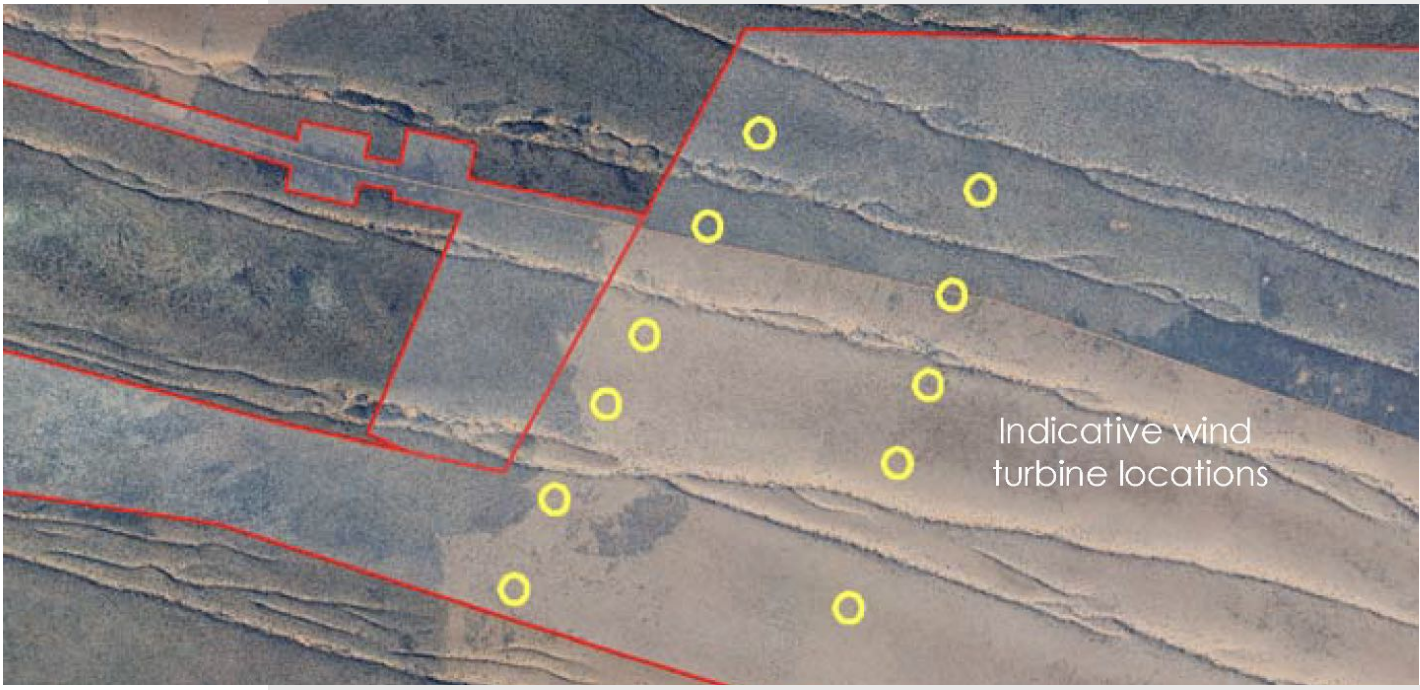
Winu Project Wind Turbine Avifauna and Bat Risk Assessment



Prepared for

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Winu Project Wind Turbine Avifauna and Bat Risk Assessment

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1.0 Introduction

1.1 Project Background

Rio Tinto Winu Pty Limited (RTW) plans to develop a new copper-gold mine, the Winu Project (hereafter 'the project'), approximately 320 km east of Port Hedland in the Pilbara region of Western Australia (Figure 1.1). The project is situated within both the Nyangumarta and Martu People's Native Title Determination Areas.

The project will involve the generation of renewable energy to help meet operational power demands, using a combination of solar arrays, wind turbines and storage batteries. The wind energy component of this solution, which will comprise eleven turbines situated within the Mine and Infrastructure Area (MIA) of the project (Figure 1.2), presents a potential impact to both avifauna and bats, principally through collision risk with turbine blades. Assessing the risk of this is informative to RTW as part of the environmental impact assessment (EIA) of the project.

Considerable fauna survey work has been completed to support the EIA of the project, and Biota Environmental Sciences (Biota) was commissioned to consolidate bird and bat records data relevant to the wind turbine aspect of the project and provide an ecological risk assessment.

1.2 Scope

The scope of this assessment was to undertake a data consolidation and literature review to gather relevant information to assess potential risks to birds and bats from the project. In particular, the focus was on potential impacts from the proposed wind turbines to any significant species recorded or considered to have a high likelihood of occurrence in the project development envelope (DE). Significant species are those which are specially protected under the *Biodiversity Conservation Act 2016* (WA) (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act).

This risk assessment focuses on risks to flying vertebrates (i.e. birds and bats) from direct collision and displacement/barrier effects from turbines.

1.3 Limitations

This risk assessment is purely desktop-based, and reliant on existing published information to assess potential risks.

Input data on specific bird and bat species, such as flight heights, visual acuity, flight maneuverability, and susceptibility to disturbance effects, is limited in an Australian context. As a result, much of the information used here has been extrapolated from overseas studies and/or studies and observations of taxonomically related species to inform the risk assessment. This means that a degree of uncertainty exists around the risk assessment more so than would be expected were more detailed local data available. It should also be noted that the assessment in this report is based purely on the expected impacts of this project and does not consider potential cumulative impacts across other projects in the region.

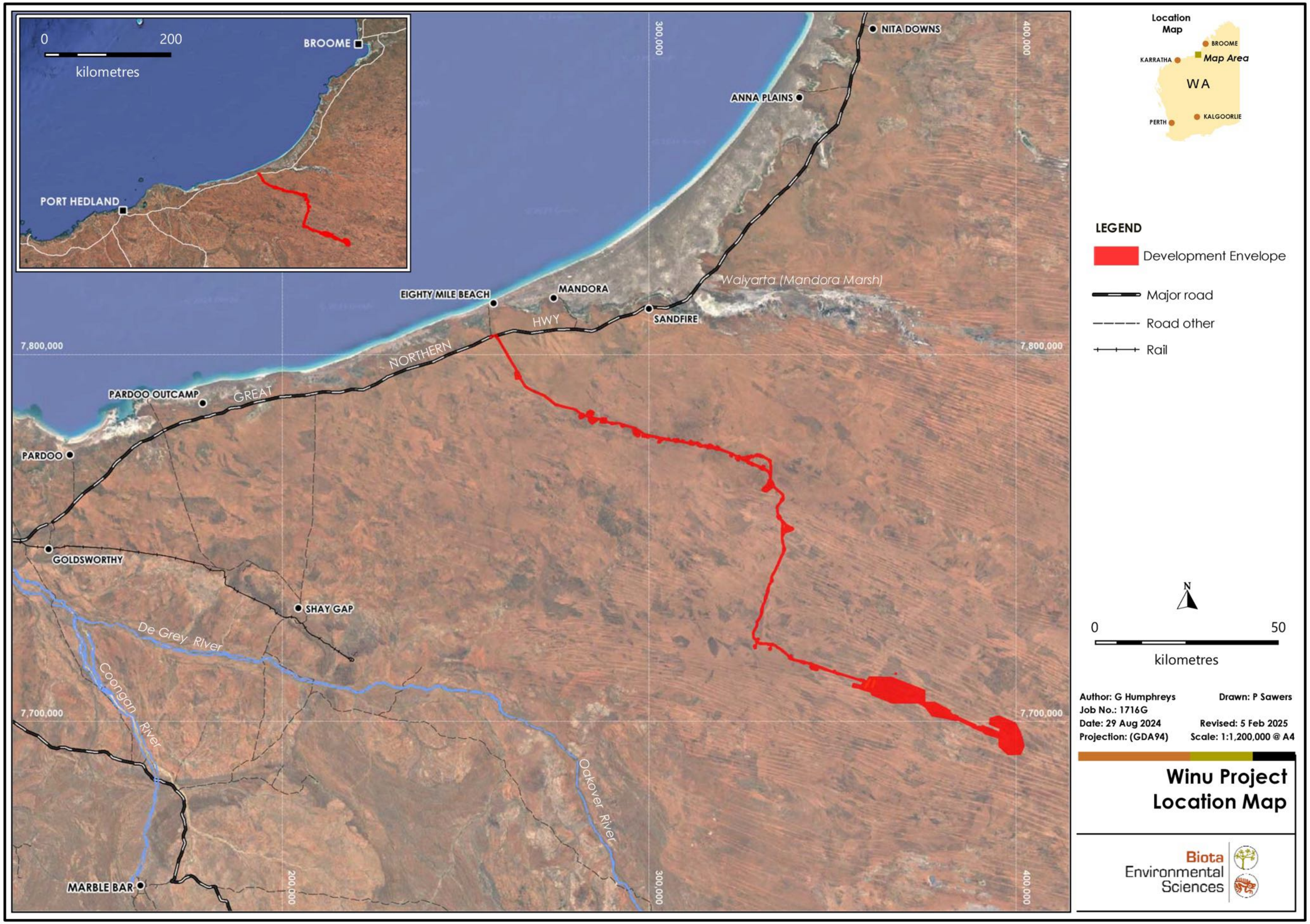

Figure 1.1: **Location map and project DE.**

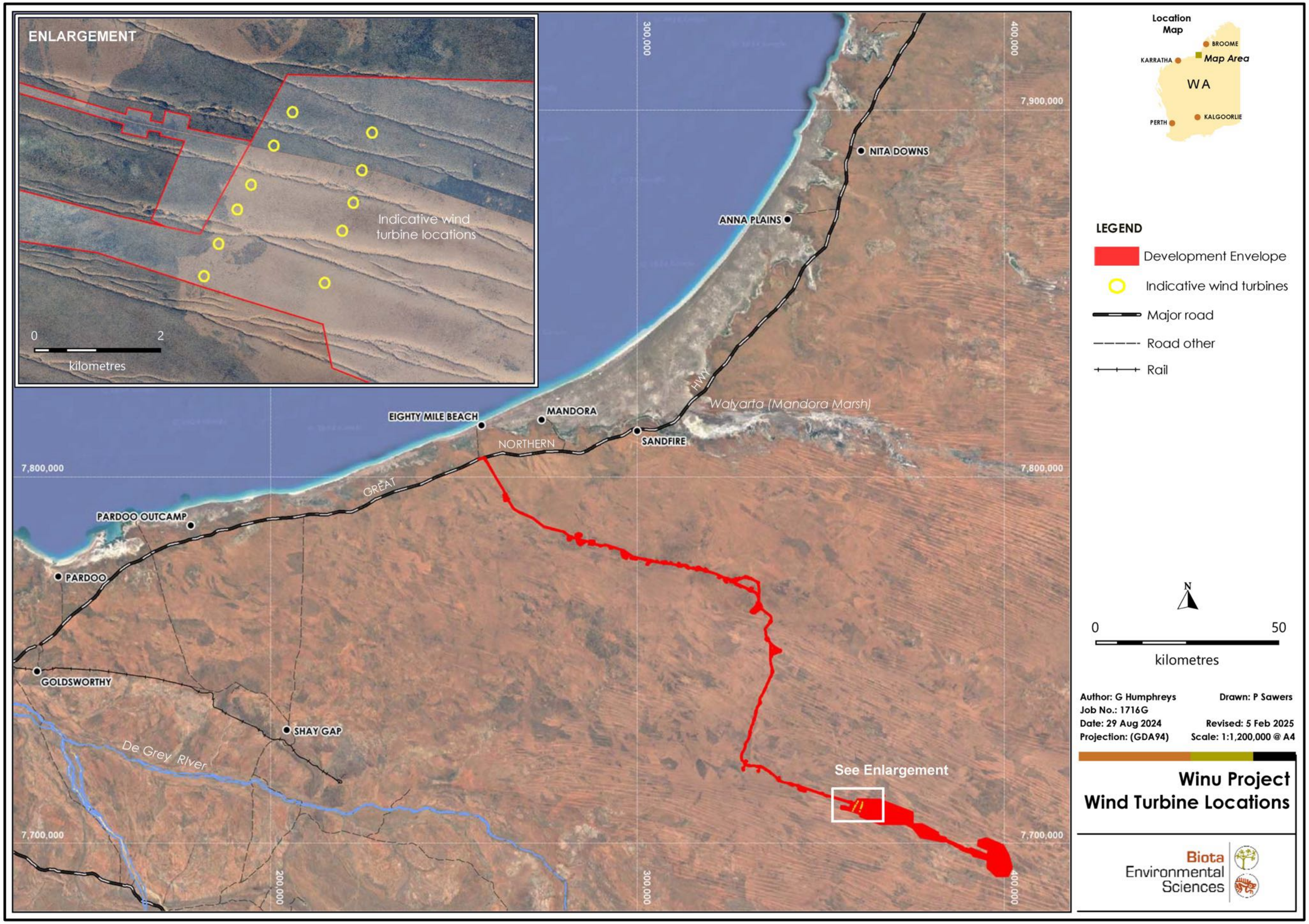

Figure 1.2: **Conceptual design of project wind turbines relative to the DE boundary.**

2.0 Context

2.1 Conservation Estate in the Locality

There are two vested conservation reserves of relevance to avifauna in the locality, Eighty Mile Beach Marine Park and Walyarta Conservation Park, which includes the Walyarta ephemeral wetland (previously known as Mandora Marsh) (see Figure 2.1).

Together, Eighty Mile Beach Marine Park and Walyarta Conservation Park effectively encompass the Eighty Mile Beach Ramsar site (Figure 2.1). Eighty Mile Beach is listed under the international Ramsar Convention as Site No. 480 and described as containing *"...the most important wetland for waders in northwestern Australia, supporting up to 336,000 birds, and is especially important as a land fall for waders migrating south for the austral summer."* [1]

The presence of the Ramsar site then, while well removed from the location of the proposed turbines, requires consideration here.

[1] https://rsis.ramsar.org/ris/480

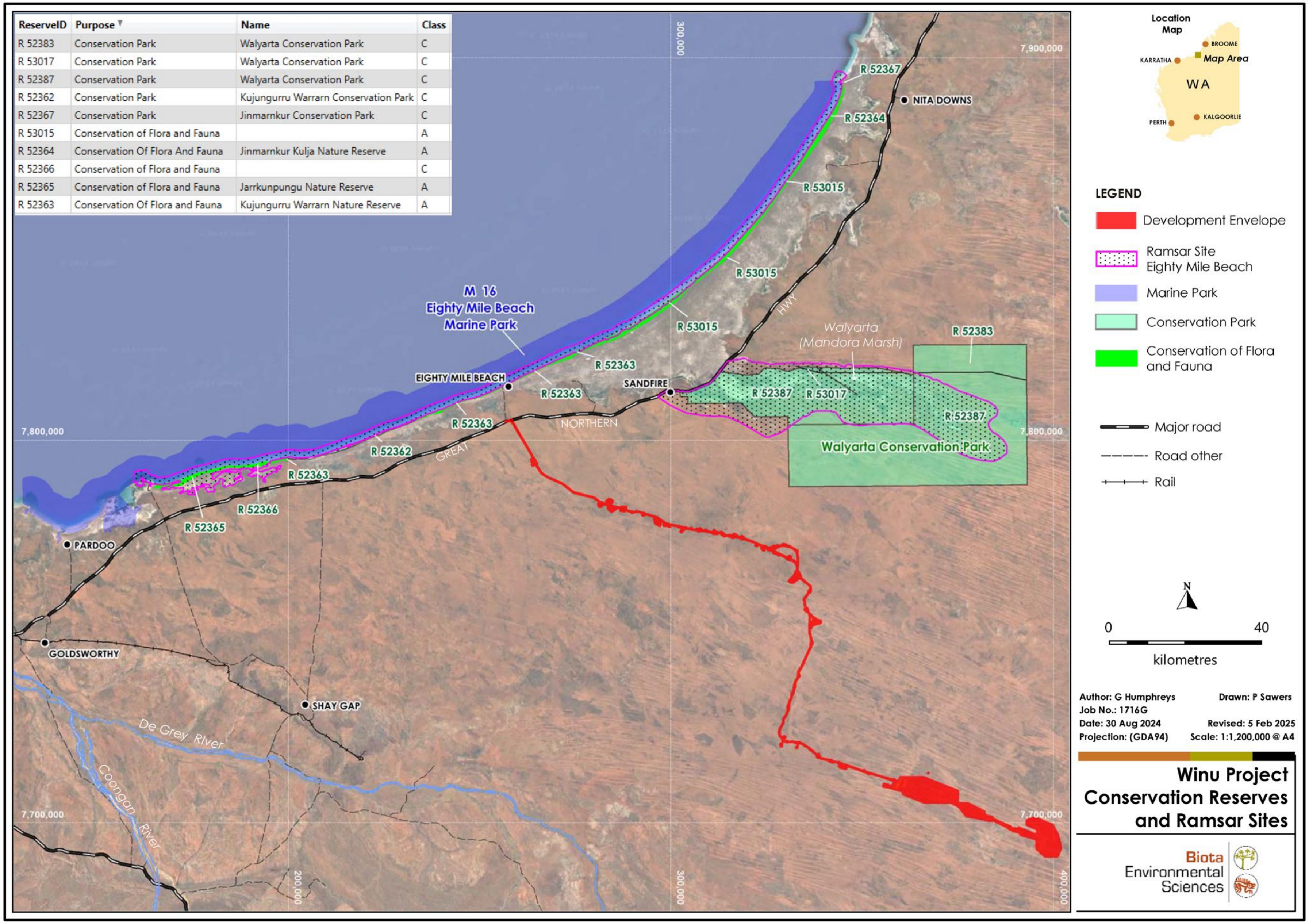

Figure 2.1: **Conservation reserves in the project locality.**

2.2 Avifauna of the Project Area

2.2.1 Survey Effort

Six fauna surveys of various types and intensity have been completed for the project over a period of approximately four years (Biota 2023). A detailed breakdown of the consolidated avifauna survey effort is presented in Table 2.1 and amounts to a total of 62 avifauna survey sites and 62 acoustic recorder locations (includes both short and long-term deployment). The location of these sites in relation to the Winu DE is presented in Figure 2.2. In addition to these sampling points, additional search effort from general searches, targeted searches and nocturnal searches are also valid for capturing opportunistic bird records (Table 2.1).

Table 2.1: Consolidated survey effort for avifauna,

	Survey Effort	
Survey Methodology	**Inside DE**	**Outside DE**
Avifauna Surveys	32 sites (1,910 minutes)	30 sites (1,690 minutes)
Acoustic Recorders (short and long-term deployments)	29 sites (3,123 nights)	33 sites (3,684 nights)
General Searches	157 searches	39 searches
Targeted Searches	100 searches	150 searches
Nocturnal Searches	9 searches	1 search
Habitat Assessments	36	109

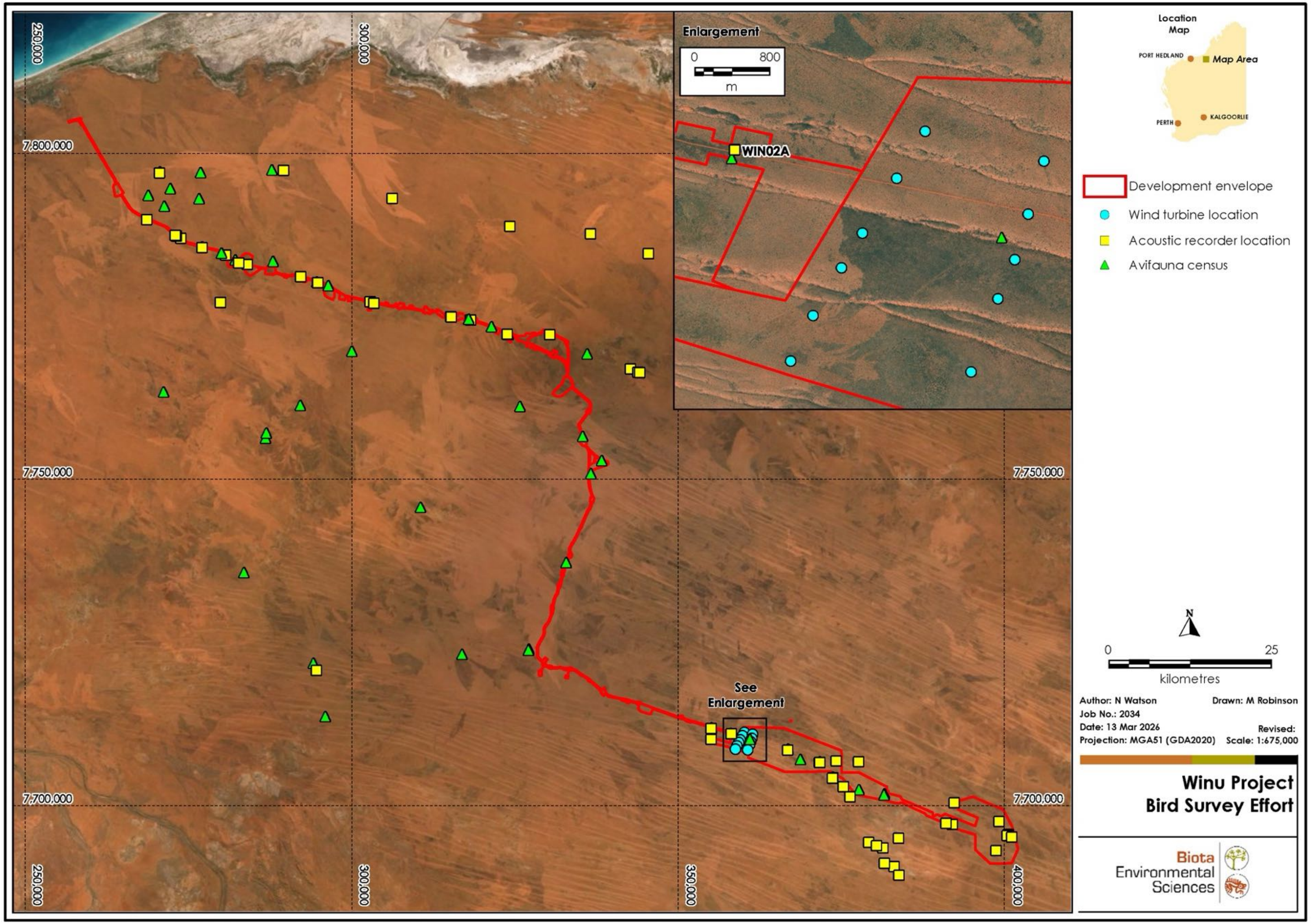

Figure 2.2: **Consolidated survey effort in relation to avifauna (acoustic recorder and avifauna census locations only).**

2.2.2 Survey Records

A total of 56 bird species have been recorded from the DE over the course of this consolidated survey effort.

The project DE includes the Road Access Corridor (RAC), which extends 138 km from the MIA, where the turbines would be situated, to the Great Northern Highway (see Figure 1.1). This means that some of the consolidated avifauna records come from habitats in more coastal areas than the proposed turbine locations.

To provide a more representative avifauna assemblage for the current assessment, the consolidated records from the past four years were spatially queried to the subset recorded within a 50 km radius of the proposed turbine locations. This yielded a documented avifauna assemblage of 49 species (Table 2.2).

The avifauna of relevance is dominated by songbird species typical of the northwest arid zone (see Table 2.2). Six of the 49 species are of elevated significance, comprising four species listed as Migratory (Pacific Swift, Oriental Plover, Little Curlew and Common Gull-billed Tern), one Vulnerable (Grey Falcon) and one Critically Endangered (Night Parrot) (Table 2.2).

The last species warrants particular attention, given its conservation status: the Night Parrot was recorded in 2024 during acoustic record unit (ARU) sampling at the project's proposed Texas bore field option, approximately 24 km southeast of the proposed turbine locations (Figure 1.1). There is currently no evidence the species occurs in the MIA part of the project DE where the turbines would be sited, and further work is currently underway to validate this through species-specific habitat assessment, but it is included here for completeness.

Table 2.2: Avifauna recorded within a 50 km radius of the proposed turbine locations.

Family	Common Name	Scientific Name	Significance
Apodidae	Pacific Swift	*Apus pacificus*	Migratory (BC Act, EPBC Act)
Otididae	Australian Bustard	*Ardeotis australis*	-
Caprimulgidae	Spotted nightjar	*Eurostopodus argus*	-
Cuculidae	Horsfield's Bronze cuckoo	*Chrysococcyx basalis*	-
Columbidae	Diamond Dove	*Geopelia cuneata*	-
Turnicidae	Little Buttonquail	*Turnix velox*	-
Charadriidae	Oriental Plover	*Anarhynchus veredus*	Migratory (BC Act, EPBC Act)
Scolopacidae	Little Curlew	*Numenius minutus*	Migratory (BC Act, EPBC Act)
Laridae	Common Gull-billed Tern	*Gelochelidon nilotica*	Migratory (BC Act, EPBC Act)
Accipitridae	Brown Goshawk	*Accipiter fasciatus*	-
	Spotted Harrier	*Circus assimilis*	-
	Whistling Kite	*Haliastur sphenurus*	-
Alcedinidae	Red-backed Kingfisher	*Todiramphus pyrrhopygius*	-
Meropidae	Rainbow Bee-eater	*Merops ornatus*	-
Falconidae	Brown Falcon	*Falco berigora*	-
	Nankeen Kestrel	*Falco cenchroides*	-
	Grey Falcon	*Falco hypoleucos*	Vulnerable (BC Act, EPBC Act)
	Australian Hobby	*Falco longipennis*	-
Cacatuidae	Little Corella	*Cacatua sanguinea*	-
	Cockatiel	*Nymphicus hollandicus*	-
Psittaculidae	Budgerigar	*Melopsittacus undulatus*	-
	Night Parrot	*Pezoporus occidentalis*	Critically Endangered (BC Act, EPBC Act)
Maluridae	Purple-backed Fairywren	*Malurus assimilis*	-

Family	Common Name	Scientific Name	Significance
	White-winged Fairywren	*Malurus leucopterus*	-
Meliphagidae	Pied Honeyeater	*Certhionyx variegatus*	-
	Crimson Chat	*Epthianura tricolor*	-
	Singing Honeyeater	*Gavicalis virescens*	-
	Brown Honeyeater	*Lichmera indistincta*	-
	Yellow-throated Miner	*Manorina flavigula*	-
	Grey-headed Honeyeater	*Ptilotula keartlandi*	-
	White-plumed Honeyeater	*Ptilotula penicillata*	-
	White-fronted Honeyeater	*Purnella albifrons*	-
	Black Honeyeater	*Sugomel nigrum*	-
Psophodidae	Chiming Wedgebill	*Psophodes occidentalis*	-
Artamidae	Black-faced Woodswallow	*Artamus cinereus*	-
	Little Woodswallow	*Artamus minor*	-
	Masked Woodswallow	*Artamus personatus*	-
	Pied Butcherbird	*Cracticus nigrogularis*	-
Campephagidae	Black-faced Cuckooshrike	*Coracina novaehollandiae*	-
	White-winged Triller	*Lalage tricolor*	-
Oreoicidae	Crested Bellbird	*Oreoica gutturalis*	-
Pachycephalidae	Rufous Whistler	*Pachycephala rufiventris*	-
Rhipiduridae	Willie Wagtail	*Rhipidura leucophrys*	-
Corvidae	Little Crow	*Corvus bennetti*	-
Petroicidae	Hooded Robin	*Melanodryas cucullata*	-
Locustellidae	Brown Songlark	*Cincloramphus cruralis*	-
	Rufous Songlark	*Cincloramphus mathewsi*	-
	Spinifexbird	*Poodytes carteri*	-
Estrildidae	Australian Zebra Finch	*Taeniopygia castanotis*	-

2.2.3 Survey Records near Wind Turbines

One avifauna census site (WIN03A) near the proposed wind turbine locations (200m away, see Figure 2.2). WIN03A received two 30-minute censuses each phase, representing 120 minutes (2 hours) total avifauna utilisation sampling for site. Species records from WIN03A comprised: Australian Bustard, Budgerigar, Singing Honeyeater, Yellow-throated Miner, Crimson Chat, White-winged Triller, Rufous Whistler, Willie Wagtail and Zebra Finch.

One acoustic recorder (WIN02A) was also proximal to the proposed wind turbine locations (1,680m away; see Figure 2.2) and sampled 12 nights effort (6 nights over 2 phases). Species from this site comprised: Singing Honeyeater, Grey-headed Honeyeater and Pied Butcherbird.

2.3 Bat Fauna of the Project Area

2.3.1 Survey Effort

Consolidated bat survey effort within Winu and AREH project areas using ultrasonic recorders amounts to a total of 24 ultrasonic recorder sites across 58 survey nights (Table 2.3). The location of these sites in relation to the Winu DE is presented in Figure 2.3.

Table 2.3: Consolidated survey effort for bats.

	Survey Effort	
Survey Methodology	**Inside DE**	**Outside DE**
Ultrasonic Recorders	14 sites (21 nights)	10 sites (37 nights)

2.3.2 Survey Records

A total of five bat species have been recorded within 50 km of the proposed turbine locations during the consolidated fauna surveys of the past four years (Biota 2023) (Table 2.4).

Table 2.4: Bat fauna recorded within 50 km of the proposed turbine locations.

Family	Species Name	Common Name
Molossidae	*Austronomus australis*	White-striped Free-tailed Bat
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat
Molossidae	*Chaerephon jobensis*	Greater Northern Free-tailed Bat
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheath-tailed Bat
Vespertilionidae	*Scotorepens greyii*	Little Broad-nosed Bat

None of these species are listed as significant at either State or Commonwealth level and all are common and widespread in the Pilbara bioregion (Biota 2021, 2023). Two significant bat species (Orange Leaf-nosed Bat and Ghost Bat) identified from the desktop study were deemed unlikely to occur due to absence of suitable roost caves within the Winu DE.

2.3.3 Survey Records near Wind Turbines

One ultrasonic call recorder was deployed for two nights near to the proposed turbine locations (WIN05BAT), and it was situated 260 m from the closest turbine. Two species were recorded from WINU05BAT: Greater Northern Free-tailed Bat (*Chaerephon jobensis*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*).

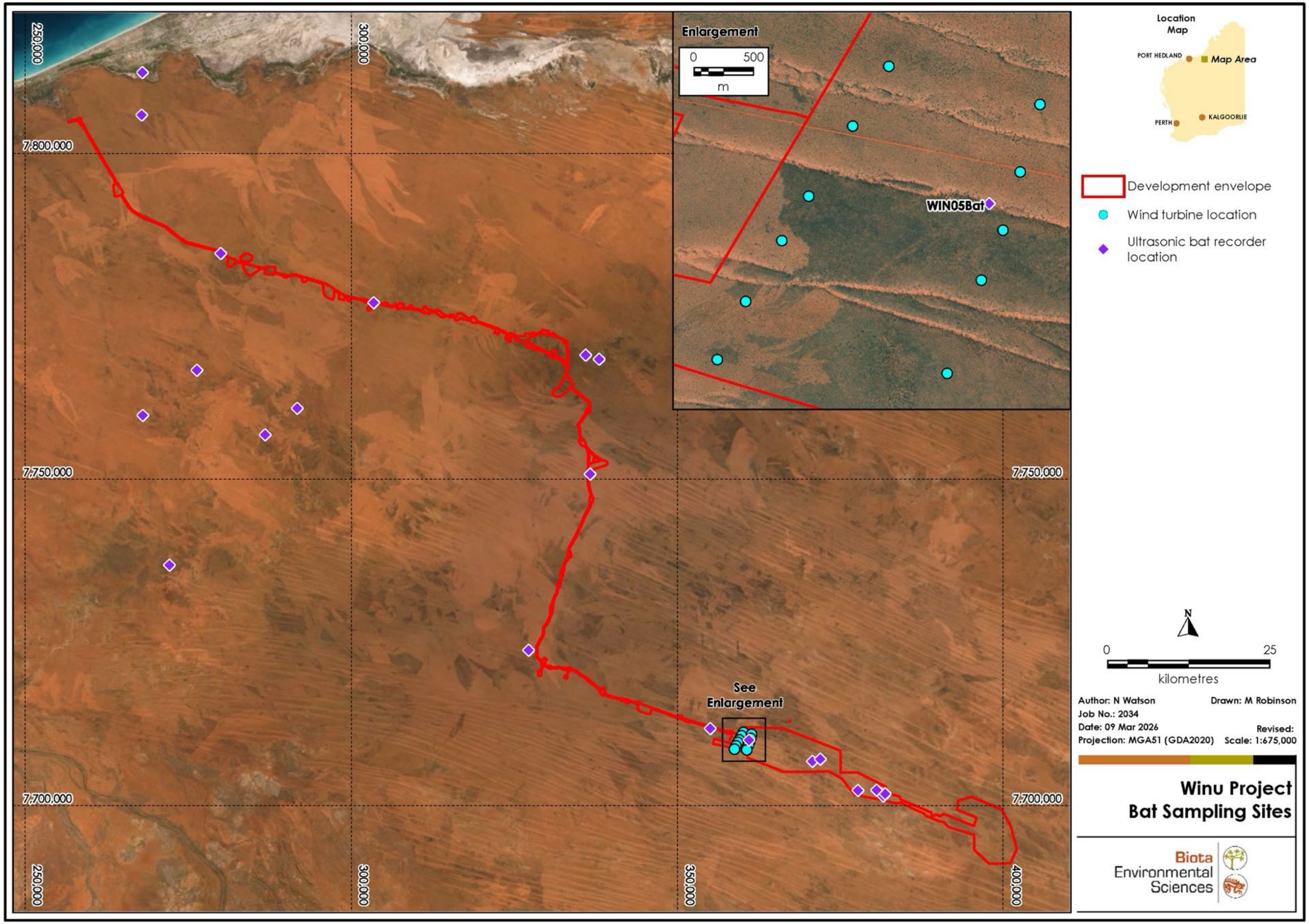

Figure 2.3: Consolidated survey effort In relation to bats.

2.4 Proposed Wind Turbines

The project proposes to construct and operate eleven 7.2 MW Vestas wind turbines (GHD 2023).

These turbines will have a hub height of 150 m above ground level and a rotor diameter of 172 m. This would result in an upper rotor tip swing of 236 m and a lower swing height of 64 m above ground level.

The conceptual design provided by RTW arranges the eleven turbines in two rows which trend from the north to the south-southwest in orientation (see Figure 1.2). The two rows are separated by distances of between 1.3 km and 1.8 km, and individual turbines within each row are separated by between 450 m and 900 m.

The turbines would be situated at the western end of the project MIA (Figure 1.2), some 145 km from the coast at its nearest point.

3.0 Assessment

3.1 Potential Impact Pathways

The potential impacts of wind turbines and wind farms on birds and bats are increasingly well-documented in the literature (e.g. Drewitt and Langston 2006, Rydell et al. 2010, 2012, Marques et al. 2014), and fall into three broad categories:

1. direct loss or degradation of important habitat through construction and operation of wind turbines and associated infrastructure (Section 3.2);
2. disturbance leading to displacement from areas (Section 3.3); and
3. barriers to movement and individual mortality through collision with wind turbines (Section 3.4).

3.2 Direct Loss of Important Habitat

The direct loss of habitat associated with the construction of eleven wind turbine pads is minor at approximately 5.5 ha of clearing (assuming a nominal 50 m by 100 m clearing extent per turbine). Further, the proposed locations are within one of the most widespread fauna habitats in the locality; Shrub and spinifex on sandplains, which accounts for 12,528 ha of the DE alone in addition to its extensive regional occurrence (Biota 2023). Lastly, this habitat type is not of particular significance to avifauna or bats, offering no special roosting, foraging or breeding resources.

Given this, direct loss or degradation of avifauna or bat habitat as a result of the proposed wind turbines is given no further consideration here.

3.3 Disturbance and Displacement Risk

The location selected for a wind farm in relation to sites of importance for birds and bats is a critical consideration and has been highlighted repeatedly in previous reviews on wind farm impacts (e.g. Langston and Pullan 2003, Marques et al. 2014, Perrow 2017).

This is also highlighted in EPBC Act policy which states that the "*main way to avoid having a significant impact on a matter of national environmental significance is to site the wind farm away from…Ramsar wetlands, or the habitat of listed threatened or listed migratory species*" (DoEE 2009), while the draft updated guidance states that the "*earliest and often the best opportunity to avoid adverse environmental impacts is at the site selection and project design phases*" (DCCEEW 2024).

The most notable site of importance for birds in the locality is the Eighty Mile Beach Ramsar site (Section 2.1). While this is a very significant habitat for migratory shorebirds and waterbirds, the project's location relative to the Ramsar site means that the turbines would not present a significant risk to birds and bats using habitats of the Ramsar site itself: The nearest proposed turbine location is 86 km from the Walyarta (Mandora Marsh) part of the site and a very considerable 140 km from Eighty Mile Beach (see Figure 3.1). These distances are orders of magnitude greater than the spatial extent of disturbance and displacement effects reported in the literature around existing wind farms.

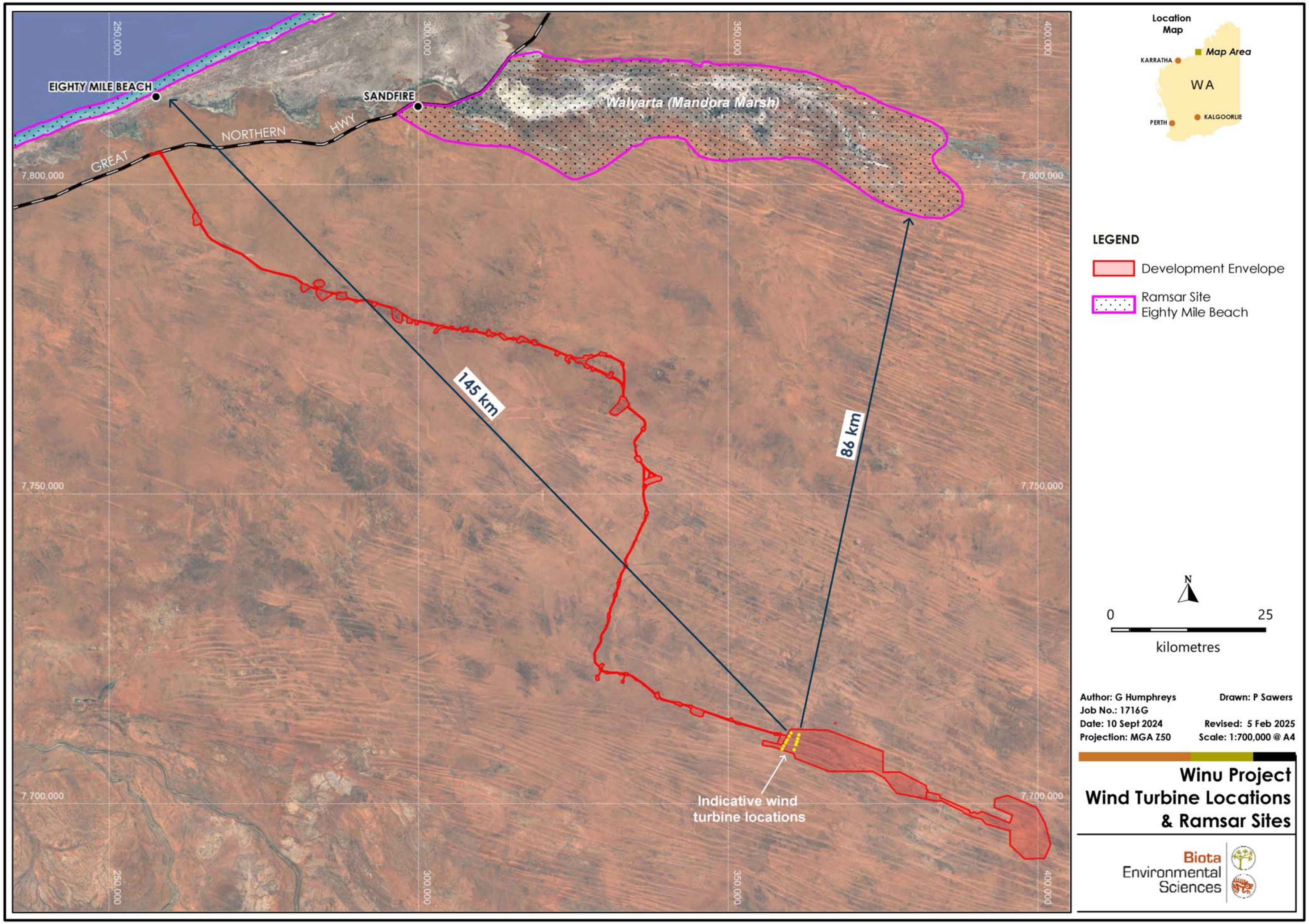

Figure 3.1: **Proposed turbine locations relative to the Eighty Mile Beach Ramsar site.**

Most earlier studies detected disturbance and displacement effects extending to less than one kilometre from turbines, with reviews indicating disturbance effects on birds extended up to 600-800 m (Drewitt and Langston 2006), and that most displacement impacts on birds extend out to a maximum of 100-200 m from the project (Pearce-Higgin et al. 2012). As a result, recommended buffer zones around important wetland areas for birds found in the literature are all dramatically less than the 86 km closest separation distance in this case.

For example, Hötker et al. (2006) recommend a buffer distance of at least 400 m from important wader and waterbird habitat. Similarly, Rydell et al. (2017) recommend buffer distances to important habitat of at least 500 m for waterfowl and shorebirds, and at least 1,000 m (1 km) for gulls and terns. More recent studies have detected disturbance impacts from wind farms extending to greater distances from turbines and infrastructure, including reduced probability of occurrence of Dupont's Larks up to 4.5 km from turbines (Gómez-Catasús et al. 2018), reduced breeding success in White-tailed Eagles (*Haliaeetus albicilla*) up to 4 km from turbines (Balotari-Chiebao et al. 2016), and significantly reduced activity levels of Whooping Cranes (*Grus americana*) within 5 km of turbines (Pearse et al. 2021). Regardless, the distance from the Ramsar site to the nearest proposed turbine location in the project DE is still very much greater than even the largest disturbance or displacement effect distances reported in the literature, and thus the risk of impacts to birds using the Ramsar site through disturbance or displacement is assessed as negligible.

This leaves direct mortality of individual birds and bats through collision with turbine blades as the only plausible potential impact pathway arising from the proposed turbines (Section 3.4).

3.4 Movement Barrier and Collision Risk

3.4.1 Wind Farm Layout and Turbine Positioning

Wind farm design is a major factor in avifauna collision risk, with multiple reviews indicating that the design, layout and spacing of turbines can have a significant influence on any movement barrier effects and the likelihood of bird collisions with rotors (e.g. Drewitt and Langston 2008, Marques et al. 2014, Zwart et al. 2016).

The planned siting and arrangement of the two rows of turbines is not in a location where there would be any ecologically significant movement of large number of birds. The rows would be sited on Shrub and spinifex on sandplains habitat, with no features that might represent a driver creating pathways for avifauna or bat movements, such as large wetland features or major roost sites, present in the immediately adjoining locality. The creation of a barrier to an important movement route therefore appears unlikely to represent a potential impact pathway of any significance to avifauna or bats, particularly significant species.

Increased spacing between turbines is likely to reduce the likelihood that a wind farm presents a barrier to bird and bat movement and allow passage between turbines while also reducing the likelihood of entering rotor-swept areas. Spacing of greater than 200 m between turbines has been recommended to avoid inhibiting bird movement (Powlesland 2009). However, empirical studies regarding the effect of turbine spacing are relatively few. Cattle Egrets (*Bubulcus ibis*) breeding near a wind farm site were observed to avoid flying between turbines spaced 200 m apart, but flew more regularly between more widely spaced turbines 500 m apart (Bai et al. 2021). Common Eiders (*Somateria mollissima*) were observed avoiding flying between turbines of an offshore windfarm with turbines arranged in rows 850 m apart, with turbines within rows 480 m apart (Masden et al. 2009).

Elevated mortality rates from turbine collisions have been observed in bats in North America and Europe (e.g. Cryan 2011), but there is very little information in the literature regarding barrier effects to bats. The lack of empirical studies means that there is uncertainty around assessing the risk of movement barriers, particularly for bats. Similarly, bat movement pathways and migratory behaviour in Australia are not mapped or understood with the same resolution as major avian flyways, and so the absence of mapped bat flyways should not be interpreted as evidence that bat movement does not occur across the project area (Reid and Baker 2025).

Given this uncertainty, the assessment here is based on whether the proposed turbine layout intersects features likely to concentrate bird or bat movement, roosting or foraging activity. The proposed turbine locations are situated in extensive sandplain habitat and are not located adjacent to features identified in bat wind farm guidance as potential higher-risk siting contexts, such as caves, cliffs, rocky escarpments, permanent water, riparian corridors, or known congregational roost sites or repeated flight paths between roosts and foraging areas (Australasian Bat Society 2024). The proposed distances between turbines, ranging from 450 m to 900 m between nearest turbine neighbours, and 1.3 km to 1.8 km between the two rows, are also sufficiently large to suggest that the risk of significant barrier effects is low based on the available literature and general information on arid-zone bat ecology.

The location of the project area is also not known to intersect a major avian migratory flyway or a documented bat movement corridor. However, because bat flyways are poorly documented in Australia, this conclusion should be treated as an assessment of currently available information and site context rather than as evidence that bat movements do not occur through the area.

Positioning of turbines within the landscape can also affect collision risk, with higher risk associated with wind farms located close to wetlands and coastal areas, and areas with distinct topographical variation including mountain tops and ridges (Rydell et al. 2012). The project area is located over 145 km from the coast, and over 86 km from Walyarta (Mandora Marsh) (see Section 3.3), so proximity to these habitats is very unlikely to increase the risk of bird fatalities.

3.4.2 Turbine Design

Turbine design can also affect collision risk, though as relevant turbine features are often correlated it can be problematic to isolate the effects of specific design aspects (Marques et al. 2014). Overall turbine size is likely to be the most relevant factor in assessing potential risks, as most modern turbines share broadly similar structure so other design features seen in older turbines that may affect collision risk (such as lattice towers) are not relevant here. Overall turbine size may influence collision risk as larger turbines with longer blades have a larger rotor swept zone for each turbine which may increase collision risk (Marques et al. 2014).

However, studies have also reported differing effects of turbine size on collision risk. A review of multiple studies in the United States found that bird collision mortality increased with increasing turbine hub height (Loss et al. 2013). This has also been reported in several other studies (e.g. Smallwood and Thelander 2004, de Lucas et al. 2008), but other studies have reported no effect (e.g. Everaert 2014). Smallwood (2013) reported that fatality rates in raptors decreased with increasing turbine size, but this effect was based on turbine power output rather than height. These reviews suggest that the effect of turbine height on collision risk is also, and likely to be strongly, influenced by other species-specific and site-specific factors. For example, in an area where bird and bat species occur that have low average flight heights, even larger turbines may present a low collision risk as the minimum height of the rotor swept area is higher than the aerial space routinely used by the fauna.

In the case of the project, the minimum planned height for the rotor swept area is approximately 64 m, which is likely to be higher than typical flight heights for most of the locally-occurring bird and bat species. However, the risk may be somewhat higher for species that regularly fly at higher altitudes, such as raptors and other soaring birds, and higher-flying bats such as the White-striped Freetail Bat *Austronomus australis*, which occurs in the DE. *A. australis* is not listed as a significant species under State or Commonwealth legislation, and neither are six of the seven raptor species known from the project area (Table 2.2).

The remaining locally-occurring raptor, the Grey Falcon, is a significant species however, as are four species listed as Migratory under both the BC Act and the EPBC Act (Table 2.2) (see Section 3.5).

3.5 Impact Risk

3.5.1 Significant Bird Species

Potential risks to significant bird species that occur within the MIA part of the project DE are summarised below in Table 3.1.

Table 3.1: Summary of collision risk and environmental outcome for significant avifauna species recorded within 50 km of the proposed turbine locations.

Species	Collision risk	Occurrence	Outcome
Pacific Swift *Apus pacificus* (Migratory)	High	Migrant to broader region. Likely sporadic occurrence, primarily from Sep-Apr, particularly in association with unsettled weather.	Risk of individual collision mortality, low risk of significant displacement impacts. Negligible risk of broader population impacts from collision mortality given the relatively small number of turbines proposed and that the species is likely to occur over the project area only sporadically, and in lower numbers overall than over more coastal areas in the Pilbara.
Oriental Plover *Anarhynchus veredus* (Migratory)	Medium	Migrant to broader region, primarily Sep-Apr, but number of records and overall numbers much lower inland than in coastal Pilbara and (particularly) Kimberley regions.	Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible.
Little Curlew *Numenius minutus* (Migratory)	Medium	Migrant to, and nomadic within, the broader region, but number of records and overall numbers much lower than in coastal Pilbara and northern Australia.	Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible.
Common Gull-billed Tern *Gelochelidon nilotica* (Migratory)	Medium	Migrant to, and nomadic within, the broader region, but number of records and overall numbers much lower than coastal Pilbara.	Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible.

Species	Collision risk	Occurrence	Outcome
Grey Falcon *Falco hypoleucos* (Vulnerable)	High	Resident in broader region at relatively low density, occurs in project DE.	Risk of individual collision mortality and/or displacement impacts, with a small potential for local population impacts. Very low risk of population impacts at State-wide scale due to wide distribution in Western Australia.
Night Parrot *Pezoporus occidentalis* (Critically Endangered)	Very low	Occurs in southeast of the project DE but not recorded within 26 km of the turbine locations and habitat there of low suitability.	Very low risk of individual collision mortality and displacement due to very low numbers (if any) moving through project area and likely low flight heights even if present.

Two of the significant species above are assessed as having a high risk of individuals being impacted through collision and bear further discussion:

- **Pacific Swift *Apus pacificus* (Migratory)**

There is little data on the susceptibility of Pacific Swifts to collision with wind turbines in the literature, though two individuals were found dead at wind turbines in the Kaban Green Power Hub in Queensland (e2m Consulting 2023). All experts surveyed for the Victorian risk assessment discussed previously identified Pacific Swift as being at high risk of collision with wind turbines (Lumsden et al. 2019). Related species have also been reported as relatively frequent victims of collision strike. Common Swifts (*A. apus*), a similar species from Europe, were recorded as turbine collision mortalities at six wind farms in Germany (four), Spain and Belgium (Kingsley and Whittam 2005), while 36 Common Swift fatalities were reported at a wind farm in Cádiz in Spain (Sebastián-González et al. 2018). Swift species also accounted for 8.6% (73 out of 848 birds) of birds killed at South African windfarms (Perold et al. 2020).

The evidence in the literature suggests that Pacific Swifts are likely to be at relatively high risk of collisions based on proportion of flight heights and observed susceptibility to turbine strike. Avoidance behaviour in the species has not been quantified, but observed collisions with wind turbines for this species (and related species) indicates that a high risk of collisions exists even taking into account any avoidance behaviour. The species is, however, likely to occur over the study area only sporadically, and in lower numbers overall than over more coastal areas in the Pilbara. As such, the risk of population-level impacts on Pacific Swift from the project is negligible (Table 3.1).

- **Grey Falcon *Falco hypoleucos* (Vulnerable)**

Grey Falcons are known to soar high, with a pair of Grey Falcons reportedly observed soaring at altitudes up to 600 m, and observations indicating "*soaring between 100 m and 300 m is common*" (Czechura and Debus 1985). This suggests that individuals of this species are likely to fly regularly within the rotor swept zone if present in the area proposed for the turbines. Falcon species accounted for 11.2% of the total number of birds observed to be killed (95 out of 848) by collisions with wind turbines across a review of 20 wind farms in South Africa, with six out of the seven local falcon species recorded as casualties (Perold et al. 2020). This suggests that falcons as a group are susceptible to collisions at least as a broader taxonomic group.

Avoidance behaviour has been observed in a variety of raptor species (e.g. Garvin et al. 2011, Hull and Muir 2013) though no direct evidence is available for Grey Falcons. The species typically occurs in low densities, and the number of turbines proposed is relatively small, so the absolute number of individuals affected by the project is likely to be very low. Overall, there is a small risk of localised impacts to the species through turbine strikes, but the risk of broader population-level impacts from this proposed project is very low (Table 3.1).

3.5.2 Other Migratory Birds

Count data and field observations at Eighty Mile Beach indicate that several shorebird species continue south from Eighty Mile Beach to non-breeding areas in southern Australia (Minton et al. 2013). Banding recovery and leg-flag resighting data also confirm that migratory shorebirds move between the Roebuck Bay–Eighty Mile Beach area and locations further south in both western and eastern Australia (Minton et al. 2011).

However, data on the flight routes used between north-western and southern Australia are very limited and the routes are not well understood (Biota 2018). This includes locations in south-western Australia where a 'Great Circle' route (the shortest distance migratory route between two points (Alerstam et al. 2001)) could potentially take some migratory birds over the project DE. While the separation distance between the Ramsar site and the planned turbine locations is very substantial, it is not impossible that migratory shorebirds may overfly the western end of the MIA during southward movement.

If some migratory birds do overfly the DE when moving to southern parts of Australia, then the potential for collision with the proposed wind turbines becomes a function of the flight heights of the bird species relative to the wind turbine rotor heights, and of the wind farm scale and design (the latter is addressed in Section 3.4.1).

Migratory shorebirds typically fly at high altitudes during migration and when undertaking movements at large geographic scale, with flight heights of 1,000-5,000 m reported as typical (Geering et al. 2007). There is also significant variation within studies, which suggests that shorebirds will use a range of flight heights during migration (Biota 2018). This is likely driven by weather, with migratory birds shown to vary their flight heights in response to wind direction and variation in winds at different altitudes, and to keep themselves below the prevailing cloud base (Newton 2008).

When considering this in context with the project's turbines swept area height of 64 m - 236 m above ground, and even allowing for the full range of values cited in the literature, there is virtually no overlap between the rotor swing range and the flight heights documented for migratory shorebirds. The overall body of data indicates that a representative range of shorebirds generally fly considerably higher than the uppermost swing of the proposed turbines once underway; a minimum elevation of at least 500 m and more commonly considerably higher (Biota 2018). This represents a scenario of very low risk of interaction with the turbine rotors, even assuming that migratory birds transiting to southern Australia directly overfly the relatively small footprint of the proposed wind farm.

3.5.3 Overall Avifauna Assemblage

The discussion in Section 3.5 focuses on significant avifauna species as a key risk for EIA. However, the broader assemblage recorded near the proposed turbine locations also warrants consideration because some non-listed species have flight ecology or behaviour that can increase their susceptibility to interaction with wind turbines.

The avifauna recorded at the nearest avifauna census site to the proposed turbines, WIN03A, comprised Australian Bustard, Budgerigar, Singing Honeyeater, Yellow-throated Miner, Crimson Chat, White-winged Triller, Rufous Whistler, Willie Wagtail and Zebra Finch. The nearby acoustic recorder WIN02A also recorded Singing Honeyeater, Grey-headed Honeyeater and Pied Butcherbird. None of these species are listed as threatened or migratory under the BC Act or EPBC Act, but they collectively provide a useful indication of the type of avifauna assemblage using the sandplain habitats near the proposed turbine locations.

The recent ecological risk assessment for birds and bats at onshore wind farms in Australia (Reid and Baker 2025) provides a relative, trait-based, risk ranking for Australian bird taxa based on ecological and susceptibility attributes, including flight height, flight time, flight manoeuvrability and habitat specialisation. Applying the Western Australian risk categories from that assessment to the species recorded near the proposed Winu turbines identifies one species as high relative risk, seven as medium relative risk and three as low relative risk (Table 3.2).

The Australian Bustard is the only non-listed bird species recorded near the proposed turbine locations that is categorised as high relative risk under the Reid and Baker (2025) framework. This species is large-bodied and relatively less manoeuvrable than most of the smaller passerines recorded near the turbines, and occasional flights could place individuals within or near the lower part of the rotor-swept zone. The species is, however, not known to occur in aggregations in the turbine locality, and the habitat around the proposed turbine locations does not represent a discrete or limiting resource for the species. The potential impact pathway for Australian Bustard is therefore individual collision mortality rather than habitat loss, displacement or a population-level effect.

Most of the remaining bird species recorded near the turbine locations are small to medium-sized passerines or parrots typical of arid-zone shrubland and spinifex habitats (Table 3.2). Although several are assigned a medium relative risk category in the regional risk assessment (Reid and Baker 2025), their local flight activity would be characterised by low-level movements between ground-level shrubs and ground surface foraging areas. Given the lower rotor sweep height of approximately 64 m above ground level, these species would spend little of their routine local activity within the rotor-swept zone. The White-winged Triller is a partial exception among the small passerines recorded near the turbine locations, as its foraging ecology includes hawking for flying insects from perches, in addition to gleaning from foliage and foraging on or near the ground (Higgins and Peter 2006). However, the species is small and manoeuvrable, and there is no evidence that the turbine locality supports elevated numbers of this species.

Budgerigars can occur in large nomadic flocks in arid Australia, particularly in response to rainfall and seeding events[2]. The risk to this species is therefore likely to vary temporally, depending on local resource conditions and regional seasonal conditions. Even so, the project comprises a relatively small number of turbines in a broad, open and very extensive landscape, with no features that would funnel movement or any resource concentration that would result in repeated flock movement through the rotor-swept area for this very common species.

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[2] https://birdlife.org.au/bird-profiles/budgerigar/

Table 3.2: Relative wind farm risk categories (after Reid and Baker (2025)) for avifauna species recorded near the proposed turbine locations.

Species	Record basis near turbines	WA relative risk category	Comment
Australian Bustard *Ardeotis australis*	WIN03A avifauna census	High	Large-bodied ground bird; regional risk category reflects relatively high susceptibility attributes, particularly morphology and life-history considerations, although typical local flight activity is expected to be mostly below the rotor-swept zone.
Budgerigar *Melopsittacus undulatus*	WIN03A avifauna census	Medium	Nomadic parrot that may occur in flocks; potential for occasional flight through the turbine envelope, though typical local movements are expected to be largely below the rotor-swept zone.
Singing Honeyeater *Gavicalis virescens*	WIN03A avifauna census and WIN02A acoustic recorder	Medium	Common honeyeater; local movements are expected to be mostly low-level movements between shrubs and small trees.
Yellow-throated Miner *Manorina flavigula*	WIN03A avifauna census	Medium	Common, widespread honeyeater/miner; local movements are expected to be mostly low-level and below the rotor-swept zone.
Grey-headed Honeyeater *Ptilotula keartlandi*	WIN02A acoustic recorder	Medium	Common arid-zone honeyeater; local activity expected to be mostly below the rotor-swept zone.
Pied Butcherbird *Cracticus nigrogularis*	WIN02A acoustic recorder	Medium	Larger passerine with more direct flight than many smaller species, but expected to occur at low density and mostly below rotor-swept height during local movements.
White-winged Triller *Lalage tricolor*	WIN03A avifauna census	Medium	Aerial and arboreal foraging behaviour gives some potential for higher flight activity, but the species is small and manoeuvrable and no aggregation was recorded near the proposed turbines.
Rufous Whistler *Pachycephala rufiventris*	WIN03A avifauna census	Medium	Common woodland/shrubland passerine; local movements expected to be mostly below the rotor-swept zone.
Crimson Chat *Epthianura tricolor*	WIN03A avifauna census	Low	Small nomadic passerine; typical flight heights expected to be well below the rotor-swept zone.
Willie Wagtail *Rhipidura leucophrys*	WIN03A avifauna census	Low	Common and widespread; typical local foraging and movement activity is expected to occur below the rotor-swept zone.
Zebra Finch *Taeniopygia castanotis*	WIN03A avifauna census	Low	Small flocking finch; typical movements expected to be low-level and below the rotor-swept zone.

Overall, the non-listed avifauna assemblage recorded near the proposed turbine locations does not materially alter the risk assessment presented for significant species. Individual collision mortality is possible, particularly for Australian Bustard and, to a lesser extent, flocking or more aerial species such as Budgerigar and White-winged Triller. However, the assemblage is dominated by common, widespread arid-zone species, the proposed turbine layout is limited in scale, and the lower rotor-swept height is above the expected routine flight height of most species recorded near the turbines. The risk of broader population-level effects on the non-listed avifauna assemblage is therefore assessed as low.

3.5.4 Overall Bat Assemblage

As noted in Section 2.3, five bat species have been recorded within 50 km of the proposed turbine locations during consolidated surveys, all of which are common and widespread in the Pilbara bioregion and none of which are listed as significant under State or Commonwealth legislation. Ultrasonic recorder WIN05BAT, situated approximately 260 m from the nearest proposed turbine, recorded two of these species: Greater Northern Free-tailed Bat *Chaerephon jobensis* and Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris*.

Bats are a relevant group for assessment because international literature indicates that bat mortality at wind farms can be proportionally higher than for many bird groups, and because some species are susceptible to collision or potential barotrauma where their flight activity overlaps with rotor-swept areas (Rydell et al. 2017, Lawson et al. 2020). The recent Australian onshore wind farm ecological risk assessment (Reid and Baker 2025) provides a relative risk framework for bats based on ecological and susceptibility attributes, including flight height, flight behaviour and habitat specialisation. That assessment rated both species recorded from the area of the proposed turbines as medium risk of interaction (Table 3.3). Both species, however, have high flight-height scores in the Reid and Baker (2025) assessment, reflecting their open-space or above-canopy flight behaviour and therefore still have some potential for overlap with turbine rotor-swept areas.

Both species recorded near the proposed turbines are relatively mobile, open-air foraging species (Churchill 2008). This means their collision-risk profile is likely to be somewhat higher than that of low-flying species that forage primarily below canopy height. The proposed lower rotor-swept height of approximately 64 m above ground level will reduce overlap for species that forage predominantly close to the ground or within vegetation, but it may not exclude interaction during commuting or higher-altitude foraging.

Site-specific context remains important in interpreting the regional risk rankings of Reid and Baker (2025). The proposed turbine locations are situated on very extensive sandplain habitat and are not located adjacent to caves, escarpments, permanent water, riparian corridors or other features likely to concentrate bat roosting or foraging activity. The two species recorded at WIN05BAT are also not listed as threatened or migratory and are common and widespread in the Pilbara and more broadly within Australia (Churchill 2008). On this basis, the main plausible impact risk is mortality of occasional individuals rather than the project resulting in displacement from important habitat or a population-level effects.

Table 3.3: Relative wind farm risk categories (after Reid and Baker (2025)) for bat species recorded near the proposed turbine locations.

Species	Record basis near turbines	WA relative risk category	Comment
Greater Northern Free-tailed Bat *Chaerephon jobensis*	WIN05BAT ultrasonic recorder	Medium	Free-tailed bat with open-air foraging and commuting behaviour; potential overlap with rotor-swept height, but not listed and regionally widespread.
Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris*	WIN05BAT ultrasonic recorder	Medium	Open-space aerial forager/commuter; potential overlap with rotor-swept height, but not listed and regionally widespread.

There remains some uncertainty because bat activity can vary seasonally and in response to local rainfall, insect abundance, temperature and wind conditions. The limited near-turbine bat sampling also means that the results should be interpreted as confirming presence rather than fully characterising seasonal activity patterns or flight-height distribution.

Nevertheless, based on the available data, the small number of turbines proposed, the absence of obvious local bat-concentration features and the conservation status of the species recorded, the risk of significant impacts to the local or regional bat assemblage is assessed as low. Individual collision mortality may occur, but broader population-level effects on the bat species recorded near the turbine locations are unlikely.

4.0 Summary and Conclusions

Overall, the risk of significant impacts to bird and bat species from the eleven turbines proposed for the project is expected to be low to negligible.

We arrive at this conclusion after considering that:

- The 86 km distance from the Walyarta (Mandora Marsh) part of the Ramsar site, and the 140 km distance from Eighty Mile Beach itself, to the nearest proposed turbine location exceeds the highest disturbance distance found in the literature by orders of magnitude. Thus, it is considered very unlikely that the project would result in disturbance to birds using the Ramsar site.
- The risk of barrier effects is also expected to be very low as the turbines will be spaced 450 m to 900 m from their nearest neighbours, the project will only require two rows of turbines spanning approximately 3 km in an otherwise extensive landscape setting, and the proposed turbine locations are not known to intersect a major avian migratory flyway or documented bat movement corridor. For bats, this conclusion is necessarily qualified by the limited state of knowledge regarding bat movement pathways in Australia, but the turbine locations are not adjacent to caves, cliffs, rocky escarpments, permanent water, riparian corridors, known congregational roosts or other features likely to concentrate bat activity.
- The proposed location of the turbines is a sandplain landform, which is a lower risk setting relative to other wind farms where higher collision frequencies have been recorded where the edges of ridges and hilltops were present.
- The large turbines proposed are likely to lower collision risk for bird and bat species with low average flight heights that will largely fly below this rotor-swept area. However, the risk may be higher for species that regularly fly at higher altitudes, such as raptors and other soaring birds, and higher-flying bat species.

No significant bat species are known from the DE and the significant bird species considered to be at greatest risk of individual mortality through collision with turbines are Grey Falcon (*Falco hypoleucos*) and Pacific Swift (*Apus pacificus*), which are likely to periodically occur over the project area. These species are likely to fly at altitudes within the rotor-swept area and individuals of which, or close congeners, are known to have been killed by turbine strike at other wind farms. Local population impacts are therefore possible for these species. However, the number of individuals and area of occupancy likely to be affected is expected to be insignificantly small compared to the distributions of the species across Western Australia and Australia as a whole. Hence, the risk of turbine strike fatalities or disturbance/displacement from this project having a significant effect at the broader population level is also very low to negligible.

The broader, non-listed avifauna assemblage recorded near the proposed turbine locations does not materially alter this conclusion. The species recorded near the turbines are mostly common, widespread arid-zone birds that would be expected to undertake most routine local flight activity below the lower rotor-swept height of approximately 64 m above ground level. The Australian Bustard is the only non-listed bird species recorded near the proposed turbine locations that is categorised as high relative risk under the Reid and Baker (2025) framework, reflecting its larger body size and lower manoeuvrability relative to the smaller passerines recorded in the same area. Individual collision mortality for this species is possible, as it is for flocking or more aerial species such as Budgerigar and White-winged Triller. However, there is no evidence that the turbine locality supports aggregations of these species, contains a discrete or limiting habitat resource, or includes landscape features that would funnel repeated movements through the rotor-swept area. The risk of broader population-level effects on the non-listed avifauna assemblage is therefore assessed as low.

Bats in general appear to be at greater risk of mortality from turbine collision than birds, but susceptibility can vary greatly between species. The two bat species recorded near the proposed turbine locations, Greater Northern Free-tailed Bat (*Chaerephon jobensis*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*), are both assessed by Reid and Baker (2025) as medium relative risk species in Western Australia. Both are relatively mobile, open-air foraging species and therefore have some potential to overlap with rotor-swept areas during commuting or higher-altitude foraging. However, neither species is listed as significant under State or Commonwealth legislation, both are common and widespread in the Pilbara and more broadly within Australia, and the proposed turbine locations are not adjacent to caves, escarpments, permanent water, riparian corridors or other features likely to concentrate bat roosting or foraging activity. While there is a small risk of individual mortality and localised effects on bats, it is unlikely that the project would have a significant effect on the local or regional bat assemblage.

The risk of turbine strike for migratory-listed shorebirds transiting the project area is expected to be very low overall, as the numbers passing through the project area are expected to be relatively low, flight heights typically exceed the maximum rotor-swept height, and there is little evidence thus far of high susceptibility to turbine strike for this species group from other locations.

Overall, while individual bird or bat collisions may occur, the proposed turbine layout, small number of turbines, inland sandplain setting, absence of local bird or bat concentration features, and the ecology and conservation status of the species recorded near the turbine locations all indicate that the project is unlikely to result in significant impacts to avifauna or bats at a local, regional or broader population scale.

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