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Long-term migratory shorebird monitoring programme for the Mardie Project

Prepared for Mardie Minerals Pty Ltd

November 2020

Final

Long-term migratory shorebird monitoring programme for the Mardie Project

Prepared for Mardie Minerals Pty Ltd

Version history

Author/s	Reviewer/s	Version	Version number	Date submitted	Submitted to
P. Strickland and J.Clark	J.Clark	Draft for client comments	0.1	13-Oct-20	N.Dixon
J.Clark		Final, client comments addressed	1.0	04-Nov-20	N.Dixon

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Project code:1355-MSP-BCI-VER

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1 INTRODUCTION

Mardie Minerals Pty Ltd (Mardie Minerals) is developing the Mardie Project (the Project) in the Pilbara region of Western Australia (Figure 1-1). Mardie Minerals is a wholly-owned subsidiary of BCI Minerals Ltd (BCI). The Project is a proposed solar salt operation that will utilise seawater and evaporation to produce a concentrated salt product and other associated products. A series of evaporation and crystallisation ponds will produce Sodium Chloride (NaCl) salt, as well as Sulphate of Potash. The waste bitterns will be discharged through a diffuser offshore.

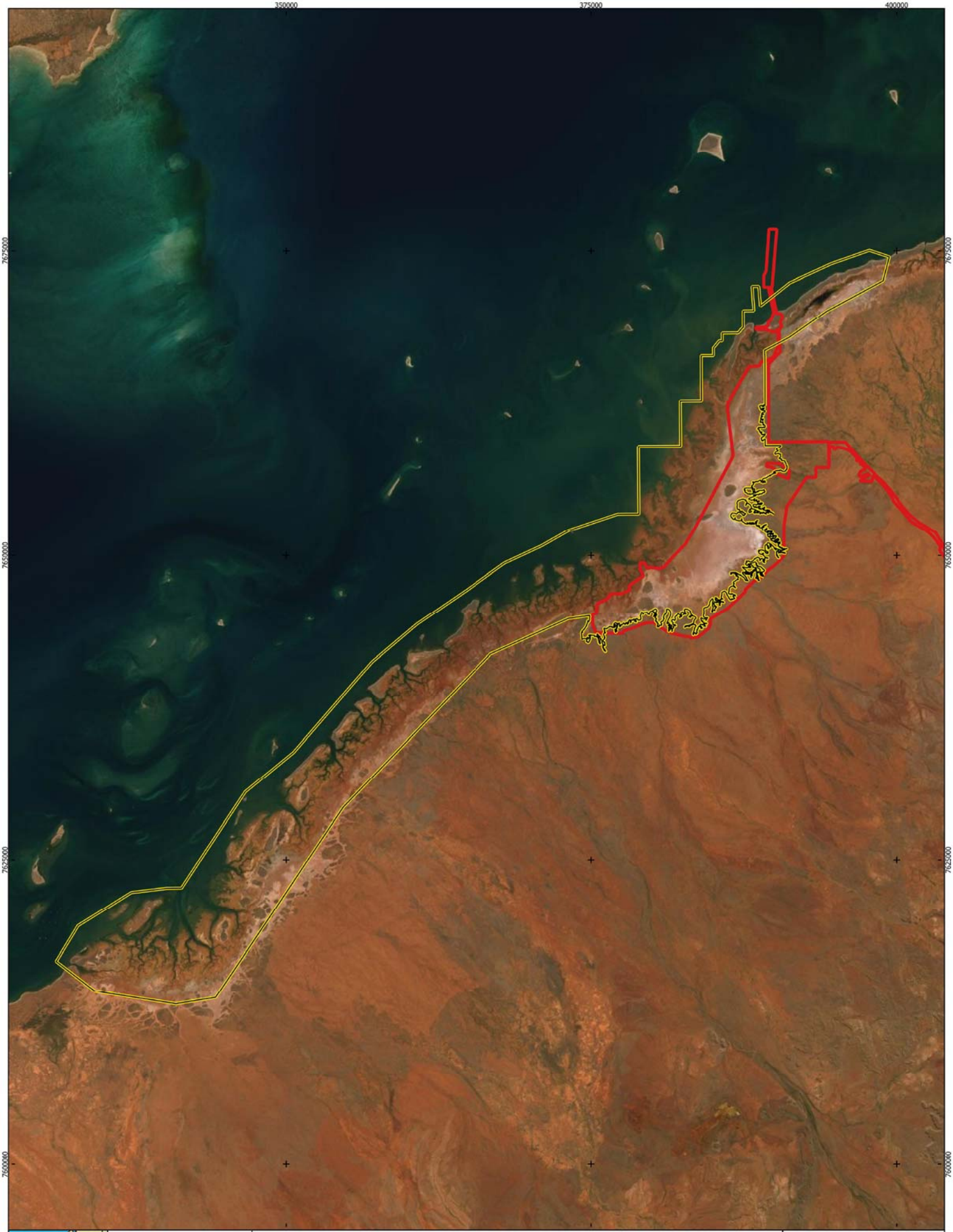
Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned to develop a migratory shorebird monitoring programme for the Project, which follows an initial desktop study and reconnaissance survey in 2017, a Level 2 targeted terrestrial fauna survey over 2017-2018 and supplementary survey work in 2019 and 2020.

1.1 BASELINE SURVEYS

Phoenix undertook a desktop study and site reconnaissance to inform the Pre-Feasibility Study (PFS) for the Project in 2017 (Phoenix 2017). The key findings of the desktop study and site reconnaissance with respect to migratory shorebirds was that migratory shorebirds are certain to occur and therefore needed to be assessed in terms of individual and collective numbers with respect to Important Bird Areas (IBA's) and East Asian-Australasian Flyway (EAAF) population criteria.

Based on the desktop and reconnaissance findings, as well as the requirements of the Project Environmental Scoping Document (ESD; BCI Minerals & Preston Consulting 2018), Phoenix undertook a targeted Level 2 survey for vertebrate fauna, including migratory shorebirds. The survey took place over 2017-2018 with supplementary surveys in 2019 to conduct further migratory shorebird sampling regionally (Phoenix 2020).

The shorebird sampling took place within a Migratory Shorebird Study Area (MSSA) associated with the coast and coastal habitats (Figure 1-1). The sampling comprised of a 'local programme' and a 'regional programme' where the local programme was within and in proximity to the Project Development Envelope (DE) and the regional programme was south of the DE within the MSSA. Similar habitats were sampled in the local and regional programs; these included Samphire wetland, Coastal mudflat and sandbar, Mangal forest stand, Mangal forest fringing tidal creeks, Non-vegetated inland mudflat and Beach (Phoenix 2020) (Figure 1-2).



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Project No	1189-MSP-BCI-
Date	04-Nov-2020
Drawn by	JDC
Map author	Phoenix Env. Sci.

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Legend

- Development Envelope
- PER shorebird investigation area

Figure 1-1

Migratory shorebird baseline study area (Phoenix 2020)

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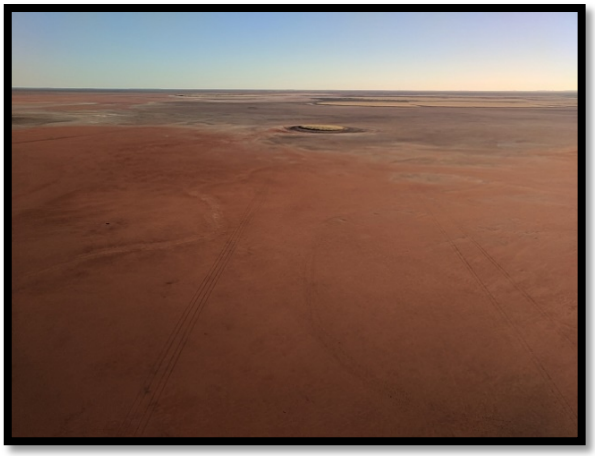
a) Samphire wetland

b) Coastal mudflat and sandbar

c) Mangal forest stand

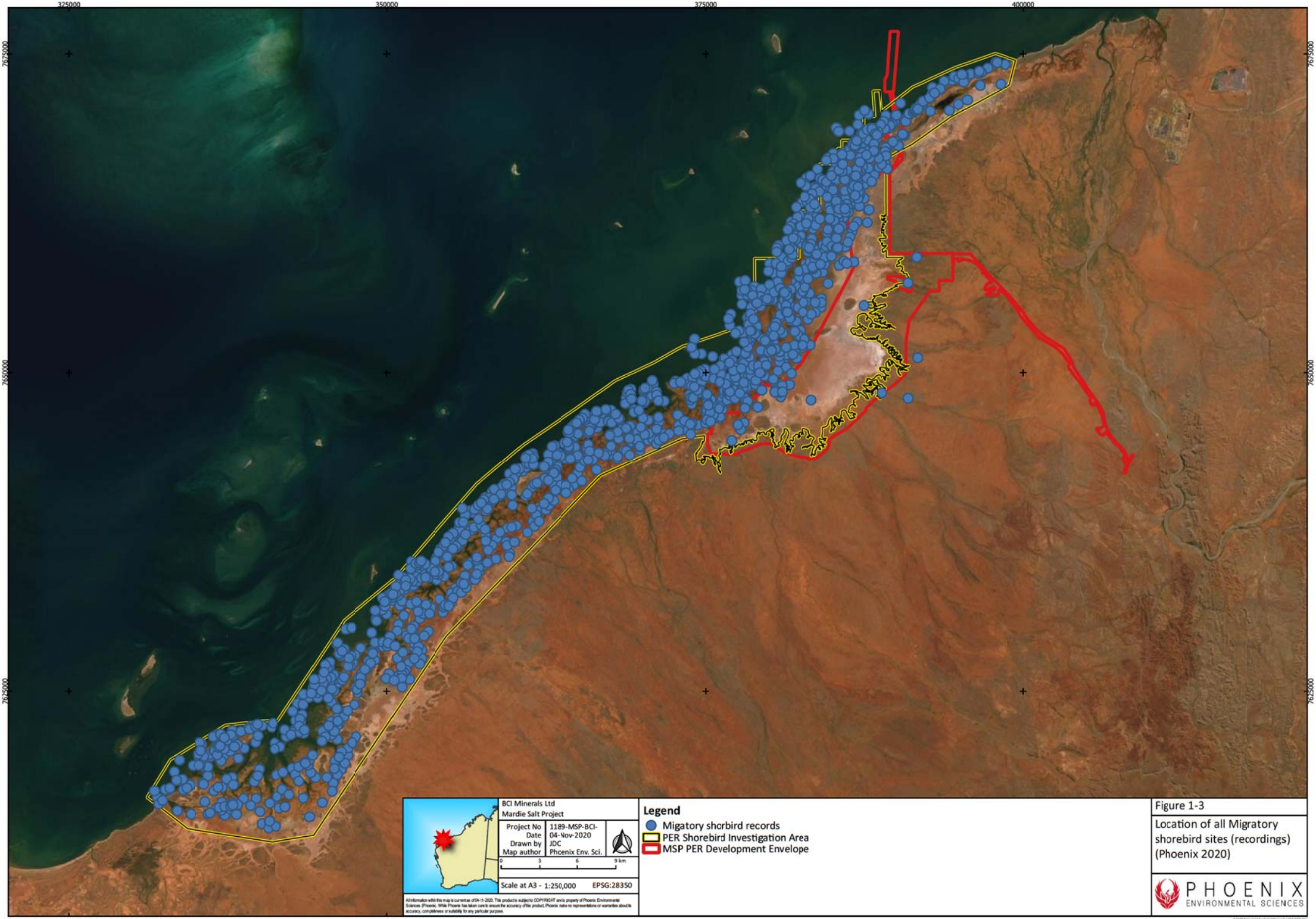
d) Mangal forest fringing tidal creeks



e) Non-vegetated inland mudflat

f) Beach

Figure 1-2 Typical migratory shorebird habitats in the area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Mardie Salt Project
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Date 04-Nov-2020
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Map author Phoenix Env. Sci.
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All information within this map is current as of 04-11-2020. This product is subject to COPYRIGHT and is property of Phoenix Environmental Sciences (Phoenix). While Phoenix has taken care to ensure the accuracy of this product, Phoenix makes no representations or warranties about its accuracy, completeness or suitability for any particular purpose.
Legend
Migatory shorbird records
PER Shorebird Investigation Area
MSP PER Development Envelope
Figure 1-3
Location of all Migratory shorebird sites (recordings) (Phoenix 2020)
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1.2 BASELINE SURVEY RESULTS

The migratory shorebird survey recorded 20 of the 37 species listed under EPBC Act Policy Statement 3.21 (DoEE 2017). Nineteen species were recorded by the local programme and 20 species by the regional programme. All 20 species were recorded in the summer sample events, and 12 were recorded overwintering; no species were confined to the overwintering survey (phase 3).

Phase 1 recorded 18 species, phase 2 recorded 17 species, phase 3 (winter) recorded 12 species and phase 4 (which included the regional programme) recorded all 20 species. The average species richness of the three summer phases was 11.3 species per sample event. The average species richness during winter (phase 3) was lower, at 7.2 species per sample event. The difference in average richness between tides in summer sample events was immaterial.

Full details of the collective baseline survey results and extrapolations of populations across the survey areas is provided in the final survey report (Phoenix 2020).

1.3 SIGNIFICANCE OF THE MARDIE AREA TO MIGRATORY SHOREBIRDS

The EPBC Act provides protection for 105 Migratory species (not including sub-species) listed under numerous international agreements that Australia is a signatory to (section 2.1). Of these, 37 Migratory shorebird species (Table 3-3) are given special consideration through recently updated guidelines: *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed Migratory shorebird species* (DoEE 2017).

Australia is geographically and ecologically an important location for Migratory shorebirds within the EAAF ('the flyway'). Thirty-six of the 37 Australian Migratory shorebird species breed in the northern hemisphere and migrate annually to southern non-breeding areas including Australia. Double-banded plovers migrate between Australia and breeding grounds in New Zealand, rather than north–south through the flyway. The flyway stretches from Siberia and Alaska, southwards through east and south-east Asia, to Australia and New Zealand.

Under the EPBC Act, 'important habitat' is a key concept for Migratory species (Department of the Environment 2013; DoEE 2017). Important habitats in Australia for Migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. The accepted and applied approach to identifying internationally important shorebird habitat has been through the use of criteria adopted under the Ramsar Convention on Wetlands (DoEE 2017).

According to that approach:

1. Internationally important habitat regularly supports
    a. 1% of the individuals in a population of one species or sub-species of waterbird or
    b. a total abundance of at least 20,000 waterbirds
2. Nationally important habitat regularly supports:
    a. 0.1% of the flyway population of a single species of Migratory shorebird or
    b. a total abundance of at least 2,000 Migratory shorebirds or
    c. at least 15 Migratory shorebird species.

The MSSA met the criteria for 1a, 2a, 2b and 2c. Within the regional programme area, the area is likely to also meet criteria 1b.

More specifically, The Level 2 migratory shorebird survey recorded 20 of the 37 species listed under *EPBC Act Policy Statement 3.21* (DoEE 2017) and therefore the MSSA meets the diversity criterion for

'nationally important shorebird habitat' as it supports at least 15 migratory shorebird species (during the summer months) (Phoenix 2020).

The results indicated the MSSA is likely to regularly support at least 2,000 birds and therefore is likely to meet the threshold criterion of 'total abundance of at least 2,000 Migratory shorebirds' for nationally significant shorebird habitat.

Six species were recorded in nationally significant numbers (i.e. >0.1% of the EAAF population estimates) in any one sample event:

- Bar-tailed Godwit
- Eastern Curlew (CR)
- Grey-tailed Tattler (P4)
- Ruddy Turnstone
- Sanderling
- Whimbrel.

Accordingly, the MSSA appears to meet the individual species abundance criterion for nationally important habitat, i.e. regularly supports >0.1% of the flyway population of a single species of Migratory shorebird. An additional eight species – Common Greenshank, Curlew Sandpiper (CR), Greater Sand Plover (VU), Oriental Plover, Pacific Golden Plover, Red Knot (EN), Red-necked Stint and Terek Sandpiper – were deemed to be likely to also occur in nationally significant numbers in the MSSA.

Based on extrapolated data, a further three species are likely to occur in internationally significant numbers (i.e. >1% of the EAAF population) in the MSSA – Grey-tailed Tattler (P4), Ruddy Turnstone and Whimbrel (all of which were evenly distributed across the MSSA).

2 SCOPE OF WORK

The scope of work for the Mardie Salt Project: Migratory Bird Monitoring Programme is to develop and implement a long-term migratory shorebird monitoring programme that principally aims to:

1. determine and track the species richness, density (birds per ha), and population size of migratory shorebirds using the ponds and in proximity to the trestle jetty (impact areas) and in representative habitats in control areas over time;
2. determine and track shorebird activity/use type in the ponds (e.g. feeding or roosting/loafing) (impact areas); and
3. record any threats to shorebirds in impact and control areas (e.g. feral or native predators, human influences).

2.1 STUDY AREA

The two study areas are defined as follows (Figure 2-1):

- The Impact Area (IA) – evaporation ponds 1 and 2, and the trestle jetty.
- The Control Area (CA) – outside the ponds, targeting each of the six recorded habitats (Samphire wetland, Coastal mudflat and sandbar, Mangal forest stand, Mangal forest fringing tidal creeks, Non-vegetated inland mudflat, Beach).

2.2 APPROACH

The shorebird monitoring will take place using fixed-location, networked cameras in both control and impact areas, which will essentially provide continuous surveillance of each site. This approach is considered superior to more traditional, single-event, on-ground observer, annual surveys which provide data on only a 2–3 hour period per year, which is inadequate for such a dynamic system.

The resultant images from the networked cameras will be wirelessly aggregated and sent over the internet to a central file directory for storage and collation using a custom-built geospatial database, which will allow for semi-automated, rapid data management. Automated processing will utilise an existing algorithm to count the birds in each photo (total abundance).

A web page will be developed to view the images and enter/update the species present in each image. The webpage will be available to stakeholders and promoted as a citizen science project enabling the ornithological community to view and assist in identifying the migratory bird species present.

Results will be reviewed and reported annually by a suitable migratory bird researcher/consultant.

3 METHODOLOGY

Migratory shorebirds will be monitored continuously using a remote, networked camera array across both impact and control sites, as described below. Motion-triggered camera traps are an increasingly popular tool for wildlife research and are useful for surveying multiple species simultaneously (Evans et al 2019).

3.1 MONITORING SITES

In the first year a survey similar to that undertaken by Phoenix (2020), will be undertaken over the long-term survey areas to confirm previous results and to identify ideal camera locations. This survey will take place in the summer season (December to February).

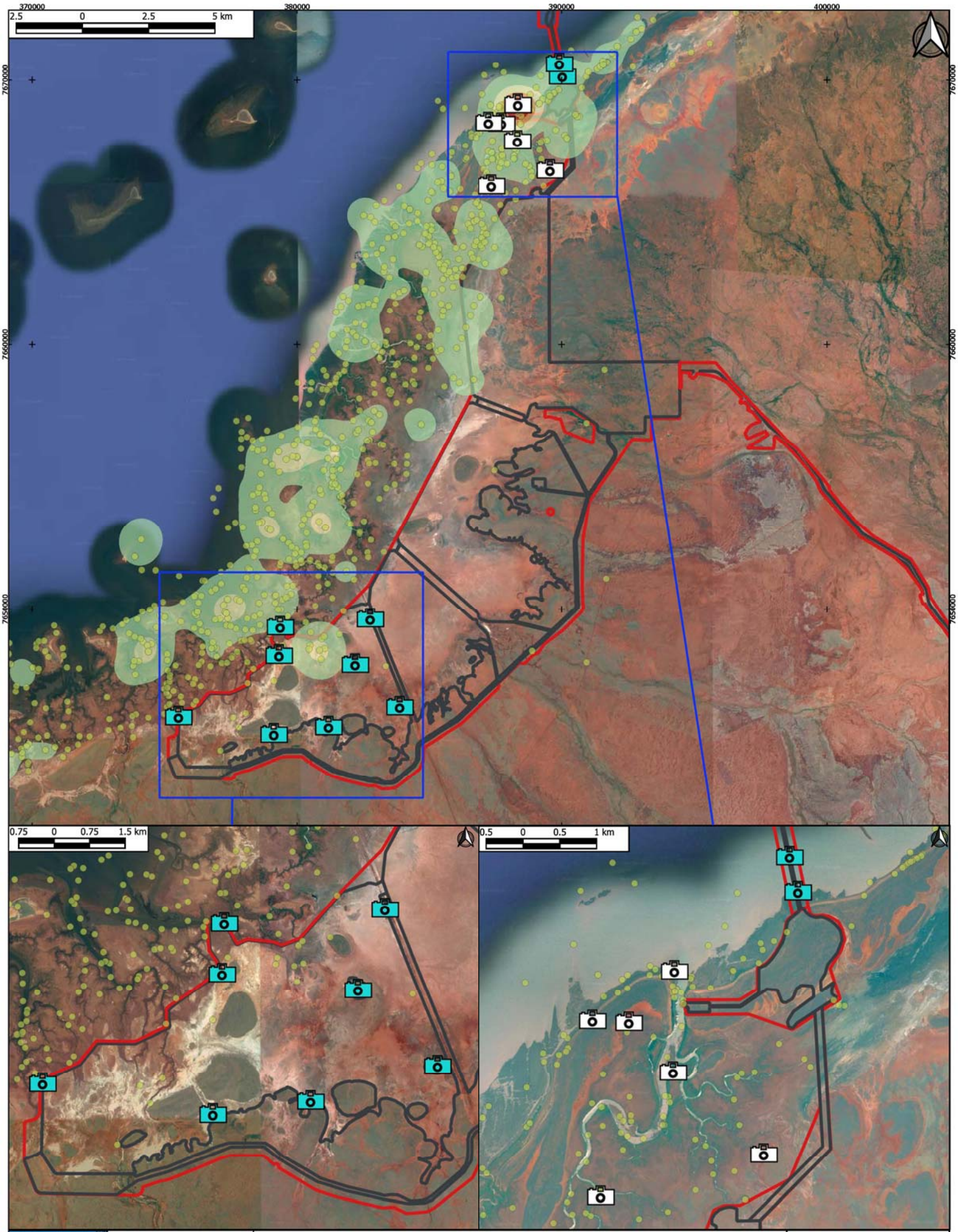
The selection of camera locations will consider:

- for control sites, the level of use as indicated by prior surveys (e.g. the two hotspots evident in Figure 1-1), while also ensuring at least one camera at a representative location in each habitat area (Table 2-1); and
- for impact sites, the prospective level of use (e.g. the walls and shallow shorelines of ponds 1 and 2), as well as along the trestle jetty;

For all sites, the coverage, suitability of physical access, interference with operations, and signal strength, are also important factors. Sites will be periodically reviewed in terms of suitability. If an established site is to be replaced with a new site, cameras will operate at both sites for a suitable period to ensure data continuity.

Table 2-1 Summary of long-term monitoring programme coverage

Area	Location	No. cameras	Approx. area of coverage (ha) per unit	Total coverage (ha) per unit
Impact	Pond 1	4	1	4
	Pond 2	4	1	4
	Trestle jetty	2	1	2
Control	Samphire wetland	1	1	1
	Coastal mudflat and sandbar	1	1	1
	Mangal forest stand	1	1	1
	Mangal forest fringing tidal creeks	1	1	1
	Non-vegetated inland mudflat	1	1	1
	Beach	1	1	1
Total		**16**	**9**	**16**



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Project No	1355-MSP-BCI-
Date	13-Oct-2020
Drawn by	JDC
Map author	Phoenix Env. Sci.

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0 1 2 3 km

Scale at A3 - 1:125,000 EPSG:28350

Legend

- Shorebird records
- Impact sites
- Control sites
- Development Envelope
- Indicative Disturbance Footprint

Figure 3-1

Long-term migratory shorebird survey areas and camera locations

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3.2 FIELD CAMERAS

The field cameras selected for the survey programme have proven themselves in similar applications and are suitably rugged for the high level of environmental exposure that they will experience at Mardie. It is expected that, as the specific technology advances, the cameras would be replaced and updated every 2-4 years.

The field cameras will include motion detectors, with the units initially set to trigger and record as follows:

- Trigger schedule – timelapse - every 30 minutes
- Flash – infrared, so as to not disturb any birds feeding nocturnally
- Image size – 2 mb

Camera settings will be regularly reviewed to ensure the number and timing of images is consistent with the survey programme's objectives, while remaining manageable in terms of volume and resources. Alerts will be set so that managers are informed when the network or individual cameras go offline

3.3 DATA COLLECTION AND PROCESSING

The images captured by the networked cameras will be transmitted via a local receiver/repeater and uploaded to an off-site repository for storage and processing.

On capture, each photo will be automatically tagged with spatial and temporal information, which is then used by the receiving database to create a new record and index the image appropriately. All images will be processed using an existing algorithm to count the number of birds in each photo. At this stage, identification of the species of each bird/flock will require manual interpretation. This would be done by utilising one or more of the following methods:

- by ornithological consultants associated with the survey programme
- by outsourcing to appropriately trained personnel
- by promoting the programme to the national/international ornithological community as a citizen science project.

A website will be established to facilitate the above options, and to allow stakeholders and the public to access appropriate-level information about the survey programme's results.

3.4 DATA METRICS

The outputs from the data processing will be summarised using the metrics shown in Table 2-3. Aggregated data refers to the combined results of all camera locations.

Table 2-2 Proposed data metrics

Metric	Control	Impact	Per image	Aggregate data	
				Per season	Annually
Species richness	✓	✓	✓	✓	✓
Average species richness	✓	✓	X	✓	✓
Number of individuals per species	✓	✓	✓	✓	✓
Average number of individuals per species	✓	✓	X	✓	✓
Species density (no. individuals / ha)	✓	✓	✓	✓	✓

Metric	Control	Impact	Per image	Aggregate data	
				Per season	Annually
Average species density (avg. no. individuals / ha)	✔	✔	X	✔	✔
Population density (total number of birds / ha)	✔	✔	✔	✔	✔
Average population density (avg. total number of birds / ha)	✔	✔	X	✔	✔
Total abundance	✔	✔	✔	✔	✔
Average total abundance (avg. abundance)	✔	✔	X	✔	✔

3.5 REVIEW AND REPORTING

The results of the long-term migratory shorebird monitoring programme will be reviewed bi-annually by a suitable migratory bird researcher/consultant. This review will also consider the programme efficacy, and recommend changes if suitable. The reviews will be made publicly available on the programme's website.

4 UTILISATION OF RESULTS

In addition to making results available to government and community stakeholders, Mardie Minerals will use the outputs of the long-term monitoring programme to:

- compare to the outputs of the Mardie Benthic Communities & Habitats Monitoring and Management Plan;
- inform regular reviews of its environmental risk profile, specifically in relation to migratory shorebirds, and adjust if necessary;
- initiate specific research if declining utilisation of the area by migratory shorebirds is observed; and/or
- if necessary, review its operational and environmental management controls relevant to migratory shorebirds.

The long-term monitoring programme will also provide valuable information for closure planning, ensuring that closure impacts to migratory shorebirds are minimised.

5 REFERENCES

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