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Annual Shorebird Monitoring Survey for the Mardie Project 2023

Prepared for BCI Minerals Pty Ltd

August 2023

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Version history

Author/s	Reviewer/s	Version	Version number	Date submitted	Submitted to
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Phoenix Environmental Sciences Pty Ltd

2/3 King Edward Road OSBORNE PARK WA 6017

P: 08 6323 5410

E: admin@phoenixenv.com.au

Project code: 1456-MSP-BCI-VERM

EXECUTIVE SUMMARY

BCI Minerals Pty Ltd (Mardie Minerals), a wholly owned subsidiary of BCI Minerals Ltd (BCI), is developing the Mardie Project (the Project). The Project is located 80 km southwest of Karratha in the Pilbara region of Western Australia (WA). The Project is a proposed solar salt operation that will make use of seawater and evaporation to produce a concentrated salt product and other associated products. This will involve the creation of a series of evaporation and crystallisation ponds to produce sodium chloride (NaCl) salt, as well as sulphate of potash. The waste bitterns will be discharged through a diffuser offshore. The Project will include disturbance of up to 9,365 hectares on shore, and up to 40 hectares of marine environment.

In February 2023, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Mardie Minerals to undertake the Annual Shorebird Monitoring 2023 Survey for the Project, as per the long-term migratory shorebird monitoring program (LMSMP). The purpose of the LMSMP is to describe the current management strategy employed by BCI to mitigate the risks of the Project to the richness and abundance of migratory shorebirds and other shorebirds.

The scope of work for the Annual Shorebird Monitoring 2023 Survey was as follows:

- Complete the Annual Shorebird Monitoring field survey prior to commencement of construction activities as per the LMSMP.
- Document the results, incorporating new data and comparing against previously collected Mardie shorebird data, setting baseline values as per the LMSMP.

The monitoring program incorporates both aerial (helicopter) and ground-based bird counts. Aerial surveys were used in the baseline survey as they provide the greatest coverage, get around the limitation caused by tides, and can be used to survey a range of habitat types that are otherwise inaccessible. Ground surveys are an effective way of providing additional data at key sites and can also provide a more accurate count of species that occur in mixed flocks of birds that can be difficult to accurately identify.

Overall the numbers of conservation significant species recorded within the study area appear to be higher than last year. Species recorded this year that were not recorded last year include Pacific Golden Plover, Grey Plover, Sharp-tailed Sandpiper, Sanderling, and Black-tailed Godwit. Red Knot, Great Knot, and Lesser Sand Plover were also recorded in 2023, however were likely present in lower numbers in 2022 and only identified as 'Knot sp.' and 'Sand Plover sp.' The most abundant species recorded in 2023 was Oriental Pratincole, occurring in internationally significant numbers, and in higher numbers than in 2022. Only 2 species recorded last year were not detected during the 2023 surveys, these were the Bridled Tern and White-winged Black Tern.

Several species had lower average counts than last year within the control area but higher average counts within impact areas. Ruddy Turnstone counts were on average lower this year both within the control area and the impact area. As this variation affected both the control and impact areas, it is likely to be regional and not attributable to the Project. It is important to note that this is only the second year that this method of annual monitoring has been undertaken, and it will be another 3 years until statistically valid population trends can be assessed.

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1 INTRODUCTION

BCI Minerals Pty Ltd (Mardie Minerals), a wholly owned subsidiary of BCI Minerals Ltd (BCI), is developing the Mardie Project (the Project). The Project is located 80 km southwest of Karratha in the Pilbara region of Western Australia (WA; Figure 1-1). The study area is located in the Eremaean Botanical Province as defined by EPA (2016b).

The Project is a proposed solar salt operation that will make use of seawater and evaporation to produce a concentrated salt product and other associated products. This will involve the creation of a series of evaporation and crystallisation ponds to produce sodium chloride (NaCl) salt, as well as sulphate of potash. The waste bitterns will be discharged through a diffuser offshore. The Project will include disturbance of up to 9,365 hectares on shore, and up to 40 hectares of marine environment.

In February 2023, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Mardie Minerals to undertake the Annual Shorebird Monitoring 2023 Survey for the Project, as per the LMSMP (Phoenix 2023).

The purpose of the LMSMP is to describe the current management strategy employed by BCI to mitigate the risks of the Project to the richness and abundance of migratory shorebirds and other shorebirds.

The LMSMP has been prepared to meet requirements included in the Minister for Environment's Statement of approval (Ministerial Statement 1175) condition 8. This Plan has also been prepared to meet requirements under condition 1 of the *Environment Protection and Biodiversity Act 1999* (EPBC Act) approval 2018/8236 issued in 2018.

The purpose of the survey is to conduct the Annual Shorebird Monitoring survey for 2023 and:

1. Monitor and track any changes in the migratory shorebird population at the impact sites (inside and adjacent to the development footprint), as well as at both the control and regional sites.
2. Determine whether the trends in number of migratory species detected each year at the impact sites are consistent with those at the control and regional sites.
3. Record any threats to shorebirds in impact and control areas (e.g. feral or native predators, human influences).
4. In the event that there is:
    a. a decline in numbers of any migratory bird species, or
    b. an increase in threats to migratory birds, such as presence of predators of human influences

    then additional works will be actioned to identify the threatening process and reverse or mitigate the declines or threatening processes. This will require an adaptive management approach, as the nature of the disturbance will need to be identified before a management plan can be implemented.

Results from the survey provide baseline values for future shorebird monitoring, which will continue for a minimum of 5 years to capture shorebird assemblage during construction and post construction phases of the Project.

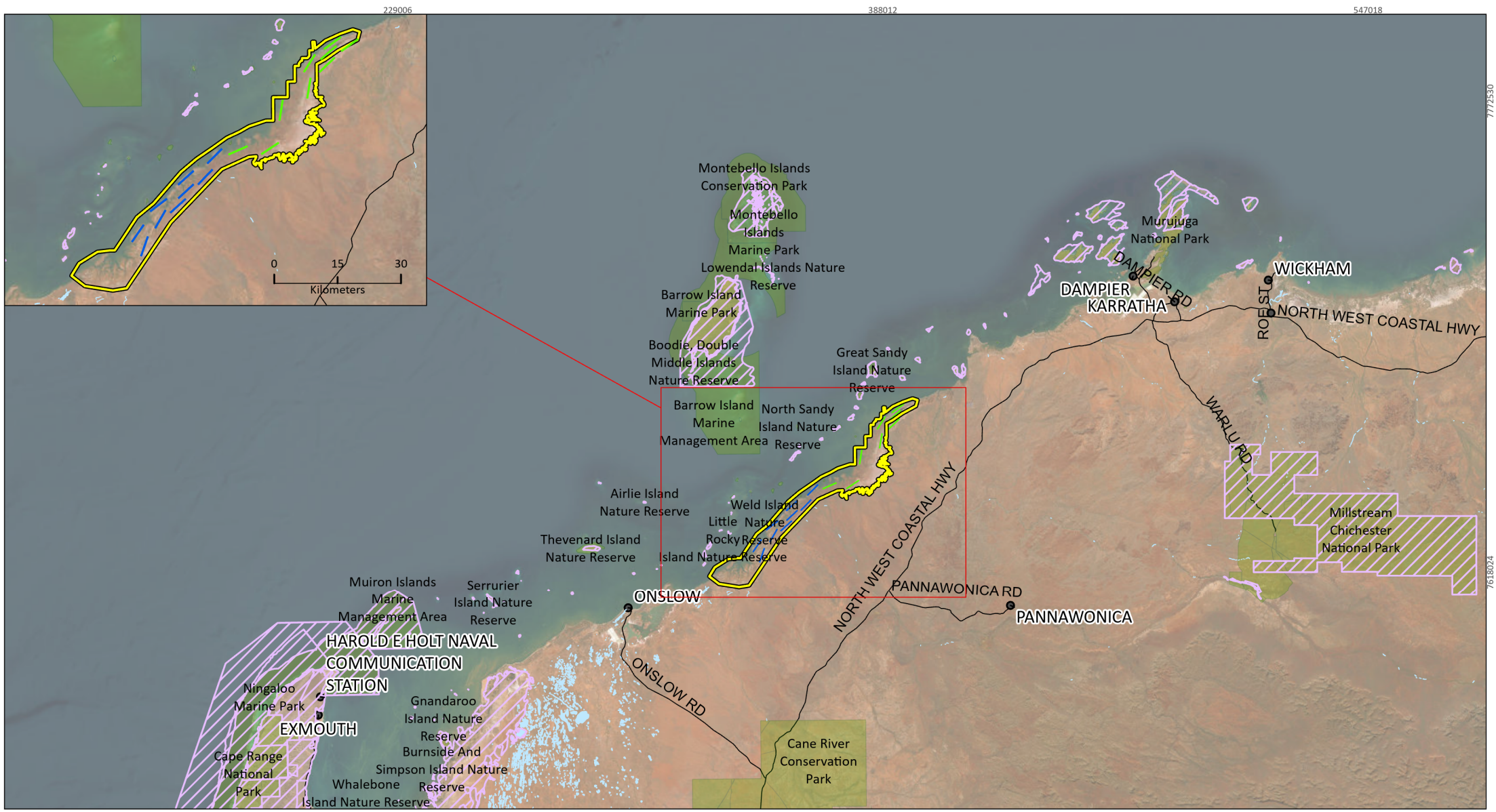
1.1 SCOPE OF WORK

The scope of work for the Annual Shorebird Monitoring 2023 Survey was as follows:

- Complete the second Annual Shorebird Monitoring field survey prior to commence of construction activities as per the LMSMP.
- Document the results, incorporating new data and comparing against historic Mardie shorebird data, setting baseline values as per the LMSMP.

1.2 STUDY AREA

The study area comprises 18 transects which are systematically counted by helicopter across the entire Migratory Shorebird Study Area (MSSA) (Figure 1-1).



BCI minerals
Mardie Salt Project

Project No	1456
Date	15/03/2023
Drawn by	BK
Map author	PW

0 25 50
Kilometers

1:1,681,400 (at A4) GDA 1994 MGA Zone 50

P:\Data\Projects\MardieSalt\Project\1456-MSP-BCI-VERM\2023\GIS\Mapping\MapDocument\Figures\Figures_1456.aprx

- Study area
- Environmentally Sensitive Areas
- Lakes
- DBCA managed land
- Roads

Transects

- Control
- Impact

Figure 1-1

Project location and study area

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2 LEGISLATIVE CONTEXT

The protection of fauna in WA is principally governed by 3 acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

The BC Act came into full effect on 1 January 2019 and replaced the functions of the *Wildlife Conservation Act 1950* (WC Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of Agriculture, Water and the Environment (DAWE). The EPBC Act provides for the listing of Threatened fauna as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process.

Conservation categories applicable to Threatened fauna species under the EPBC Act are as follows:

- Extinct (EX)[1] – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)[1] – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

The EPBC Act is also the enabling legislation for protection of migratory species as matters of NES under several international agreements:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

2.2 STATE

2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened fauna species (Government of Western Australia 2018a, b)[2] in the following categories:

[1] Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

[2] The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act.

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future[3]
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future[3]
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium-term future[3].

Species may also be listed as specially protected (SP) under the BC Act in one or more of the following categories:

- species of special conservation interest (conservation dependent fauna, CD) – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- migratory species (Mig.), including birds subject to international agreement
- species otherwise in need of special protection (OS).

The Department of Biodiversity, Conservation and Attractions (DBCA) administers the BC Act and also maintains a non-statutory list of Priority fauna. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority fauna lists are assigned to one of 4 Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species or a Threatened Ecological Community (TEC) and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Other significant fauna

Under the EPA's environmental factor guidelines, fauna may be considered significant for a range of reasons other than listing as a Threatened or Priority species.

In addition to listing as Threatened or Priority, EPA (2016a) identifies the following attributes that constitute significant fauna:

- species with restricted distribution
- species subject to a degree of historical impact from threatening processes
- providing an important function required to maintain the ecological integrity of a significant ecosystem.

2.2.4 Environmentally sensitive areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be an Environmentally Sensitive Area (ESA). ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

ESAs are areas where the vegetation has high conservation value. Several types of areas are declared ESAs including:

[3] As determined in accordance with criteria set out in the ministerial guidelines.

- the area covered by vegetation within 50 metres (m) of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located
- the area covered by a TEC
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland
- Bush Forever sites.

3 METHODS

3.1 SURVEY TIMING

Field survey dates are provided in Table 3-1.

Table 3-1 Survey dates

Survey type	Season	Dates
Shorebird Monitoring, 2023	Summer	6 - 11 February, 2023

3.1.1 Survey personnel

The personnel involved in the surveys are listed in (Table 3-2).

Table 3-2 Survey personnel

Name	Qualifications	Role/s
Floyd Holmes	PhD, BSc (Hons)	Field work, reporting
Patrick Williams	MSc (Research), BSc	Field work, reporting

3.1.2 Weather and tides

The climate of the Roebourne subregion is described as arid (semi-desert) tropical with highly variable rainfall primarily in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually (Kendrick & Stanley 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Mardie (no. 005008), Latitude: 20.13°S Longitude 116.21°E), located 18 km east of the study area.

Mardie records the highest mean maximum monthly temperature (39.3°C) in February (lowest in June, 20.1°C) and the lowest minimum mean monthly temperature (7.0°C) in August (highest in February, 26.8°C) (BoM 2023; Figure 3-1). Median annual rainfall is 239.4 mm with February and June recording the highest monthly median (26.5 and 18.2 mm respectively; Figure 3-1). Mardie experienced minimal rainfall over the months preceding the field survey, with less than 30 mm between January 2023 and July 2022, however higher total monthly rainfall during August and September than the median long-term average. February had higher than average rainfall with most occurring after the field survey was completed.

Mean daily max temperatures at Mardie preceding the surveys were cooler than the long-term averages with January 2023 – July 2024 averaging close to 10°C cooler than the long-term average (Figure 3-1). Mean daily min temperatures also fell below the long-term average for several months leading up to the field survey.

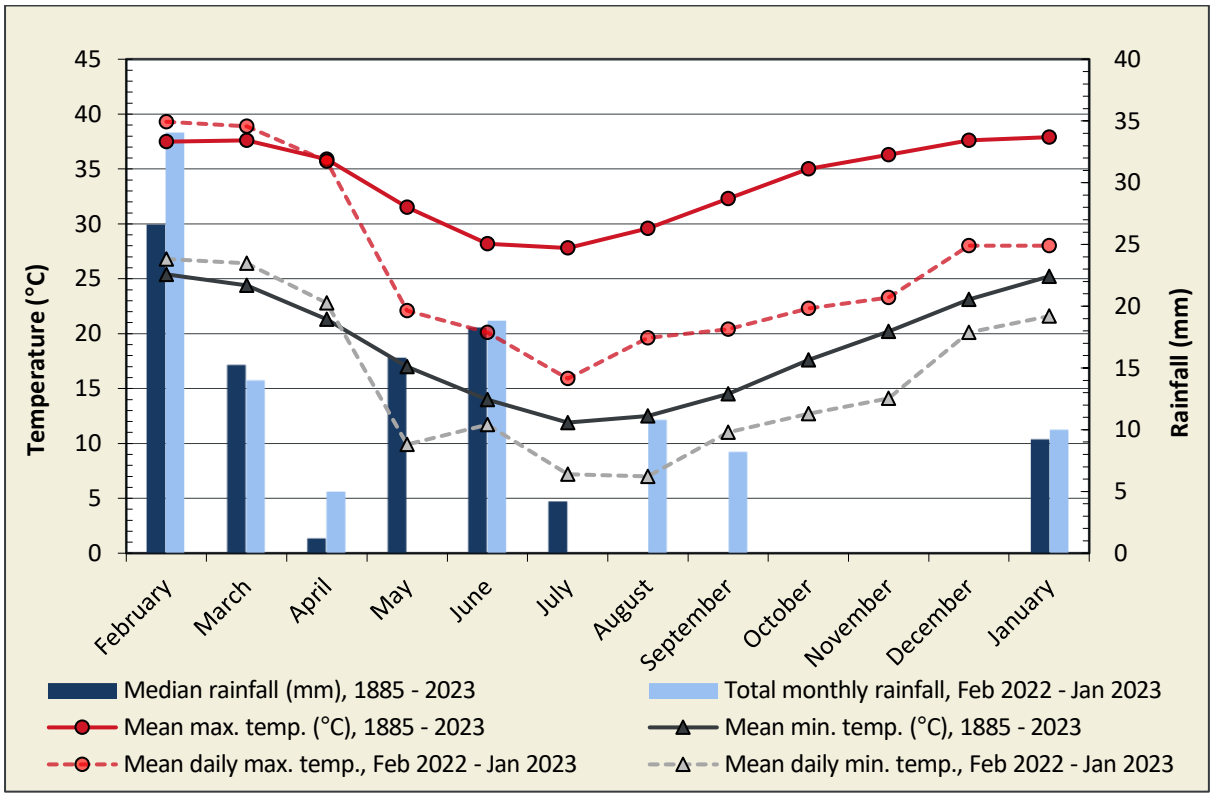


Figure 3-1 **Annual climate and weather data for Mardie (no. 005008) and mean monthly data for the 12 months preceding the survey (BoM 2023)**

The tide times and heights from the 2023 field season are displayed below (Table 3-3). Only the heights and times of surveyed tide periods are included.

Table 3-3 Tide times and heights from Onslow (Beadon Creek) for the survey period in 2023

Date	Time	Tide status	Height (m)
6th Feb	1750	High	1.30
7th Feb	0631	Low	0.68
	1253	High	2.46
8th Feb	0655	Low	0.68
	1319	High	2.54
9th Feb	0717	Low	0.70
	1345	High	2.60
10th Feb	0737	Low	0.76
	1411	High	2.63

3.2 AVIFAUNA SURVEYS

3.2.1 Overview

The methods outlined below were developed with consideration for the following factors:

- Tidal variation – birds use a range of different habitats at different times of the day in accordance with the tides.
- Seasonality – number of birds present varies dramatically throughout the year.
- Annual variability – number of birds varies between years depending on a wide range of factors at each of the birds' annual migration stages.
- Remote/difficult to access areas – birds occur in areas with poor access and use a range of habitats where they can be difficult to observe.
- Detectability – many migratory species can be difficult to correctly identify from a distance and can be difficult to detect in certain habitats.

The goal of the methods outlined below are to provide a robust, spatially explicit dataset that will show whether a change in the migratory shorebird population occurs inside the impact area and identify whether that change is attributable to the developments associated with the Project. Consideration has been made to assess changes in the numbers of migratory shorebird species at the local scale (comparing trends involving the impact area and control area), the regional scale (trends involving the control area and regional area) and national scale (trends involved in national count data collated by BirdLife Australia (BirdData). If a decline measured at the impact area is greater than the trend measured at the control area, or regional area, then it will be considered a decline attributable to the Project and the threatening process will need to be identified and managed. If declines measured at the impact area are less than those measured at the control area or regional area, then they will be considered a reflection of changes in the migratory bird species populations caused by factors other than the Project.

The monitoring program incorporates both aerial (helicopter) and ground-based bird counts (Table 3-4). Aerial surveys were used in the baseline survey as they provide the greatest coverage and can be used to survey a range of habitat types that are otherwise inaccessible. However, due to the difficulties of identifying species during aerial surveys, some birds can only be accurately identified to genus. Ground surveys are an effective way of providing additional data at key sites and can also provide a more accurate count of species that occur in mixed flocks of birds that can be difficult to accurately identify to species level.

By using this combination of survey methods and surveying at various spatial scales over several years, it will be possible to assess whether the diversity and abundance of birds at the impact area is increasing, decreasing, or static and whether that change is attributable to the Project. In the event that a change is detected, the annual habitat monitoring assessments (BCI and Phoenix 2021) and finer scale location data will be useful in identifying the cause(s). These methods were developed using the baseline data (Phoenix 2020), and the *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DoEE 2017).

3.2.2 Aerial surveys

The baseline surveys for the proposal that Phoenix completed between 2017-2020 used aerial survey methods. Aerial surveys, using a helicopter, are a useful method for surveying migratory shorebirds in large remote regions where access is a limiting factor (DoEE 2017). Aerial surveys provide a cost-effective and efficient method for sampling large numbers of birds quickly (Kingsford *et al.* 2020). The survey method used for the monitoring program will be a modified version of the method used during the baseline survey. Adjustments were made to maximise the repeatability of the survey between years, which will aid in the statistical analysis of changes in migratory shorebird occurrence at the impact area and control area.

A series of 18 transects across the MSSA was selected to be sampled systematically each year. The transects are made up of 1x10 grids that are 500 m by 500 m squares. Sites were placed so that 9 are located in the impact area and 9 are in the control area. The transects are aligned along paths flown during the baseline surveys and thus target the range of potential shorebird habitats, taking into account the habitat-tidal sequence, from ocean mud/sand flats, through beaches, mangrove stands, samphire wetlands and finally bare mudflats that are barely inundated at the limit of the tide.

Each transect is surveyed systematically by flying slowly at a low height through the middle of the grid, and recording all birds observed. A team of 2 people is used to complete these surveys with at least one member being an ornithologist with experience conducting aerial surveys of shorebirds. These surveys are repeated at both high and low tide over 4 consecutive days in late January or early February when shorebird numbers are at their highest.

3.2.2.1 Statistical analysis

Following the collection of aerial survey data, average counts by species per detection were compared to the previous year's data to determine whether there are any changes to the population of shorebirds present within the study area.

Average counts were also determined per species in the 5 dominant habitat types present within the transects surveyed. The total area of each habitat type present within a given cell was determined using the habitat mapping from (Preston Consulting 2022). If one habitat type covered 50% or more of a given cell, then that habitat type was determined to be the dominant habitat. All cells with a dominant habitat type were then grouped into their habitats and then the average counts per species per habitat type were determined.

The number of detections of each species was also assessed in this year's report. Each time a species is recorded within a cell at one time is considered one detection. For example, if one species was present in all 180 cells in each of the 8 flights then it would have 1,440 detections. The number of individuals per detection does not influence this number. This assessment was included as it gives a good indication for how prevalent one species is throughout the study area. This can also be refined to determine how common a species is in a specific habitat type.

3.2.3 Ground surveys

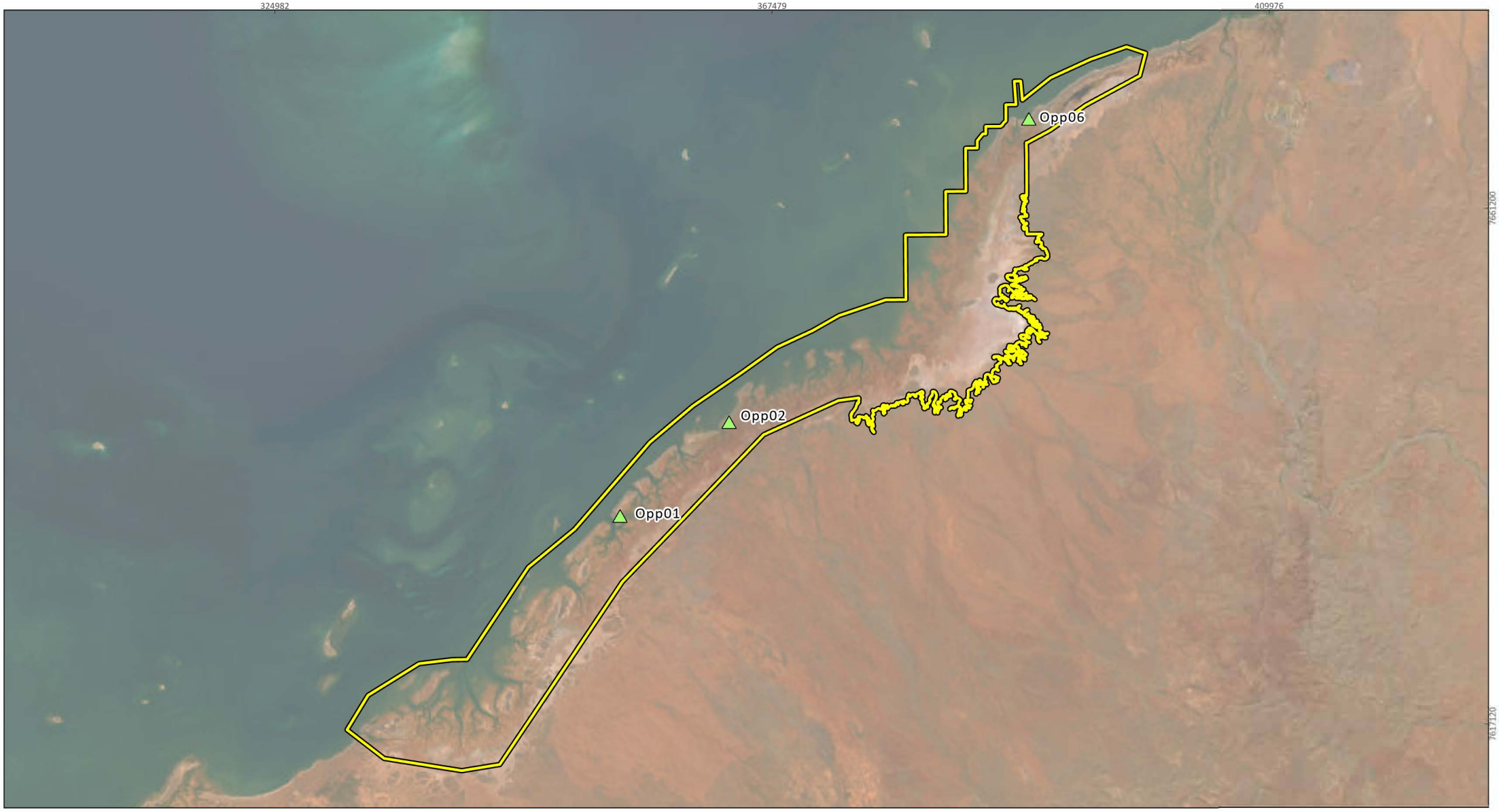
The purpose of the ground surveys at the ponds is to provide information on any changes to habitat use by migratory birds in response to the development. Numerous studies have shown that salt works such as this one along the north-western and north-eastern coasts of Australia can provide suitable foraging habitat for migratory shorebirds (e.g., Bennelongia 2011; Bertzeletos *et al.* 2012; Clemens *et al.* 2009; Estrella *et al.* 2016; Houston *et al.* 2012; Storr 1984). As such, it is likely that the first few stages of the evaporation ponds will see an increase in usage once the development has been completed. This may result in an apparent decline in some species in the surrounding area, as they move into the newly created foraging habitat. To account for this, the birds will be monitored in the areas expected to see the greatest increase in numbers.

Once the infrastructure has been put into place to allow driving a vehicle around the perimeter of the first 2 evaporation ponds, systematic counts will be carried out by the same team performing the aerial surveys, on days immediately preceding or following the aerial surveys. This survey will be done using a car to move around the site with a spotting scope to locate and identify birds. This will allow more detailed assessments for similar species (e.g. Knots, Sand Plovers) that are difficult to distinguish during the aerial surveys. These counts will only be done once at high tide and once at low tide as tidal variation in the surrounding area will likely influence the birds and the purpose of the ground-based surveys is primarily to detect species that are difficult to identify during the aerial surveys. While completing these surveys, any evidence of predation pressure from cats and/or dogs or disturbances caused by humans will also be recorded. Due to access limitations this year the systematic count of the evaporative ponds was only undertaken once by helicopter during high tide. These counts will continue to be done aerially until roads are developed to drive around the ponds.

Additional ground-based surveys may also be completed around Karratha, approximately 100 km east of the Development Envelope (DE), to provide regional data to be used to calibrate for annual variation in migratory shorebird numbers.

Table 3-4 Summary of long-term monitoring program coverage

Method	Location	No. of replicates	Total area of coverage (ha)
Aerial Survey (Figure 1-1)	Impact Area	9	2,250
	Control Area	9	2,250
	Subtotal	**18**	**4,500**
Ground Survey (Figure 3-2)	Evaporation ponds 1 and 2	1	2,953
	Total	**19**	



BCI minerals
Mardie Salt Project

Project No	1456
Date	29/06/2023
Drawn by	BK
Map author	PW

0 10 20
Kilometers

1:439,300 (at A4) GDA 1994 MGA Zone 50

Study area
Ground based point count locations

Figure 3-2
Ground survey sites

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4 RESULTS

4.1 AERIAL SURVEY RESULTS

4.1.1 Overall annual comparison

The number of detections per species overall are presented in Table 4-1 as well as the impact and control transects, and the mean counts per detection across all transects. Figure 4-1 summarises records of significant species (as average per detection) for 2023 and 2022. Figure 4-1 excludes Oriental Pratincole which was by far the most abundant in both 2023 and 2022, averaging 3258 and 2931 individuals respectively.

Two species recorded in 2022 were not detected during the 2023 surveys: Bridled Tern and White-winged Black Tern. Six of the species recorded in both years (Bar-tailed Godwit, Roseate Tern, Red-necked Stint, Little Tern, Ruddy Turnstone, Osprey) had higher average counts in 2022. Several new conservation significant species were also recorded in 2023 that were not recorded in 2022: Pacific Golden Plover, Grey Plover, Sharp-tailed Sandpiper, Sanderling, Red Knot, Great Knot, Lesser Sand Plover, and Black-tailed Godwit. For the remainder of significant species, higher numbers were recorded this year than in 2022 (Knot sp., Common Tern, Grey-tailed Tattler, Terek Sandpiper, Gull-billed Tern, Sand Plover sp., Caspian Tern, Whimbrel, Common Greenshank, Common Sandpiper, Eastern Curlew, Greater Sand Plover, Crested Tern).

Table 4-1 Number of detections, and mean count per species in impact and control transects

Species	Detections		Mean count per detection		Impact		Control	
	2022	2023	2022	2023	2022	2023	2022	2023
Australian Kestrel *Falco cenchroides*		11		1		9		2
Australian Pelican *Pelecanus conspicillatus*	2	6	8	3	2	5		1
Australian Pipit *Anthus australis*		5		1		3		2
Australian Pratincole *Stiltia isabella*		1		3				1
Australian White Ibis *Threskiornis moluccus*	1		1		1			
Bar-tailed Godwit *Limosa lapponica* (Mig.)	20	39	23	10	3	11	17	28
Beach Stone-curlew *Esacus magnirostris*	3	11	1	2	3	7		4
Black-faced Cuckoo-shrike *Coracina novaehollandiae*		1		1		1		
Black-faced Woodswallow *Artamus cinereus*		2		1		1		1
Black-fronted Dotterel *Elseyornis melanops*		4		2				4
Black-shouldered Kite *Elanus caeruleus*		2		1		2		
Black-tailed Godwit *Limosa limosa* (Mig.)		2		1		1		1
Black-winged Stilt *Himantopus himantopus*		1		1		1		
Brahminy Kite *Haliastur indus*	5	1	1	1	1		4	1
Bridled Tern *Onychoprion anaethetus* (Mig.)	1		40				1	
Brown Quail *Coturnix ypsilophora*		1		2				1
Brown Songlark *Megalurus cruralis*		1		1		1		
Budgerigar *Melopsittacus undulatus*		3		35		1		2
Caspian Tern *Sterna caspia* (Mig.)	27	67	3	5	15	46	12	21
Cat *Felis catus*		5		1		3		2
Common Greenshank *Tringa nebularia* (Mig.)	54	73	2	4	19	27	35	46
Common Sandpiper *Actitis hypoleucos* (Mig.)	50	179	1	2	19	69	31	110
Common Tern *Sterna hirundo* (Mig.)	2	114	7	15		74	2	40
Crested Tern *Sterna bergii* (Mig.)	14	20	6	4	11	14	3	6

Species	Detections		Mean count per detection		Impact		Control	
	2022	2023	2022	2023	2022	2023	2022	2023
Eastern Curlew *Numenius madagascariensis* (CR/Mig.)	38	38	1	2	9	8	29	30
Eastern Reef Egret *Ardea sacra*	19	6	1	1	11	1	8	5
Great Knot *Calidris tenuirostris* (CR/Mig.)		13		2		5		8
Greater Sand Plover *Charadrius leschenaultii* (VU/Mig.)	3	18	1	8		13	3	5
Grey Plover *Pluvialis squatarola* (Mig.)		25		7		12		13
Grey Teal *Anas gracilis*	1		2				1	
Grey-tailed Tattler *Tringa brevipes* (P4/Mig.)	217	215	6	9	94	84	123	131
Gull-billed Tern *Gelochelidon nilotica* (Mig.)	44	9	4	13	16	9	28	
Knot sp. *Calidris* sp. (CR/EN/Mig.)	6	34	7	13	1	12	5	22
Lesser Sand Plover *Charadrius mongolus* (EN/Mig.)		2		2				2
Little Buttonquail *Turnix velox*	2		3				2	
Little Egret *Ardea garzetta*	11	21	2	3	5	13	6	8
Little Tern *Sternula albifrons* (Mig.)	9	39	13	9	2	20	7	19
Little Woodswallow *Artamus minor*		1		1				1
Oriental Pratincole *Glareola maldivarum* (Mig.)	10	118	2931	3258	7	55	3	63
Osprey *Pandion cristatus* (Mig.)	6	10	1	1	2	5	4	5
Pacific Golden Plover *Pluvialis fulva* (Mig.)		4		7		1		3
Pied Oystercatcher *Haematopus longirostris*	21	24	4	17	20	21	1	3
Red Fox *Vulpes vulpes*	1		1				1	
Red Knot *Calidris canutus* (EN/Mig.)		2		2				2
Red-capped Plover *Charadrius ruficapillus*	43	35	4	10	11	11	32	24
Red-necked Stint *Calidris ruficollis* (Mig.)	11	47	15	10	3	27	8	20
Roseate Tern *Sterna dougallii* (Mig.)	2	5	23	13		3	2	2
Ruddy Turnstone *Arenaria interpres* (Mig.)	77	11	5	2	42	4	35	7
Sacred Kingfisher *Todiramphus sanctus*	1	7	1	1	1	2		5
Sand Plover sp. *Charadrius* sp. (EN/VU/Mig.)	112	299	3	15	38	133	74	166

Species	Detections		Mean count per detection		Impact		Control	
	2022	2023	2022	2023	2022	2023	2022	2023
Sanderling *Calidris alba* (Mig.)		7		5		5		2
Sharp-tailed Sandpiper *Calidris acuminata* (Mig.)		36		7		20		16
Silver Gull *Larus novaehollandiae*	82	187	3	5	31	86	51	101
Singing Honeyeater *Lichenostomus virescens*		4		1				4
Sooty Oystercatcher *Haematopus fuliginosus*	15	20	3	3	13	14	2	6
Striated Heron *Butorides striata*	10	13	1	1	3	4	7	9
Swamp Harrier *Circus approximans*		1		1		1		
Terek Sandpiper *Xenus cinereus* (Mig.)	6	25	4	5	3	13	3	12
Tree Martin *Hirundo nigricans*		1		1		1		
Wedge-tailed Eagle *Aquila audax*		1		1		1		
Welcome Swallow *Hirundo neoxena*		1		1				1
Whimbrel *Numenius phaeopus* (Mig.)	137	200	2	3	49	73	88	127
Whiskered Tern *Sterna hybrida*	5	7	5	28		4	5	3
White-bellied Sea-Eagle *Haliaeetus leucogaster*	3	5	1	1		1	3	4
White-breasted Woodswallow *Artamus leucorynchus*		14		2		4		10
White-faced Heron *Ardea novaehollandiae*	7	14	1	1	5	5	2	9
White-winged Black Tern *Chlidonias leucopterus* (Mig.)	4		8		4			

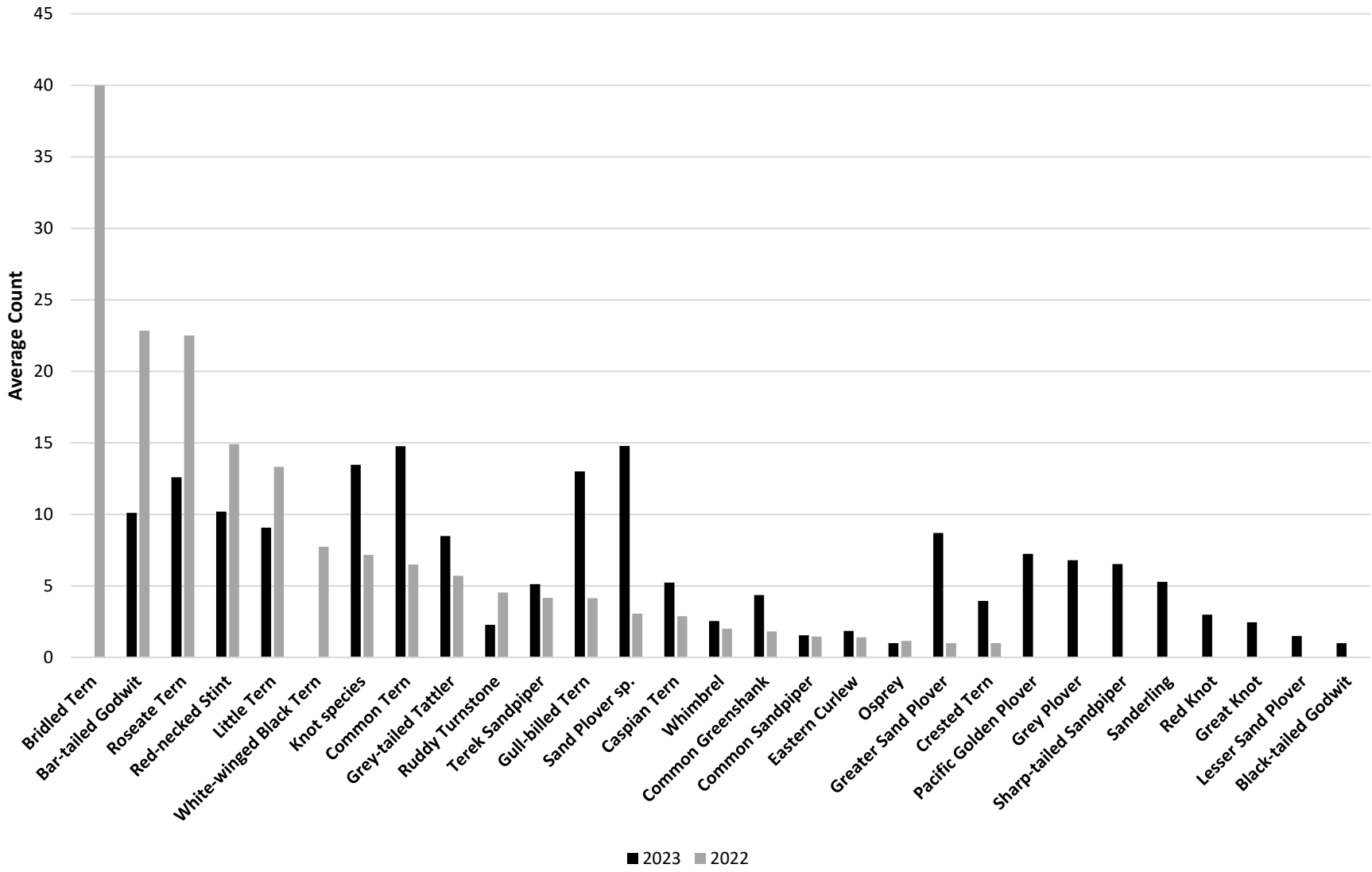

Figure 4-1 Average counts of conservation significant species between 2022 and 2023

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4.1.2 Annual comparison between control and impact areas

Conservation significant species recorded within the impact areas in 2023 occurred in higher average numbers than in 2022, except for 2 species (Ruddy Turnstone and Osprey) (Figure 4-2; Table 4-1). Several new conservation significant species were also recorded within the impact area that were not present in 2022, including Common Tern, Roseate Tern, Grey Plover, Sanderling, and Black-tailed Godwit. All species that were recorded last year in the impact area were recorded again this year.

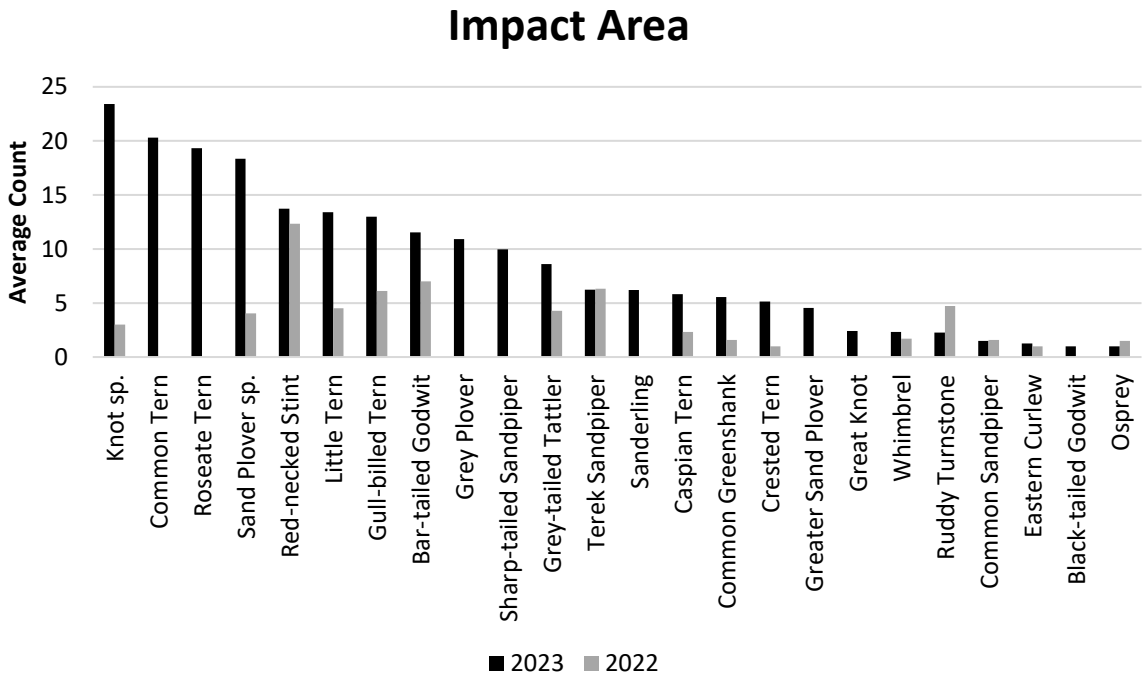

Figure 4-2 Average counts of significant species within the impact area

Conservation significant species recorded within the control areas in 2023 occurred in higher average numbers than in 2022, except for Roseate Tern, Gull-billed Tern, Bar-tailed Godwit, Grey Plover, Greater Sand Plover, and Great Knot (Figure 4-3; Table 4-1). Several new conservation significant species were also recorded within the control area that were not present in 2022, including Sanderling, Caspian Tern, Crested Tern, Whimbrel, Ruddy Turnstone, Black-tailed Godwit, Osprey, and Pacific Golden Plover. There were also increased averages of Knot sp., and Common Tern. All species that were recorded last year in the impact area were recorded again this year.

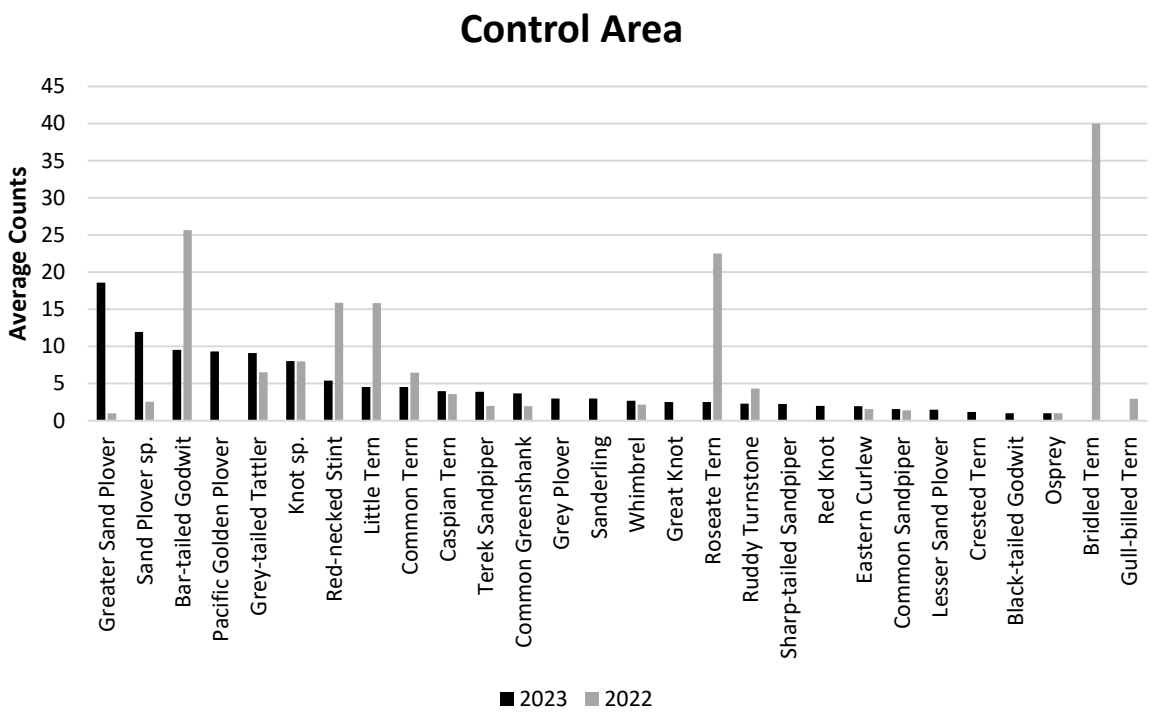

Figure 4-3 Average counts of significant species within the control area

4.1.3 Fauna habitats

Table 4-2 shows the average count of shorebird and other conservation significant species across each dominant habitat types in 2023, however some caution should be applied as most habitats had less than 30 replicates (cells) except for the mudflats / salt flats habitat type (56). The top 5 species with the highest average counts in the mangroves were Pied Oystercatcher, Common Greenshank, Silver Gull, Common Tern, and Sand Plover sp. (Figure 4-4). Despite having the highest mean count, Pied Oystercatcher was only detected on 2 occasions in the mangroves. Whimbrel, Sand Plover sp., and Grey-tailed Tattler were the most frequently detected species in the mangroves, with between 11 and 8 detections of each species.

Table 4-2 Shorebird and significant species' average counts across the dominant habitats

Species	Mangal community (5 cells)		Mudflat or salt flat (56 cells)		Spinifex grassland (10 cells)		Tidal channel and ocean (24 cells)		Tidal samphire mudflat (26 cells)	
	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count
Australian Pratincole *Stiltia isabella*	0	N/A	0	N/A	1	3	0	N/A	0	N/A
Bar-tailed Godwit *Limosa lapponica* (Mig.)	1	9	0	N/A	1	4	0	N/A	8	16
Beach Stone-curlew *Esacus magnirostris*	0	N/A	0	N/A	2	1	0	N/A	0	N/A
Black-fronted Dotterel *Elseyornis melanops*	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Black-tailed Godwit *Limosa limosa* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Bridled Tern *Onychoprion anaethetus* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Caspian Tern *Sterna caspia* (Mig.)	4	10	0	N/A	0	N/A	0	N/A	12	5
Common Greenshank *Tringa nebularia* (Mig.)	5	16	0	N/A	0	N/A	0	N/A	9	2
Common Sandpiper *Actitis hypoleucos* (Mig.)	3	1	0	N/A	0	N/A	0	N/A	25	1
Common Tern *Sterna hirundo* (Mig.)	5	11	0	N/A	0	N/A	0	N/A	19	62
Crested Tern *Sterna bergii* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	9	5
Eastern Curlew *Numenius madagascariensis* (CR/Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	10	3
Great Knot *Calidris tenuirostris* (CR/Mig.)	1	2	0	N/A	0	N/A	0	N/A	5	2
Greater Sand Plover *Charadrius leschenaultii* (VU/Mig.)	1	2	0	N/A	0	N/A	0	N/A	2	6
Grey Plover *Pluvialis squatarola* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	7	4
Grey-tailed Tattler *Tringa brevipes* (P4/Mig.)	8	5	0	N/A	0	N/A	0	N/A	42	6

Species	Mangal community (5 cells)		Mudflat or salt flat (56 cells)		Spinifex grassland (10 cells)		Tidal channel and ocean (24 cells)		Tidal samphire mudflat (26 cells)	
	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count
Gull-billed Tern *Gelochelidon nilotica* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	3	34
Knot sp. *Calidris* sp. (CR/EN/Mig.)	3	5	0	N/A	0	N/A	0	N/A	6	30
Lesser Sand Plover *Charadrius mongolus* (EN/Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Little Tern *Sternula albifrons* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	9	24
Oriental Pratincole *Glareola maldivarum* (Mig.)	3	5	0	N/A	0	N/A	0	N/A	31	5641
Osprey *Pandion cristatus* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	2	1
Pacific Golden Plover *Pluvialis fulva* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	2	2
Pied Oystercatcher *Haematopus longirostris*	2	58	0	N/A	0	N/A	0	N/A	0	N/A
Red Knot *Calidris canutus* (EN/Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Red-capped Plover *Charadrius ruficapillus*	0	N/A	0	N/A	0	N/A	0	N/A	7	16
Red-necked Stint *Calidris ruficollis* (Mig.)	1	4	0	N/A	0	N/A	0	N/A	4	7
Roseate Tern *Sterna dougallii* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	2	17
Ruddy Turnstone *Arenaria interpres* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Sand Plover sp. *Charadrius* sp. (EN/VU/Mig.)	9	11	0	N/A	0	N/A	0	N/A	40	18
Sanderling *Calidris alba* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	2	10
Sharp-tailed Sandpiper *Calidris acuminata* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	5	9
Silver Gull *Larus novaehollandiae*	7	11	0	N/A	0	N/A	0	N/A	23	8
Sooty Oystercatcher	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A

Species	Mangal community (5 cells)		Mudflat or salt flat (56 cells)		Spinifex grassland (10 cells)		Tidal channel and ocean (24 cells)		Tidal samphire mudflat (26 cells)	
	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count	No. detection	Mean count
Haematopus fuliginosus										
Terek Sandpiper *Xenus cinereus* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	3	9
Whimbrel *Numenius phaeopus* (Mig.)	11	2	0	N/A	0	N/A	0	N/A	42	2
Whiskered Tern *Sterna hybrida*	0	N/A	0	N/A	0	N/A	0	N/A	1	2
White-winged Black Tern *Chlidonias leucopterus* (Mig.)	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A

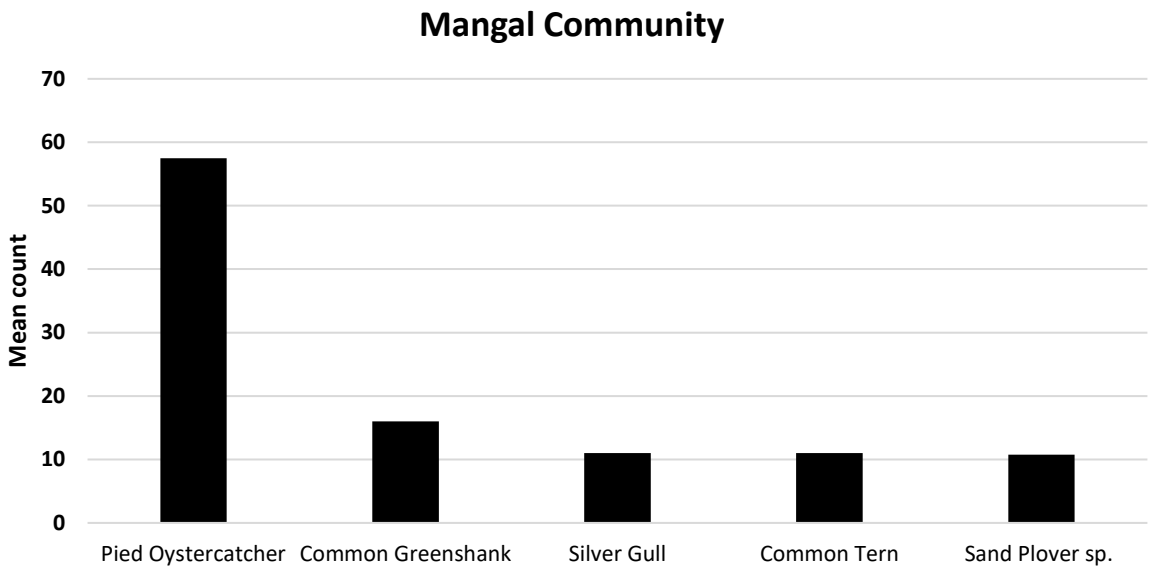

Figure 4-4 Most common species' average counts in mangal community habitats in 2023

Oriental Pratincole had the highest average count in the mudflats / salt flats, averaging 2,270 individuals per detection. Sand Plover sp., Grey-tailed Tattler, Red-necked Stint, and Grey Plover had the next highest average counts in the mudflats / salt flats (Figure 4-5; Table 4-2). Despite these species having the highest average counts in the habitat, Sand Plover sp., Oriental Pratincole, Silver Gull, Common Tern, and Caspian Tern were the most frequently detected species within the mudflats / salt flats (47-15 detections).

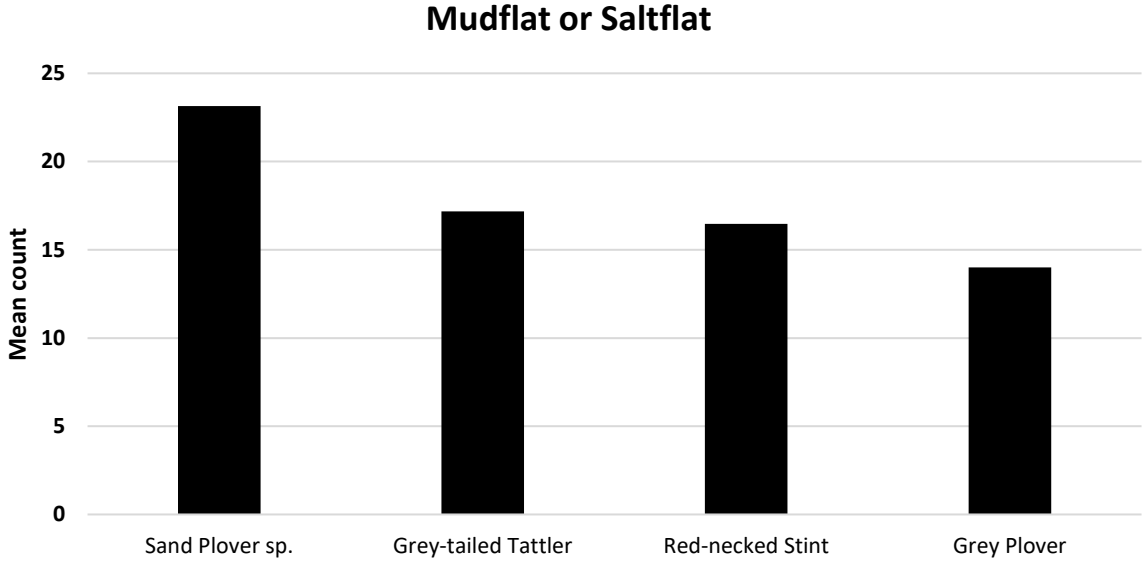

Figure 4-5 Most common species' average counts in mudflat or sandflat habitats in 2023

The top 5 species with the highest average counts in the tidal channel and ocean were Pied Oystercatcher, Sand Plover sp., Greater Sand Plover, Sharp-tailed Sandpiper, and Knot sp. (Figure 4-6; Table 4-2). Overall Pied Oystercatcher had the highest mean count but had the second highest number of detections, 16 and 18 respectively, in the mudflats / salt flats habitat type. Sand Plover sp. had the highest number of detections (88).

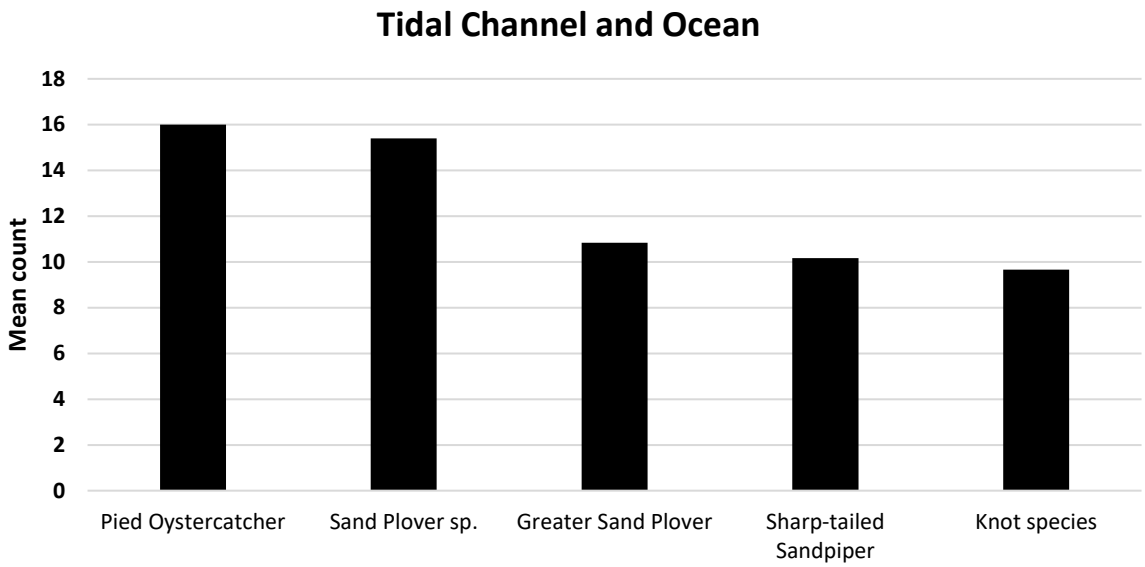

Figure 4-6 Most common species' average counts in tidal channel and ocean habitats in 2023

Oriental Pratincole had the highest average count in the spinifex grasslands, averaging 3,365 individuals per detection. The next 4 species with the highest average counts in the spinifex grassland habitat were Greater Sand Plover, Grey-tailed Tattler, Sand Plover sp., and Knot sp. (Figure 4-7; Table 4-2). Overall Greater Sand Plover had the second highest average count, although only detected on one occasion in the habitat. Most species were detected less than 3 times, but Sand Plover sp., Whimbrel, and Oriental Pratincole were detected at least 9 times.

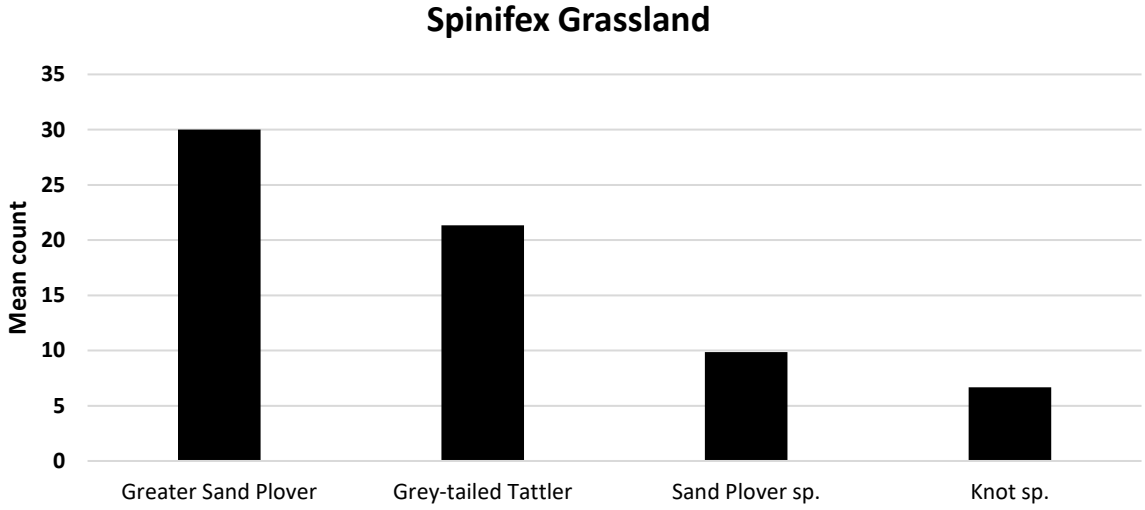

Figure 4-7 Most common species' average counts in spinifex grassland habitats from 2023

Oriental Pratincole had the highest average count in the tidal samphire mudflats, averaging 5,641 individuals per detection. The next 4 species with the highest average counts in the tidal samphire mudflats habitat were Common Tern, Gull-billed Tern, Knot sp., and Little Tern (Figure 4-8; Table 4-2). However, despite these species recording the highest average count, some species such as the Whimbrel and Grey-Tailed Tattler and Sandpiper Plover sp. had a much higher number of detections (40-42 times).

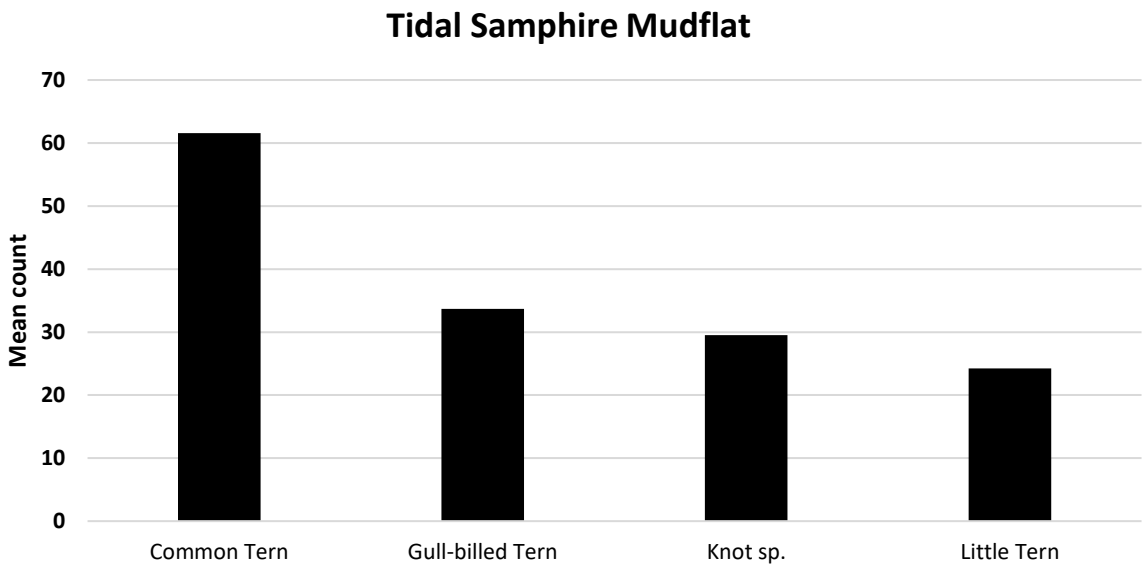

Figure 4-8 Most common species' average counts in tidal samphire mudflat habitats in 2023

4.2 GROUND SURVEY RESULTS

4.2.1 Ponds 1 and 2

Table 4-3 displays the point count data for ponds 1 and 2 from the 2023 field season. Two conservation significant species were detected during the survey of this area including one Pacific Golden Plover and 2 Common Sandpiper.

Table 4-3 Species list and count data for aerial count of Ponds 1 and 2

Name	Status	Count
Common Sandpiper (*Actitis hypoleucos*)	Mig. (EPBC & BC Acts)	2
Pacific Golden Plover (*Pluvialis fulva*)	Mig. (EPBC & BC Acts)	1
Australian Pelican (*Pelecanus conspicillatus*)		3
Budgerigar (*Melopsittacus undulatus*)		6
Pacific Black Duck (*Anas superciliosa*)		10
Sand Plover sp. (*Charadrius sp.*)	EN/VU, Mig. (EPBC & BC Acts)	5
Singing Honeyeater (*Lichenostomus virescens*)		1
Spinifex Pigeon (*Geophaps plumifera*)		1
Wedge-tailed Eagle (*Aquila audax*)		1
White-faced Heron (*Ardea novaehollandiae*)		1

4.2.2 Opportunistic surveys

Table 4-4 displays the total species list and count data for ground-based point counts completed throughout the study area. During these surveys 29 species were detected including 17 conservation significant species.

Table 4-4 Species list for ground-based point counts across the study area

Name	Status	Total Count
Great Knot (*Calidris tenuirostris*)	CR/Mig. /CR (EPBC Act; BC Act)	1
Lesser Sand Plover (*Charadrius mongolus*)	EN/Mig. (EPBC & BC Acts)	1
Greater Sand Plover (*Charadrius leschenaultii*)	VU/Mig. /VU (EPBC Act; BC Act)	7
Grey-tailed Tattler (*Tringa brevipes*)	Mig. EPBC and BC Acts; P4 DBCA list	4
Caspian Tern (*Hydroprogne caspia*)	Mig. (EPBC & BC Acts)	3
Common Greenshank (*Tringa nebularia*)	Mig. (EPBC & BC Acts)	5
Common Sandpiper (*Actitis hypoleucos*)	Mig. (EPBC & BC Acts)	1
Common Tern (*Sterna hirundo*)	Mig. (EPBC & BC Acts)	10
Crested Tern (*Sterna bergii*)	Mig. (EPBC & BC Acts)	1
Grey Plover (*Pluvialis squatarola*)	Mig. (EPBC & BC Acts)	1
Little Tern (*Sternula albifrons*)	Mig. (EPBC & BC Acts)	1
Osprey (*Pandion cristatus*)	Mig. (EPBC & BC Acts)	1
Red-necked Stint (*Calidris ruficollis*)	Mig. (EPBC & BC Acts)	22
Ruddy Turnstone (*Arenaria interpres*)	Mig. (EPBC & BC Acts)	19
Sanderling (*Calidris alba*)	Mig. (EPBC & BC Acts)	15
Terek Sandpiper (*Xenus cinereus*)	Mig. (EPBC & BC Acts)	7
Whimbrel (*Numenius phaeopus*)	Mig. (EPBC & BC Acts)	5
Australian Pelican (*Pelecanus conspicillatus*)		1
Mangrove Golden Whistler (*Pachycephala melanura*)		1
Mangrove Grey Fantail (*Rhipidura phasiana*)		1
Pied Oystercatcher (*Haematopus longirostris*)		1
Red-capped Plover (*Charadrius ruficapillus*)		34
Silver Gull (*Larus novaehollandiae*)		4
Singing Honeyeater (*Gavicalis virescens*)		1
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)		1
White-breasted Woodswallow (*Artamus leucorynchus*)		1
White-winged Fairy-wren (*Malurus leucopterus*)		1
Willie Wagtail (*Rhipidura leucophrys*)		1
Yellow White-eye (*Zosterops luteus*)		31

4.3 FERAL CATS

Feral cats were also detected 6 times, 3 each in the impact and control areas, over the course of the field survey (Table 4-5). There were 5 encounters where feral cats were seen during the aerial surveys and one scat was also recorded during an opportunistic ground-based survey.

Table 4-5 Feral cat record locations

Site	Area	Latitude	Longitude
OppCatScat2023	Control	-21.3099712	115.6805885
A05I	Impact	-21.050294	115.971597
Q04I	Impact	-21.0938	115.9626

K09C	Control	-21.407811	115.601917
L02C	Control	-21.3858	115.583638
A09I	Impact	-21.060801	115.955938

5 DISCUSSION

Overall the numbers of conservation significant birds recorded within the study area were higher in 2023 than in 2022, with 8 new species detected. These include Pacific Golden Plover, Grey Plover, Sharp-tailed Sandpiper, Sanderling, Red Knot, Great Knot, Lesser Sand Plover, and Black-tailed Godwit. (Both Knot species may have occurred in low numbers in 2022 but were only recorded as 'Knot sp.'; similarly for Lesser Sand Plover, where 'Sand Plover sp.' was recorded in low numbers in 2022 and may have included 2 species.)

Only 2 of the species recorded last year were not detected during the 2023 surveys, the Bridled Tern and White-winged Black Tern. There were 5 species which were recorded in lower numbers overall this year than in 2022, including Bar-tailed Godwit, Little Tern, Red-necked Stint, Roseate Tern, Osprey and Ruddy Turnstone. However, in comparison of the average count data for conservation significant species in the control area and impact area, Bar-tailed Godwit, Little Tern, Red-necked Stint, and Roseate Terns all recorded increased counts in the impact area but declines in the control area. The Osprey count was lower this year within the impact area, but they were also detected within the control areas for the first time, so overall the numbers appear stable between the 2 years across the full survey extent. Ruddy Turnstone numbers were on average lower this year within the control area and the impact area. As this decline was recorded in both the control and impact areas, it is likely that this reflects regional variation and unlikely to be a consequence of the Project.

This year there were also increased numbers of Oriental Pratincoles, with nationally and internationally significant numbers recorded. Based on the highest count of Oriental Pratincoles per flight during 2023, we can estimate at least 171,079 (5.94 % of the global population) individuals were utilising the MSSA during the 2023 field season. One count of Grey-tailed Tattlers was also of national significance. Overall this is similar to the species of significance recorded in 2022, however last year there were also nationally significant numbers of Ruddy Turnstone (30 individuals required for national significance).

As we are still in the interim phase of the monitoring program, the trends of the migratory shorebird population present at Mardie cannot yet be quantitatively assessed using generalised linear models that can assess the trends of the migratory shorebird population between years. As a result, only averages can be compared between years and habitats as the dataset's sample size is too small to meaningfully make any conclusions. As per the LMSMP (Phoenix 2023), it is expected that enough data should be available following 5 consecutive years of monitoring (i.e. following the 2026 field season).

Surveys of evaporation ponds 1 and 2 were also undertaken during the 2023 field season as per the requirements of the LMSMP (Phoenix 2023). However, as the Project is still in construction there is currently no access by road to survey the evaporation ponds 1 and 2. As a result, the ponds were surveyed by helicopter and will be surveyed aerially until access is provided. During the survey it was noted that the birds were not utilising the ponds and were only detected roosting or just passing through the area. Some of the pumps were turned on for the first time recently and it is likely that as the ponds begin to be filled with water over the next year, the number of shorebirds using the area will increase (Phoenix 2023).

A series of opportunistic ground-based surveys were also undertaken during the 2023 field season and a series of additional species were detected as a result. Completing these ground-based surveys

provided an opportunity for the field team to take a more detailed look at some of the species present in the study area, allowing a more comprehensive identification of some of the difficult to identify species. Sand Plover are difficult to identify to a species level while not in breeding plumage and when flying at speed, so the completion of ground-based surveyed allowed for increased certainty with identification of which Sand Plover species were present. During this survey, presence of both Lesser and Greater Sand Plovers was confirmed and a more accurate count of some of the conservation significant shorebirds could also be completed. Lesser Sand Plovers were not detected during last year's survey.

5.1 CONCLUSION

Overall the numbers of conservation significant species recorded within the study area appear to be higher than last year. A total of 8 significant species were recorded this year that were not recorded last year including Pacific Golden Plover, Grey Plover, Sharp-tailed Sandpiper, Sanderling, Red Knot, Great Knot, Lesser Sand Plover, and Black-tailed Godwit. Only 2 species which were recorded last year were not detected during the 2023 surveys, which included Bridled Terns and White-winged Black Terns. Several species counts were below last year's within the control area but had higher average counts within control areas. Ruddy Turnstone counts were on average lower this year within the control area and the impact area. As these declines were recorded in both the control and impact areas, it is likely that this is a regional decline and unlikely to be a cause of the Project. This year there were also increased numbers of Oriental Pratincoles with nationally and internationally significant numbers. Statistically significant population trends are still not able to be calculated based on the amount of data available however, this year's dataset provides valuable information that will be used to create a robust model once sufficient data has been collected.

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Appendix 1 Opportunistic survey site locations

Site	Site type	Sample type	Latitude	Longitude
Opp01_2023	Fauna site	Birding	-21.380983	115.5883951
Opp02_2023	Fauna site	Birding	-21.309316	115.6788814
Opp06_2023	Fauna site	Birding	-21.0769487	115.9275137
Opp08_reg_2023	Fauna site	Birding	-20.8396795	116.3456947

Appendix 2 Shorebird and significant species' average counts across the dominant habitats

Species	Mangal community (5 cells)		Mudflat or salt flat (56 cells)		Spinifex grassland (10 cells)		Tidal channel and ocean (24 cells)		Tidal samphire mudflat (26 cells)	
	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022
Australian Pratincole *Stiltia isabella*					3					
Bar-tailed Godwit *Limosa lapponica* (Mig.)	9		14	105	4	1	7	10	16	9
Beach Stone-curlew *Esacus magnirostris*			1		1		3	1		
Black-fronted Dotterel *Elseyornis melanops*							6			
Black-tailed Godwit *Limosa limosa* (Mig.)			1							
Bridled Tern *Onychoprion anaethetus* (Mig.)								40		
Caspian Tern *Sterna caspia* (Mig.)	10		4	2			5	3	5	4
Common Greenshank *Tringa nebularia* (Mig.)	16	2	7	2	1	1	4	2	2	2
Common Sandpiper *Actitis hypoleucos* (Mig.)	1		4		2	1	2	2	1	1
Common Tern *Sterna hirundo* (Mig.)	11		6		4		4	9	62	
Crested Tern *Sterna bergii* (Mig.)			3		2		1	6	5	
Eastern Curlew *Numenius madagascariensis* (CR/Mig.)		3	1	1	2				3	1
Great Knot *Calidris tenuirostris* (CR/Mig.)	2		2				6		2	
Greater Sand Plover *Charadrius leschenaultii* (VU/Mig.)	2		7		30		11	1	6	1
Grey Plover *Pluvialis squatarola* (Mig.)			14		4		4		4	
Grey-tailed Tattler *Tringa brevipes* (P4/Mig.)	5	2	17	15	21	6	9	7	6	3
Gull-billed Tern *Gelochelidon nilotica* (Mig.)			2		4				34	
Knot sp. *Calidris* sp. (CR/EN/Mig.)	5		11		7		10	1	30	
Lesser Sand Plover *Charadrius mongolus* (EN/Mig.)			2							
Little Tern *Sternula albifrons* (Mig.)			7	8	3		3	13	24	
Oriental Pratincole *Glareola maldivarum* (Mig.)	5		2270	68	3365		5		5641	7127
Osprey *Pandion cristatus* (Mig.)					1		1	1	1	
Pacific Golden Plover *Pluvialis fulva* (Mig.)							1		2	
Pied Oystercatcher *Haematopus longirostris*	58		2				16	3		40

Red Knot *Calidris canutus* (EN/Mig.)			1				3			
Red-capped Plover *Charadrius ruficapillus*			13	5	2	6	5	1	16	4
Red-necked Stint *Calidris ruficollis* (Mig.)	4	25	16	19	5	1	4	28	7	4
Roseate Tern *Sterna dougallii* (Mig.)			3				1	23	17	
Ruddy Turnstone *Arenaria interpres* (Mig.)			2	4	2	4	2	5		6
Sand Plover sp. *Charadrius* sp. (EN/VU/Mig.)	11	3	23	9	10	4	15	3	18	3
Sanderling *Calidris alba* (Mig.)							4		10	
Sharp-tailed Sandpiper *Calidris acuminata* (Mig.)			3		2		10		9	
Silver Gull *Larus novaehollandiae*	11	2	5	2	3		6	4	8	2
Sooty Oystercatcher *Haematopus fuliginosus*							3	4		
Terek Sandpiper *Xenus cinereus* (Mig.)			8	2	1		5	2	9	
Whimbrel *Numenius phaeopus* (Mig.)	2	1	3	3	3	1	2	1	2	2
Whiskered Tern *Sterna hybrida*			3	3	2				2	2
White-winged Black Tern *Chlidonias leucopterus* (Mig.)		1								