

Pardoo Irrigation Project Fauna Assessment



The dominant vegetation association - shrublands and spinifex on pindan red sandy loam
(photo: Tim Gamblin)

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Executive Summary

The Pardoo Irrigation Project (Stages 1 to 3) has already been approved and developed under relevant legislation. This report summarises previous surveys at Pardoo, due to a need to clear small easements which will be developed to provide access to the pastoral lease. This report presents the results of all Bamford Consulting Ecologists (BCE) assessments that have been conducted for the Pardoo Irrigation Project (and adjacent areas) and provides information on the fauna values of the proposed re-zoning area, particularly for significant species.

The study area has been subject to several previous fauna surveys conducted by BCE from 2016 to 2018. The Pardoo Irrigation Project sites and adjacent land were visited on:

- 12th – 14th July 2016 - Stage 2 and 3.
- 28th - 30th June 2017 – Stage 2.
- 18th – 21st September 2017 Stage 3 and adjacent Ramsar Site.
- 17th – 19th July 2018 – Stage 3 pre-clearing and south of Great Northern Hwy.

Fauna values within the study area can be summarised as follows:

Fauna assemblage. Largely intact and moderately rich, but highly variable seasonally and annually. Assemblage includes elements of the Great Sandy Desert, Pilbara and Kimberley. The desktop study identified 186 vertebrate fauna species as potentially occurring in the project area: 5 frogs, 45 reptiles, 101 birds and 37 mammals. This excludes 51 water birds (which could fly over the area but not utilize it).

Species of conservation significance. While 21 species of conservation significance could be present, most are expected only as vagrants or irregular visitors, with few species expected to be regularly reliant on the project area. The most notable of these is the Greater Bilby (a regular visitor to Stage 2, 3 and surrounding areas). There are an additional 16 conservation significant waterbird species including some migratory which can be expected to be regular migrants visiting the claypans and wetland in small numbers. The latter habitats are close to but not within the study area.

Vegetation and Substrate Associations (VSAs). The study area is a largely uniform landscape supporting only two VSAs and dominated by one.

Patterns of biodiversity. Within the study area, vegetation types that have not been subject to excessively frequent fires and/or grazing are likely to be most important for fauna.

Key ecological processes. The main processes which may affect the fauna assemblage are likely to be local hydrology, the fire regime and the presence of feral predators.

Impacts to conservation fauna and habitat from the proposed easement clearing are expected to be small given the small amount of clearing involved and the surrounding large amount of similar habitat present. The 1.2 ha of habitat disturbance proposed represents 0.0016% of the 75,040 ha of native vegetation from the Nita Land System within a 15 km buffer around the irrigation project.

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1 Introduction

Pardoo Station is located north of the Great Northern Highway, approximately 100 kilometres (km) east-north-east of Port Hedland and 365 km south west of Broome in the western extremity of the Dampierland bioregion – Figure 1 (Thackway & Cresswell 1995). The owner of Pardoo Station, Pardoo Beef Corporation Pty Ltd, has developed the Pardoo Irrigation Project (Stages 1, 2 and 3), a pivot irrigated cattle fodder production facility to improve cattle welfare, condition and throughput (Figure 2).

This report describes previous surveys conducted at Pardoo, due to a need to clear small easements which will be developed to provide access to the pastoral lease. This report presents the results of all Bamford Consulting Ecologists (BCE) assessments that have been conducted for the Pardoo Irrigation Project (and adjacent areas) and provides information on the fauna values of the study area, particularly for significant species.

The study area has been subject to several previous fauna surveys conducted by BCE (Bamford *et al.* 2016, Bamford and Shepherd 2017, Bamford, Chuk and Gamblin 2018a, Bamford, Chuk and Gamblin 2018b, and Bamford, Shepherd and Gamblin 2018). Previous field survey locations are shown in Figure 3.

The purpose of this report is to provide information on the fauna values of this area, particularly for significant species. This includes:

- Assemblage characteristics: uniqueness, completeness and richness;
- Species of conservation significance;
- Recognition of ecotypes or vegetation/substrate associations (VSAs) that provide habitat for fauna, particularly those that are rare, unusual and/or support significant fauna;
- Patterns of biodiversity across the landscape; and
- Ecological processes upon which the fauna depend.

Descriptions and background information on these values and processes can be found in Appendices 1 to 4. In particular, Appendix 1 explains and defines the fauna values, including the recognition of three classes of species of conservation significance (CS): those listed under legislation (CS1), those listed as priority by the Department of Biodiversity, Conservation and Attractions (CS2), and those that can be considered of local or other significance, but which have no formal listing (CS3). Appendix 2 describes threatening processes, while Appendix 3 outlines the legal definitions and classes of conservation significance, and Appendix 4 presents the threatening processes recognised under legislation.

1.1 Description of Project Area

Pardoo Station, including the study area, falls into the western extremity of the Dampierland bioregion – Figure 1 (Thackway & Cresswell 1995). The climate is semi-arid tropical monsoonal with a hot, wet summer and a warm, dry winter. Median and mean annual rainfall in this region is 327 mm and 341 mm respectively. Annual evaporation is c. 3400- 3600 mm. There is a high degree of variability in rainfall events with significant variations in rainfall between years as well as the period when the bulk of the rain falls (Graham 1999).

The Dampierland bioregion can be sub-divided as follows: (1) Quaternary sandplain overlying Jurassic and Mesozoic sandstones with Pindan Hummock grasslands on hills. (2) Quaternary marine deposits on coastal plains, with Mangal, samphire - *Sporobolus* grasslands, *Melaleuca acacioides* low forests, and *Spinifex* - *Crotalaria* strand communities. (3) Quaternary alluvial plains associated with the Permian and Mesozoic sediments of Fitzroy Trough support tree savannas of *Cryspogon* - *Dichanthium* grasses with scattered *Eucalyptus microtheca* and *Lysiphyllum cunninghamii*. Riparian forests of River Gum and Cadjeput fringe drainages. (4) Devonian reef limestones in the north and east supporting sparse tree steppe over *Triodia intermedia* and *T. wiseana* hummock grasses. (Thackway & Cresswell 1995). The study area (Figure 1) lies across Quaternary sandplain overlying Jurassic and Mesozoic sandstones. Vegetation and Substrate Associations are described in detail in Section 3.1.

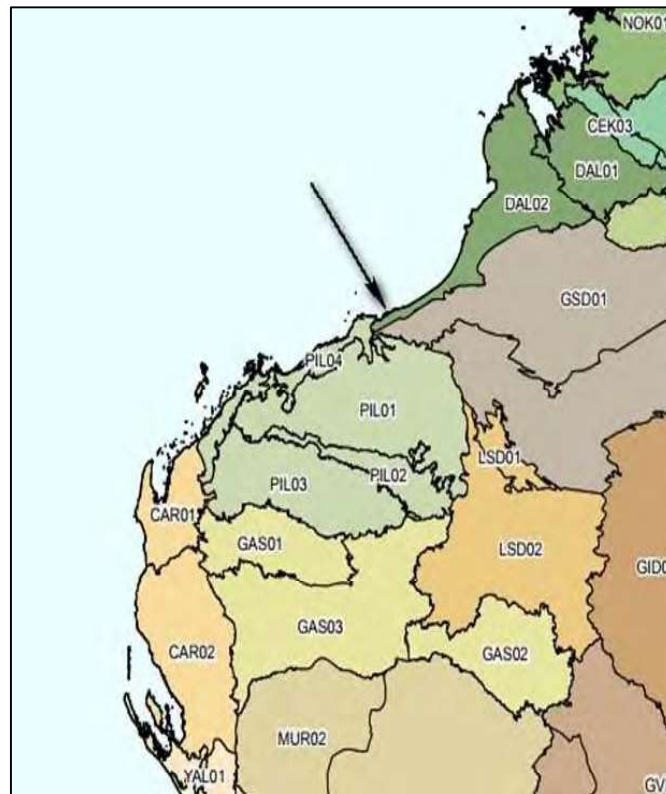


Figure 1. Bioregions across Western Australia, indicating the location of the project area in the Dampierland bioregion.

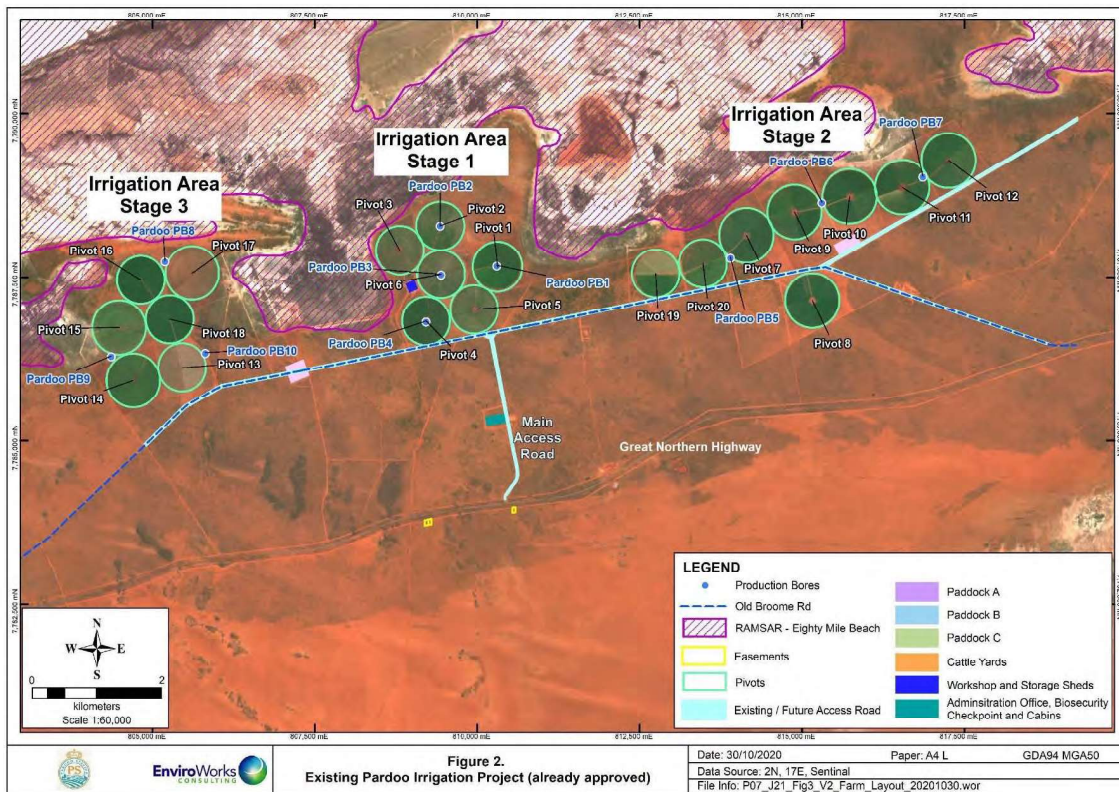


Figure 2. Existing Pardoo Pivot Project site layout and easements (yellow).

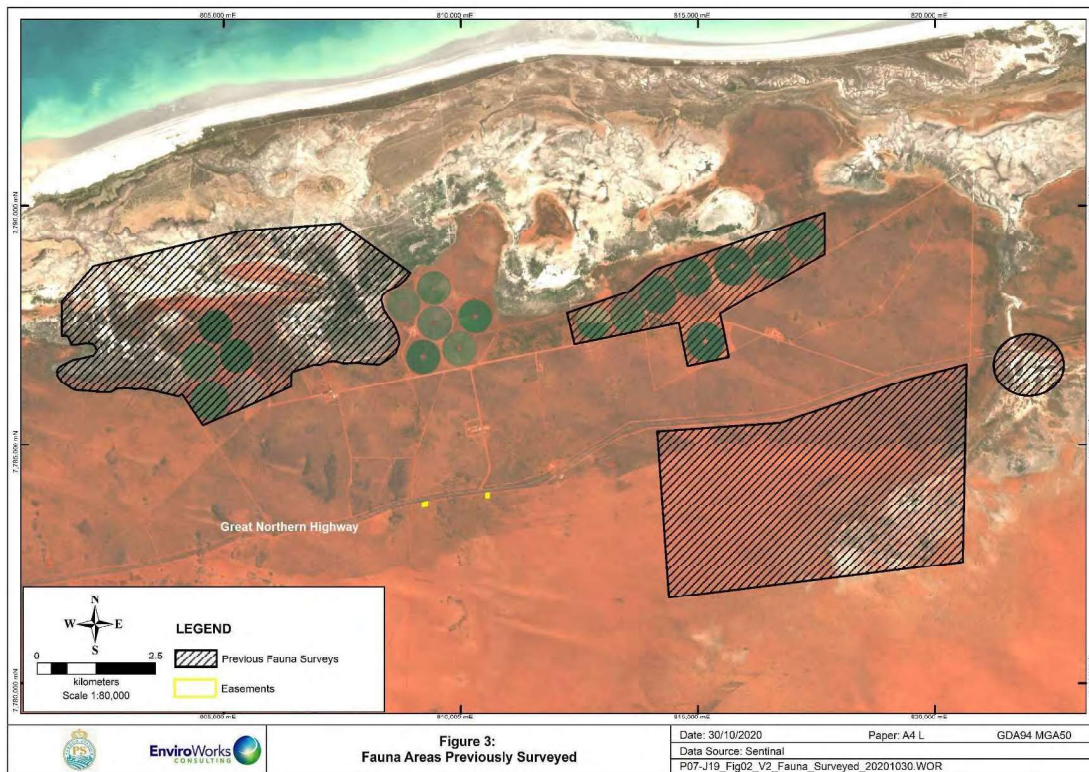


Figure 3. Location of field fauna surveys (black hatching) and the proposed easements (yellow)

2 Methods

2.1 Desktop Assessment

2.1.1 Sources of information

Information on the fauna assemblage of the study area was drawn from a wide range of sources. These included state and federal government databases and results of regional studies. Databases accessed were the Atlas of Living Australia (ALA), the Western Australian (WA) Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap (incorporating the Western Australian Museum's FaunaBase and the DBCA Threatened and Priority Fauna Database), BirdLife Australia's Birddata (Atlas) Database (BA), the EPBC Protected Matters Search Tool and the Bamford Consulting Ecologists (BCE) Database (**Error! Reference source not found.**). These databases were accessed in 2016 to 2018 for the earlier fauna assessments on Pardoo station and subsequently re-queried in April 2020 to include any new records which had any been added in the intervening period. Information from the above sources was supplemented with species expected in the area based on general patterns of distribution. Sources of information used for these general patterns were:

Frogs: Tyler *et al.* (2000) and Anstis (2013);

Reptiles: Storr *et al.* (1983, 1990, 1999 and 2002) and Wilson and Swan (2013);

Birds: Blakers *et al.* (1984); Johnstone and Storr (1998, 2004), Barrett *et al.* (2003) and Menkhorst *et al.* (2017);

Mammals: Menkhorst & Knight (2004); Churchill (2008); and Van Dyck and Strahan (2008).

Table 1. Sources of information

Database	Type of records held on database	Area searched
Atlas of Living Australia (ALA 2018 and 2020)	Records provided by collecting institutions, individual collectors and community groups	20.01944°S, 120.03583°E – plus 20 km buffer.
NatureMap (DBCA 2018 and 2020)	Records in the WAM and DPaW databases. Includes historical data and records on Threatened and Priority species in WA.	20.01944°S, 120.03583°E – plus 20 km buffer.
BirdLife Australia Birddata (Atlas Database, 2018 and 2020)	Records of bird observations in Australia, 1998-2018.	20.01944°S, 120.03583°E – plus 20 km buffer.
EPBC Protected Matters (2018 and 2020)	Records on matters of national environmental significance protected under the EPBC Act.	20.01944°S, 120.03583°E – plus 40 km buffer.

2.1.2 *Previous fauna surveys*

BCE has conducted multiple fauna surveys at Pardoo Station and nearby stations such as Anna Plains and the adjacent Wallal Downs Station. These surveys have included targeted significant species investigations. Other surveys conducted by BCE further afield on Pardoo and Wallal Downs Stations have been used as background information only to inform potential species lists compiled during desktop studies. There have also been studies by other consultants in the region. Species records from these studies are contained in the Naturemap database which was consulted as part of the desktop review. In addition, BCE maintains a detailed database and annotated species lists that were available for reference as part of the desktop study. Some of the BCE records pre-date Naturemap. Previous Pardoo Pivot Project reports consulted for background information include Bamford *et al.* (2016), Bamford and Shepherd (2017) and Bamford, Chuk and Gamblin 2018a, Bamford, Chuk and Gamblin 2018b and Bamford, Shepherd and Gamblin 2018 (Table 2). All species records used to inform the expected species list for the study area (and the source of the records) are included in Appendix 3.

2.1.3 *Nomenclature and taxonomy*

As per the recommendations of EPA (2004), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum's (WAM) Checklist of the Fauna of Western Australia 2016. The authorities used for each vertebrate group were: amphibians (Doughty *et al.* 2016a), reptiles (Doughty *et al.* 2016b), birds (Johnstone and Darnell 2016), and mammals (Travouillon, 2016). In some cases, more widely-recognised names and naming conventions have been followed, particularly for birds where there are national and international naming conventions in place (e.g. the BirdLife Australia working list of names for Australian Birds). English names of species where available are used throughout the text; Latin species names are presented with corresponding English names in tables in the appendices.

2.1.4 *Interpretation of species lists*

Species lists generated from the review of sources of information are generous as they include records drawn from a large region and possibly from environments not represented in the study area. Therefore, some species that were returned by one or more of the data searches have been excluded because their ecology, or the environment within the study area, meant that it is highly unlikely that these species will be present. Such species can include, for example, seabirds that might occur as extremely rare vagrants at a terrestrial inland site, but for which the site is of no importance. Species returned from databases but excluded from species lists are presented in Appendix 4. In addition, waterbirds were excluded from the expected species list for this assessment as the study area is considered unsuitable habitat. These species are listed in Appendix 6.

Species returned from the databases and not excluded on the basis of ecology or environment are therefore considered potentially present or expected to be present in the study area at least occasionally, whether or not they were recorded during field surveys, and whether or not the study area is likely to be important for them. This list of expected species is therefore subject to interpretation by assigning each a predicted status in the study area.

The status categories used are:

- Resident: species with a population permanently present in the study area;
- Migrant or regular visitor: species that occur within the study area regularly in at least moderate numbers, such as part of annual cycle;
- Irregular Visitor: species that occur within the study area irregularly such as nomadic and irruptive species. The length of time between visitations could be decades but when the species is present, it uses the study area in at least moderate numbers and for some time;
- Vagrant: species that occur within the study area unpredictably, in small numbers and/or for very brief periods. Therefore, the study area is unlikely to be of importance for the species; and
- Locally extinct: species that would have been present but has not been recently recorded in the local area and therefore is almost certainly no longer present in the study area.

These status categories make it possible to distinguish between vagrant species, which may be recorded at any time but for which the site is not important in a conservation sense, and species which use the site in other ways but for which the site is important at least occasionally. This is particularly useful for birds that may naturally be migratory or nomadic, and for some mammals that can also be mobile or irruptive, and further recognises that even the most detailed field survey can fail to record species which will be present at times, or may have been previously confirmed as present. The status categories are assigned conservatively. For example, a lizard known from the general area is assumed to be a resident unless there is very good evidence that the site will not support it, and even then, it may be classed as a vagrant rather than assumed to be absent if the site might support dispersing individuals.

2.1.5 Short Range Endemics (SREs)

SREs are included within the above databases that were checked as part of desktop investigations, but no SRE's were identified during the desktop study for this area. This is expected as the landscape does not have the types of features conducive to the evolution of SRE species which includes sheltered, relatively mesic environments such as slopes with south-west facing aspects, vine thickets, rock piles, drainage systems, deep gorges, mound springs/natural springs, fire refuge areas such as cliffs/isolated rock piles, and other similar habitats or habitat isolates (EPA, 2016b). The study area is located on a relatively uniform, flat, continuous Pindan sands habitat which does not contain such features conducive to the evolution of SRE species.

Therefore, no SRE species are included within potential species lists compiled via desktop studies and consequently field investigations for SRE species were not conducted.

2.2 Field Investigation Methodology and Personnel

The proposed area of re-zoning (or study area) has been subject to several previous fauna surveys conducted by BCE from 2016 to 2018. Staff involved in the assessments were Dr Mike Bamford - BSc (Biol.), Hons (Biol.), PhD (Biol.), Mr Tim Gamblin B.Sc. (Zool.) Cert. (Env. Man.) and Dr Barry Shepherd - B.Sc. Hons. Ph.D. (Ecology); Cameron Everard B.Sc. (Zool.) and Katherine Chuk B. Sc. (Zool.) Hons. assisted with report production.

Table 2. Previous surveys and associated reports in the Pardoo Pivot Project area.

Date	Year	Site	Report Reference
12 th – 14 th July	2016	Stage 2 and 3	Bamford <i>et al.</i> 2016
28 th - 30 th June	2017	Stage 2	Bamford and Shepherd. 2017
18 th – 21 st Sept	2017	Stage 3 and Ramsar Site	Bamford <i>et al.</i> 2018
17 th – 19 th July	2018	Stage 3 preclearing, South of Great Northern Hwy and Wetland	Bamford <i>et al.</i> 2018a and b.

The authors of this report, Dr Mike Bamford and Mr Tim Gamblin, participated in the previous on-ground fauna surveys. Dr Mike Bamford supervised and was present in all surveys and Mr Tim Gamblin in several of the other surveys. All site surveys involved traversing as much of the area as possible to enable environmental descriptions to be prepared and opportunistic fauna observations to be made. Targeted searching was undertaken for several significant species known from the general area, in particular the Greater Bilby, Mulgara and significant waterbirds. Bilby activity was confirmed by searching for evidence such as scats, tracks, diggings and burrows. All personnel involved in searching were familiar with the evidence of the species.

The methods used in the previous surveys, particularly for Bilby, involved walking a series of transects across each pivot and around most of the perimeter surrounding each plot. Transects were generally spaced about 100-200m apart, but this varied due to the terrain, visibility, areas of dense vegetation, clearings and diversions to investigate promising locations. This transect approach is intended to detect Bilby evidence, with foraging holes the easiest to find and the most informative as they occur where a Bilby is likely to be resident, at least temporarily. Tracks are distinctive but can be difficult to find except along earthen roads and in clearings, while burrows and scats are usually only found through concentrated searching in an area where the presence of a Bilby has been confirmed by finding foraging signs. The spacing of transects at about 100m (in reality ranging from <50m to c. 200m) is a higher resolution than is required to detect foraging signs of a resident Bilby, as recorded home ranges (over which foraging activity is dispersed and thus detectable) are in the order of 11.3 to 16.2 ha, or 250m in radius (Johnson 1989, citing other authors). Using a high resolution of transects increases certainty of detecting even foraging by a passing individual, and of detecting old signs. It also increases the chance of encountering high densities (and therefore easy to detect) of foraging signs, as these are not spread evenly across a home range. In two other studies, one of the authors of the current report (MB) has found foraging signs of small (<5 animals) colonies of Bilbies dispersed over areas about 1km across. Survey waypoints were established in the sites where photographs were

taken and habitat descriptions recorded. In addition, time was spent in the evenings listening for rare fauna (including the Night Parrot) and spotlighting for reptiles.

2.3 Survey Limitations

The EPA Guidance Statement 56 (EPA 2004, now EPA, 2016a) outlines a number of limitations that may arise during surveying. These survey limitations are discussed in the context of the BCE investigation of the study area in Table 3.

Table 3. Survey limitations as outlined by EPA.

EPA Limitation	BCE Comment
Level of survey.	A review of previous field surveys was deemed adequate due to the amount of data available in the region and number of previous level 1 and Targeted Conservation Significant Fauna Surveys nearby given the small clearing footprint and similar habitat.
Competency/experience of the consultant(s) carrying out the survey.	The ecologists have had extensive experience in conducting fauna surveys and have conducted several fauna studies within the immediate region including the previous on-ground Pardoo Pivot Project Fauna Assessments.
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	The survey focussed on vertebrate fauna and fauna values.
Proportion of fauna identified, recorded and/or collected.	N/A - All vertebrate fauna observed in <i>previous</i> surveys were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	Abundant information from databases and <i>previous</i> studies/surveys.
The proportion of the task achieved and further work which might be needed.	The desktop survey was completed and the report provides fauna values for the project area.
Timing/weather/season/cycle.	N/A
Disturbances (e.g. fire, flood, accidental human intervention etc.) that affected results of survey.	N/A
Intensity. (In retrospect, was the intensity adequate?)	N/A - All major VSAs were visited and significant species habitat and traces were identified in <i>previous</i> surveys.
Completeness (e.g. was relevant area fully surveyed).	The study area was fully reviewed to the level appropriate for a level 1 desktop assessment, with previous level 1 and Targeted Conservation Significant Fauna Surveys over parts of the proposed re-zoning area. Fauna database searches covered a 20 km radius beyond the study area boundary. Detailed previous field investigations covered the VSAs present.

EPA Limitation	BCE Comment
Resources (e.g. degree of expertise available in animal identification).	Field personnel have extensive experience with fauna and habitat in the region.
Remoteness and/or access problems.	N/A
Availability of contextual (e.g. biogeographic) information on the region.	Regional information was available and was consulted.

3 Results

3.1 Vegetation and Substrate Associations

The study area site reflects major components of the Dampierland Bioregion. The majority of the site is characterised by Pindan (red sandy) soils which support acacia and mixed species shrublands over spinifex grasslands. The area is unlikely to flood and is not considered seasonally wet. Water infiltration rates of the pindan soil are considered high (Water Technology, 2018).

The study area provides habitat values for species which utilise both the dry, sandy, shrubland environment to some extent (particularly mulgara) but of far greater value for Bilby are those environments close to or incorporating margins with claypans on grey loamy soils (adjacent to the study area). The vegetation and substrate associations (VSAs) that characterise the study area are described below and are consistent with structural vegetation types identified by EnviroWorks Consulting (2020):

- VSA 1: Pindan shrublands occur on red or red-brown sands dominated by Acacia species and are located at a higher elevation in the landscape than the adjacent coastal plain vegetation types. These shrublands occur adjacent to the irrigation project areas (and were the pre-development vegetation type prior to the development of the pivots).
- VSA 2: Pindan open woodlands/shrublands occur in the south east and south west of the study area. This community covers areas higher in the landscape than Acacia Shrublands and consist of low open woodland over a low mixed-species shrubland.
- VSA3: Coastal Plain shrublands (and seasonally wet thickets) occur predominantly in the coastal plain and Ramsar section of the study area on seasonally wet grey to white clayey silty soil and brown sandy loam, at a lower elevation in the landscape compared with the Pindan shrublands. There is also a pocket of this vegetation type in the far south east of the study area, coinciding with a lower elevation area.
- VSA4: Coastal Plain grasslands and low shrublands occur predominantly in the coastal plain and Ramsar section of the study area on seasonally wet grey to white clayey silty soil, at a lower elevation in the landscape compared with the Pindan shrublands. These grasslands form a mosaic with the coastal plain thickets and shrublands described above.
- VSA5: Salt pans occur in minor depressions in the landscape within the coastal plain and Ramsar section of the study area at slightly lower elevation than surrounding areas on grey to white clay. These depressions naturally collect rainfall from surrounding areas after rainfall and evaporation results in the build-up of salts over time. They consist of bare salt pan areas and associated low samphire, herblands and shrublands/
- VSA6: Low limestone ridges / outcrops occur in localised areas within the coastal plain and Ramsar section of the study area with limestone cap rock visible at the surface. These ridges are sparsely vegetated and occur with shallow red or brown sands.
- VSA7: Completely degraded areas were areas devoid of vegetation mainly coinciding with cleared tracks and stock watering points.

The proposed clearing of the easements occurs within VSA 1: Pindan shrublands and also contains some areas of VSA7: Completely degraded.

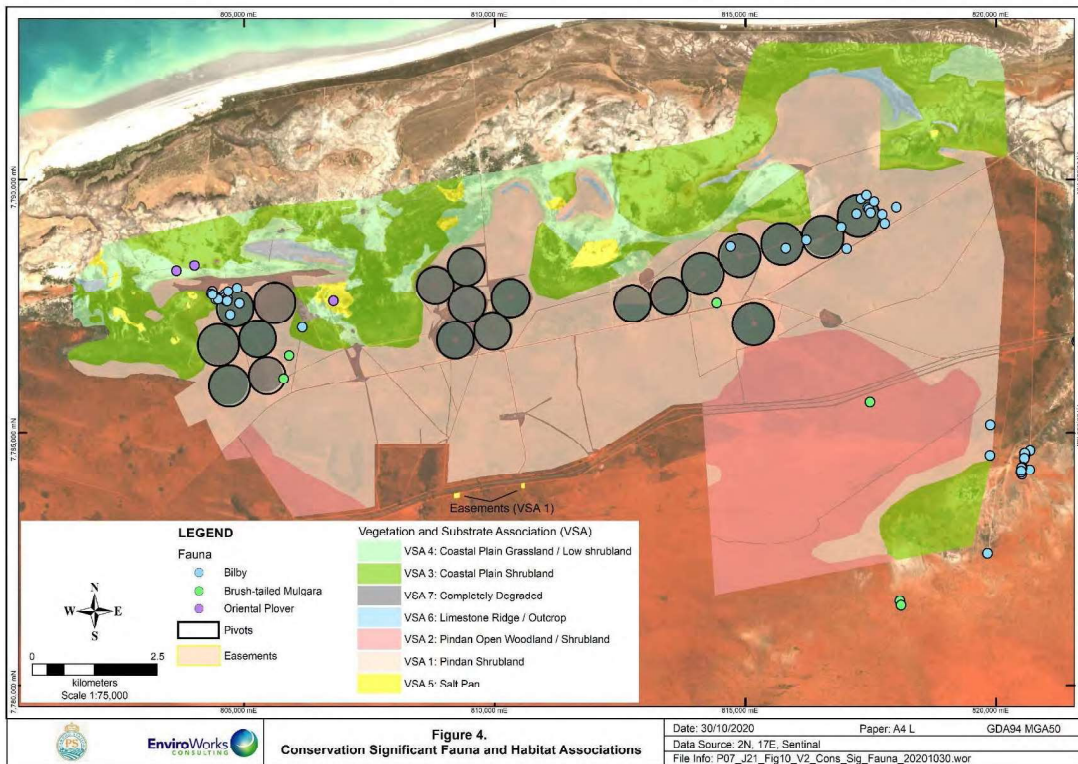


Figure 4. Distribution of VSAs and Conservation significant fauna in the study area.
VSA descriptions are given in Section 3.1.

3.2 Fauna

3.2.1 Overview of fauna assemblage

This study identified 186 vertebrate fauna species as potentially occurring in the study area (see Table 4 and Appendix 3): 5 frogs, 45 reptiles, 101 birds and 37 mammals. This excludes 51 water birds expected with 14 waterbird species recorded in previous surveys. The assemblage includes 19 species of conservation significance that are known to be or may still be present, and two locally extinct species of conservation significance. These are all discussed in Section 3.2.2.

The five frog species are all considered resident except one, the Green Tree Frog. Two species of tree frog, the Green Tree Frog and Desert Tree Frog, are likely to take advantage of artificial structures and water sources as habitat; both have been recorded in the general region by BCE. The others are burrowing species that spend long periods inactive below ground during naturally extended dry periods. These species breed following rain. Note that while not recorded in the area, it is likely that the Cane Toad *Rhinella marina* will colonise the area in the next ten to 15 years (based upon the maximum spread rate of >50 km/year reported by Tingley *et al.* (2012) and the presence of the species well into the eastern Kimberley in summer 2016/2017 (M. Bamford pers. Obs.).

The 45 reptile species are mostly considered resident but one, the Ring-tailed Dragon, is classed as vagrant (because the study area has few rocky outcrops, the preferred habitat of this species) while the Common House Gecko is more or less limited to occupied human dwellings, but may occur in nearby buildings. The fauna assemblage includes elements of the Great Sandy Desert, Pilbara and Kimberley. Twenty reptile species have been recorded in the general region by BCE, including 3 species in July 2018 either south of Great Northern Hwy or the wetland nearby.

The bird assemblage of 101 species includes 40 classed as residents and 14 considered to be vagrants, with 34 regular visitors. This doesn't include the waterbirds (listed in Appendix 6) many of which are vagrants. There is no suitable habitat for water birds in the study area, given it consists of pindan red sand/loam shrublands and spinifex – however it's possible they may be observed flying over. Grassland-dependent migratory species (principally Oriental Plover, Oriental Pratincole and Little Curlew) may use areas to the north. The bird assemblage is a mixture of Pilbara and arid-zone species, with migratory waterbirds present at least as vagrants, and some more regularly, because the area is close to tidal flats of the coastline.

The mammal assemblage of 29 native species is poorly documented and some of the species included are based upon the general literature rather than nearby database records. At least two additional native species are locally extinct (these are discussed in the following section). Almost half the native species are bats that roost in tree hollows. With eight species (not including domestic livestock), introduced species are a major component of the mammal fauna.

Documenting the invertebrate assemblage is beyond the scope of even a level 2 investigation, but no invertebrate species of conservation significance are expected in the project area based on database searches and on ground assessments in previous surveys. That is, the landscape does not have the types of features conducive to the evolution of SRE species which includes sheltered, relatively mesic environments such as slopes with south-west facing aspects, vine thickets, rock piles, drainage

systems, deep gorges, mound springs/natural springs, fire refuge areas such as cliffs/isolated rock piles, and other similar habitats or habitat isolates (EPA, 2016b).

Key features of the fauna assemblage expected in the project area are:

- **Uniqueness:** The assemblage is typical of a broad region of overlap between the Pilbara, Great Sandy Desert and Kimberley. It is notable for the presence of large numbers of migratory waterbird species associated with the coastal areas of the 80 Mile Beach Ramsar site, with the majority of these species reliant on the tidal coastline several km away from the study area.
- **Completeness:** The assemblage of species from the study area is almost complete, with perhaps one bird (Night Parrot) and at least two mammals (Golden Bandicoot and Boodie) species locally extinct.
- **Richness:** The assemblage appears rich but the number of species present will vary greatly seasonally and annually such that many species are absent for periods of time

Table 4. Composition of vertebrate fauna assemblage of the study area site.

Taxon	Number of species expected	Number of species in each category				
		Resident	Regular visitor or migrant	Irregular visitor	Vagrant	Locally extinct
Frogs	5	4	1			
Reptiles	45	43			2	
Birds	101	40	34	12	14	1
Native Mammals	29	8	10	6	3	2
Introduced Mammals	8	3	4		1	
Total	186 (including 8 int.)	98	49	16	20	3

3.2.2 Species of conservation significance

The current vertebrate assemblage includes 19 species of conservation significance; and an additional two species of conservation significance that are considered to be locally extinct (Tables 5 and 6). The overall list of extant significant species includes 12 CS1, 4 CS2 and 3 CS3 species. As outlined in Appendix 2, species classed as CS1 are those listed under WA State and/or Commonwealth legislation, while those classed as CS2 are listed as Priority by the Department of Parks and Wildlife. The CS3 class is more subjective and is assigned by BCE (not any regulatory listing), but includes species that have declined extensively across the Pilbara region, and some species that occur at the edge of their range. This makes their presence in the study area significant as populations on the edge of a species' range are often less abundant and more vulnerable to local extinction than populations at the centre of the range (Curnutt *et al.* 1996).

Most of the significant species are expected in the project area only as vagrants, and therefore the area is probably of low importance for them. Notes on species that are considered to be at least irregular visitors are provided below. Locally extinct species are also briefly discussed.

Table 5. Composition of extant conservation significant vertebrate fauna expected in the study area.

Taxon	Conservation Significant (CS) fauna		
	CS1	CS2	CS3
Frogs	-	-	-
Reptiles	1	1	1
Birds	6	-	2
Native Mammals	5	3	-
Invertebrates	-	-	-

(CS1 – listed under legislation; CS2 – listed as priority by DBCA; CS3 – locally significant).

Table 6. Conservation significant fauna species expected and confirmed in the project area (but including two locally extinct species).

Species listed as confirmed in the study area were recorded in previous surveys of Stages 2 and 3. Waterbirds are not expected in the project area but potentially nearby and are listed in Appendix 6.

CS Species	Status	CS Level	Confirmed	Expected Status
REPTILES				
Airlie Island Ctenotus <i>Ctenotus angusticeps</i>	V S3	CS1		Resident
Dampierland Plain Slider <i>Lerista separanda</i>	P2	CS2		Resident
Woma <i>Aspidites ramsayi</i>		CS3		Resident
BIRDS				
Fork-tailed Swift <i>Apus pacificus</i>	M S5	CS1	study area	Migrant
Peregrine Falcon <i>Falco peregrinus</i>	S7	CS1		Irregular visitor
Rainbow Bee-eater <i>Merops ornatus</i>		CS3	study area	Resident
Night Parrot <i>Pezoporus occidentalis</i>	E S1	CS1		Locally extinct?
Eastern Grass Owl <i>Tyto longimembris</i>		CS3		Vagrant
Grey Wagtail <i>Motacilla cinerea</i>	M S5	CS1		Vagrant
Yellow Wagtail <i>Motacilla flava</i>	M S5	CS1		Vagrant
Barn Swallow <i>Hirundo rustica</i>	M S5	CS1		Migrant
MAMMALS				
Brush-tailed Mulgara <i>Dasyercus blythi</i>	P4	CS2	study area	Regular visitor

CS Species	Status	CS Level	Confirmed	Expected Status
Northern Quoll <i>Dasyurus hallucatus</i>	E S2	CS1		Vagrant
Greater Bilby <i>Macrotis lagotis</i>	V S3	CS1	study area	Regular visitor
Golden Bandicoot <i>Isodon auratus</i>	V S3	CS1		Locally extinct
Northern Brushtail Possum <i>Trichosurus arnhemensis</i>	S3	CS1		Irregular visitor
Boodie <i>Bettongia lesueur</i>	Ex V S4 S6	CS1		Locally extinct
Spectacled Hare-Wallaby <i>Lagorchestes conspicillatus leichardti</i>	P3	CS2		Regular visitor
Ghost Bat <i>Macroderma gigas</i>	V S3	CS1		Vagrant
Pilbara Leaf-nosed Bat <i>Rhinonictis aurantia</i> (Pilbara form)	V S3 P4	CS1		Vagrant
Lakeland Downs Mouse <i>Leggadina lakedownensis</i>	P4	CS2		Irregular visitor
Total Number of Species:	21		4	

See Appendix 1 and 2 for descriptions of conservation significance levels. Species recorded are indicated and the predicted status of each species in the study area is also given.

See Appendix 6 for waterbirds.

Confirmed species in the study area = study area

EPBC Act listed species: V = Vulnerable, E = Endangered, C = Critically Endangered, M = Migratory.

WC Act listed species: S1 – S7 = Schedule 1 – 7; DpaW Priority Species: P1 – P5 = Priority 1 – 5.

Conservation significance level 1

Airlie Island Ctenotus

The Airlie Island Ctenotus has a restricted distribution, being confined to fragments of the Pilbara and southern Kimberley coast. Prior to 2012 it was known from only a few locations but is now known to occur in coastal areas and islands between Onslow and Broome, including four records from 2012 at Cape Keraudren, 15km to the west. The Airlie Island Ctenotus is described as occurring in low open samphire shrubland, coastal tussock or hummock grasslands and mangrove margins. Within the study area, it is therefore possible that the species occurs in the low open grasslands.

Migratory Waterbirds

Within the study area, there is no suitable habitat for the migratory waterbirds seen in the region and nearby (Appendix 6), however a wetland 2km to the east of the site would be used by many waterbird species. In addition, three listed migratory waterbirds are likely to occur regularly close by in the Ramsar site as they are grassland-dependent species that forage (mostly on invertebrates) on dry grasslands. These are the Oriental Plover, Little Curlew and Oriental Pratincole, and while only the Oriental Plover was recorded in September 2017 (in the Ramsar site in grasslands and salt pans), the Little Curlew and Oriental Pratincole arrive later in the year so can be expected regularly from about late October. The study area lacks the dry (but seasonally wet) grasslands that are used by grassland-

dependant waterbird species such as the Little Curlew and Oriental Pratincole, but such areas are adjacent.

Barn Swallow, Fork-tailed Swift and Rainbow Bee-eater

The swift and swallow are listed as Migratory; the bee-eater was formally also listed as Migratory but was removed in early 2018. It can still be considered locally significant. In this area the bee-eater is likely to be a resident and will breed in the area, especially on open ground. Therefore, open ground within study area could be used for breeding. The Barn Swallow breeds from the eastern Himalayas to Japan and is a non-breeding summer visitor to northern Australian coasts; it occurs in open country in coastal lowlands and may occur in the study area for part of the year, but most likely in small numbers. The Fork-tailed Swift is less predictable but could be a regular, non-breeding summer visitor that would overfly the area and thus would be more or less independent of terrestrial environments. The Rainbow Bee-eater was recorded in the July 2018 site visit and the Fork-tailed Swift has been recorded in the study area in 2017.

Peregrine Falcon

This species is known to occur over a wide range of environments across Australia. Preferred nesting locations include a range of elevated locations with steep bisected topography such as rocky hills, breakaways, cliffs and high artificial structures. It will also nest in very large, horizontally-aligned tree hollows, and in old Raven nests in tall trees (M. Bamford pers. Obs.). The study area may be within the hunting range of a pair of Peregrine Falcons, but as the project area lacks elevated landscapes/cliffs and tall trees, it is unlikely to support nesting.

Night Parrot

The Night Parrot is one of the rarest and most enigmatic of Australia's birds. It has been recorded only from arid landscapes of Australia's interior and while seen fairly regularly in the late 19th Century, it was considered by some authorities to be extinct by the middle of the 20th Century despite occasional unconfirmed sightings. Since then there have been several confirmed sightings of Night Parrots including at two locations in WA, the closest to the Pardoo area being on the Fortescue Marsh in the eastern Pilbara in 2005 (Davis and Metcalf 2008). Recent unpublished observations at a second location indicate the species favours long unburnt spinifex close to salt marsh. The general region around Pardoo and along the 80 Mile Beach includes areas of spinifex close to saline flats and marshes, but the frequency of fire is high. Recent observations on Night Parrots mean that recordings of their distinctive call are now available and it is known they call fairly reliably just after sunset; listening was carried out at the wetland (2km east of the study area) on the evening of 18th July 2018, but the species was not heard. This does not constitute a comprehensive survey for the species, but the fire frequency and lack of any unconfirmed records in the broader region suggest it is very unlikely to be present regularly and thus is classed as probably locally extinct.

Greater Bilby

The Bilby is listed as Vulnerable under the relevant state and federal legislation (DotEE 2016). The species formerly utilised a wide range of environments across the continent. Extant populations are restricted to a variety of "tall shrublands, open woodlands, and hummock grasslands" (Maxwell *et al.* 1996). The species appears to occur in scattered populations across the northern Pilbara, including close to Port Hedland (Thompson and Thompson 2008). The Greater Bilby has been recorded in Pardoo Station in all previous surveys (Bamford and Shepherd 2017, Bamford *et al.* 2018), and was

recorded in areas within the study area. Locations of Bilby records in the study area and in previous surveys nearby are described in Table 7 and shown in Figure 4, along with other conservation significant species. The Bilby is considered to be resident in the study area.

Table 7. Locations of Conservation significant fauna recorded in previous fauna surveys on Pardoo Station.

SGNH: South of Great Northern Hwy

GDA94 and MGA Zone K (51K for Stages 4 and 2, Zone 50K for 3 and Ramsar.)

Area	CS Fauna	Evidence	Easting	Northing	Status
SGNH	Bilby	Tracks	192863.69	7784520.74	Recent
SGNH	Bilby	Burrow, foraging	192745.59	7784840.56	Fresh
SGNH	Bilby	Tracks	192856.44	7784897.79	Fresh
SGNH	Bilby	Burrow	192042.96	7785384.79	Old
SGNH	Bilby	Burrow	192082.02	7782837.91	Old
SGNH	Bilby	Foraging	192059.95	7784770.22	Fresh
SGNH	Bilby	Foraging, scats	192761.47	7784824.66	Fresh
SGNH	Bilby	Tracks, foraging	192744.81	7784729.51	Recent
SGNH	Bilby	Tracks, foraging	192749.66	7784763.51	Fresh
SGNH	Bilby	Tracks	192758.21	7784801.99	Recent
SGNH	Bilby	Burrow	192750.37	7784842.63	Fresh
SGNH	Bilby	Burrow, foraging	192749.6	7784743.23	Fresh
SGNH	Bilby	Burrow	192710.86	7784420.32	Fresh
SGNH	Bilby	Foraging	192697.88	7784455.77	Recent
SGNH	Bilby	Foraging	192685.45	7784465.86	Recent
SGNH	Bilby	Foraging	192704.61	7784526.03	Recent
SGNH	Bilby	Foraging	192712.96	7784569.17	Recent
SGNH	Bilby	Scat	192696.38	7784553.15	Recent
SGNH	Bilby	Track	192695.53	7784452.3	Recent
SGNH	Bilby	Tracks, foraging and scats	192693.78	7784492.71	Fresh
SGNH	Bilby	Foraging	193711.47	7787092.98	old
SGNH	Brush-tailed Mulgara	Burrow	189631.2	7785748.77	Old
SGNH	Brush-tailed Mulgara	Burrow	190368.75	7781834.87	Recent
SGNH	Brush-tailed Mulgara	Burrow	190394.2	7781751.88	Recent
SGNH	Brush-tailed Mulgara	Burrow	193745.44	7787102.99	Fresh
3 (study area)	Bilby	Burrow	804615	7787767	Recently active
3 (study area)	Bilby	Burrow	804609	7787687	Recently active
3 (study area)	Bilby	Burrow	804621	7787642	Recently active
3 (study area)	Bilby	Burrow	804669	7787676	Active
3 (study area)	Bilby	Burrow	804658	7787623	Recently active
3 (study area)	Bilby	Burrow	804431	7787720	Recently active
3 (study area)	Bilby	Burrow	804432	7787691	Recently active
3 (study area)	Bilby	Burrow	804433	7787656	Active
3 (study area)	Bilby	Burrow	804479	7787657	Active

3 (study area)	Bilby	Burrow	804660	7787623	Recently active
3 (study area)	Bilby	Burrow	804360	7787821	Recently active
3 (study area)	Bilby	Burrow	804339	7787773	Old but well-formed
3 (study area)	Bilby	Burrow	804363	7787754	Old but well-formed
3 (study area)	Bilby	Burrow	804363	7787751	Recently active
3 (study area)	Bilby	Burrow	804680	7787815	Old – partly collapsed
3 (study area)	Bilby	Burrow	804857	7787884	Old – partly collapsed
3 (study area)	Bilby	Burrow	804904	7787578	Old – partly collapsed
3 (study area)	Bilby	Burrow	804721	7787351	Old – partly collapsed
3 (study area)	Brush-tailed Mulgara	Burrow	805893	7786540	Old
3 (study area)	Brush-tailed Mulgara	Track	805786	7786086	Old
Ramsar Site	Bilby	Track	806159	7787096	Recent
Ramsar Site	Oriental Plover	Observed	806778	7787626	Observed
Ramsar Site	Oriental Plover	Observed	804008	7788329	Observed
Ramsar Site	Oriental Plover	Observed	803647	7788224	Observed
2 (study area)	Bilby	tracks	186741	7788725	Recent
2 (study area)	Bilby	tracks	187842	7788730	Recent
2 (study area)	Bilby	tracks	188248	7788905	Recent
2 (study area)	Bilby	tracks	189056	7788765	Recent
2 (study area)	Bilby	tracks	188934	7789197	Recent
2 (study area)	Bilby	tracks	188973	7990067	Recent
2 (study area)	Bilby	burrows	189449	7789590	Old – partly collapsed
2 (study area)	Bilby	burrows	189476	7789564	Old – partly collapsed
2 (study area)	Bilby	burrows	189742	7789472	Old – partly collapsed
2 (study area)	Bilby	Foraging	189231	7789464	Recent
2 (study area)	Bilby	Foraging	189310	7789761	Recent
2 (study area)	Bilby	Foraging	189414	7789839	Recent
2 (study area)	Bilby	Foraging	189510	7789494	Recent
2 (study area)	Bilby	Foraging	189572	7789717	Recent
2 (study area)	Bilby	Foraging	189800	7789298	Recent
2 (study area)	Bilby	Foraging	190018	7789619	Recent
2 (study area)	Brush-tailed Mulgara	Potential burrow	186505	7787600	Recent



Plate 1. Greater Bilby *Macrotis lagotis* Foraging dig (Stage 3 area within the study area – July 2018).



Plate 2. View of Bilby burrow considered to be active (north-west corner of study area).



Plate 3. Bilby scat showing elongated form. Several scats of this form were found on or around typical Bilby digs. Note “scarified” soil surface which the Bilby has excavated (Stage 3 area within the study area, July 2018).



Plate 4. View of shrubland vegetation with occasional stands of larger Acacia scrub in north-west corner of study area where most Bilby signs were found (July 2018). Note broken surface of soil where Bilbies had been foraging for the bulbs of Bush Onions.



Plate 5. Photograph of female Bilby (July 2018); north-west corner of the Stage 3 study area.

Northern Brushtail Possum

While not recorded during surveys at Pardoo and not listed in databases for the area, BCE has two records from the greater area: inland of Sandfire Roadhouse (September 1997) and on Shelamar Station to the east-north-east (August 2017). These records suggest that the species is present in the general region and thus it was concluded that it may be an irregular visitor to the study area.

Locally extinct mammals

Two additional species are thought to be locally extinct from the area, the Golden Bandicoot and the Boodie. While these species are not expected to be present, they may have persisted in the area until the middle of the Twentieth Century. Their local extinction is likely due to a combination of factors including altered fire regimes, grazing impacts and feral predators.

Conservation significance level 2

Dampierland Plain Slider

The Dampierland Plain Slider occurs in sandy areas generally in coastal south-western Kimberley from Kimbolton to Nita Downs, however there are a few isolated records in the Pilbara including one 40km south of the study area. If present this species is likely to be resident in the study area.

Brush-tailed Mulgara

This species is generally associated with mature Spinifex hummock grasslands on sandplains and/or sand ridges but has been recorded from other VSAs. Evidence of Brush-tailed Mulgara (P4) was found during previous surveys from 2016 to 2018 in Stages 2,3 and 4 (Table 7, Figure 4) and the species is considered likely to be at least a regular visitor to the area.

Spectacled Hare-Wallaby

The Spectacled Hare-Wallaby is found in tussock or hummock grasslands, particularly where these are large and long-unburnt. The study area has fire in recent years (2016) so the habitat is not highly suitable, but the species could occur nearby with a recent (2017) record from Anna Plains Station (BCE database). Therefore, it is assumed to be at least a visitor.

Lakeland Downs Mouse

This species is often associated with Gilgai and clay soils in the Pilbara, and has been found around the lower slopes of rocky hills in the Great Sandy Desert (Bamford and Davies 1996). Although it does not appear to have declined, the species does show large fluctuations in population numbers (Moro and Kutt 2008). It may be present in the study area as an irregular visitor.

Conservation significance level 3

Bush Stone-curlew

This species was recently removed from the DBCA priority fauna list (CS2). The Bush Stone-curlew is a widespread species over much of northern Australia, however it has almost disappeared from the southern half of its range. It was recorded during the field survey south of the Great Northern Hwy and is expected to be a resident.

Woma

The Woma is widespread at low densities throughout sand plains of the semi-arid and arid inland of Western Australia. The southern population has suffered significant declines and is classed as a Priority species by DBCA (therefore CS2), but the northern population is considered stable (Maryan, 2002). It is considered to be resident in the study area and BCE has records from near Sandfire Roadhouse (1981), the mouth of Petermarer Creek (1995) and Shelamar Station (2017).

Eastern Grass Owl

While expected only as a vagrant, there were reports from Pardoo staff of 'barn owls' being flushed during the day in existing pivot irrigated pasture. This behaviour is typical of the Eastern Grass Owl, and suggests that the species may have colonised the area in response to the development of pivot irrigation. It otherwise is restricted to the Kimberley and has a patchy and uncertain distribution.

3.2.3 Introduced species

Eight introduced species could occur in the study area and the species of greatest interest is the Red Fox, due to the threat it poses to the Bilby. Suspected Fox tracks were found south of the Great Northern Hwy (July 2018) and the Fox is already a confirmed visitor to Stage 3 (within the study area); any increase in its abundance or persistence would be a risk to the Bilby.

The Cane Toad is also of concern as while not currently present, pivot irrigation systems may provide it with habitat. The expansion of pivot irrigation along the coast from Broome to Port Hedland may provide the species with a series of 'stepping stones' by which it could cross what has been identified as a major barrier to its spread in Western Australia (Tingley *et al.* 2012). The large distance between the pivot irrigation projects in the region may make it extremely difficult for Cane Toads to travel

unassisted between them, but Tingley *et al.* (2012) identified stock watering points as a 'risk' in this regard even in the absence of pivot systems. Nevertheless, unintentional transport of the species by vehicles probably presents a major threat.

Spread of Cane Toads is a regional issue which should be managed on a wholistic basis by regulatory authorities and cannot be attributed to one project. The responsibility for regional management cannot be placed on one pastoral station. However, Pardoo should participate in regional efforts coordinated by the regulators. The pivot irrigation systems and the workforce that will be established to operate these can assist with management by providing a management system to minimise the spread of the toad, including measures such as detection and local eradication, euthanising individuals caught and regulatory reporting. This is discussed further below (Recommendations).

3.2.4 *Patterns of biodiversity*

Analysing patterns of biodiversity requires massive levels of field studies, especially in an annually variable environment, but some patterns can be deduced even from a short period of field investigations. The study area study site appears fairly uniform with just two VSAs and VSA1 dominating most of the landscape. Within the study area, vegetation that has not been subject to frequent fires and/or grazing and/or development are likely to be most important for fauna, and there may be some edge effects along roads. Otherwise, the environment is fairly uniform and the distribution of biodiversity are likely to be similarly uniform.

3.2.5 *Ecological processes*

The nature of the landscape and the fauna assemblage indicate some of the ecological processes that may be important for ecosystem function (see Appendix 3 for descriptions and other ecological processes). These include:

Local hydrology. Local inundation patterns are affected by rainfall and surface hydrology. Effectively all the local environment is thus sensitive to hydrological change.

Fire. Based upon the appearance of vegetation, fires are frequent and often extensive, and may be altering vegetation structure and composition. Infrequent fire is natural in this landscape but changes to the fire regime can impact upon the fauna. Some fauna, including Bilbies, are reliant on occasional, cool fires. Evidence of a fire from approximately 2016 was found in stage 3 the western end of the study area.

Feral species and interactions with over-abundant native species. Feral species are a major component of the mammal fauna and as noted above, Foxes and Cane Toads may be of particular concern. Domestic livestock (Cattle) are not part of the fauna assemblage but they do impact upon the landscape through grazing and trampling.

Connectivity and landscape permeability. The study area is part of a much greater area of native vegetation that is largely continuous. There are no distinct linear environmental features likely to be important for connectivity, although the project area does overlie the transition between two major land systems (Anna and Nita Land systems). Landscape permeability is probably not currently a constraint for the fauna assemblage.

3.2.6 *Summary of fauna values*

The desktop study identified 186 vertebrate fauna species as potentially occurring in the study area: 5 frogs, 45 reptiles, 101 birds and 37 mammals. This excludes 51 water birds.

One bird and at least two mammal species may be locally extinct. The vertebrate assemblage includes 21 species of conservation significance. Most are expected only as vagrants or irregular visitors, with few species expected to be regularly reliant on the project area. The most notable of these is the Bilby (a regular visitor to Stage 2, 3 and 4) and a few migratory waterbirds that will use dry grasslands in the wetland site. There are an additional 16 conservation significant waterbird species including some migratory, which can be expected to be regular migrants visiting the claypans and wetland in small numbers (the latter habitats are close to but not within the study area).

Fauna values within the study area can be summarised as follows:

Fauna assemblage. Largely intact and moderately rich, but highly variable seasonally and annually. Assemblage includes elements of the Great Sandy Desert, Pilbara and Kimberley.

Species of conservation significance. Only a small number of the many significant species that may be present occasionally are actually reliant on the project area. The most notable of these are the Bilby (a regular visitor to Stage 2,3 and 4) and some migratory waterbirds that can be expected to be regular migrants visiting the claypans and wetlands outside of the study area.

Vegetation and Substrate Associations (VSAs). The study area is fairly uniform and supports only two VSA's and is dominated by VSA1.

Patterns of biodiversity. Within the study area, vegetation that has not been subject to excessively frequent fires and/or grazing and/or development are likely to be most important for fauna, and there may be some edge effects along roads. Otherwise, the environment is fairly uniform and the distribution of biodiversity are likely to be similarly uniform.

Key ecological processes. The main processes which may affect the fauna assemblage are likely to be local hydrology, the fire regime and the presence of feral predators.

3.3 Impact assessment

Impacting processes have to be considered in the context of fauna values and the nature of the proposed easement clearing and are examined below.

Habitat loss leading to population decline.

The area of habitat loss across the largely intact landscape is proportionately small, and therefore the impact upon fauna biodiversity from habitat loss is predicted to be negligible. The 1.2 ha of habitat disturbance proposed represents 0.0016% of the 75,040 ha of native vegetation from the Nita Land System within a 15 km buffer around the irrigation project (Figure 5).

Habitat loss leading to population fragmentation.

The area proposed for clearing does not have a connectivity function for fauna as it lies in a fairly uniform landscape.

Mortality during clearing

Mortality of fauna during clearing is inevitable and can be a conservation concern if the species are of conservation significance or naturally occur at low population densities. However, given the small area of habitat, this is not expected to be a significant impact with appropriate pre-clearing inspections by site personnel and photographs of any burrows sent to an experienced zoologist for interpretation and advice regarding management.

Degradation of habitat due to weed invasion.

This impact should be negligible assuming standard hygiene and monitoring procedures are employed.

Ongoing mortality from traffic

It is understood that speed limits are in place – this should minimise risk.

Hydrological change

Assuming that access road design follows accepted practices to manage hydrological flows this risk should be negligible.

Altered fire regimes

The vegetation in general is fire-dependent but can be degraded if subjected to too-frequent fires. Increased human activity in the area could result in an increase in fire frequency, and therefore strict fire management measures should be in place (it is understood Pardoo have a fire management plan in place).

Disturbance (dust, noise, light).

The level of dust, noise and light from construction of the access roads should be minimal, given the small area to be disturbed.

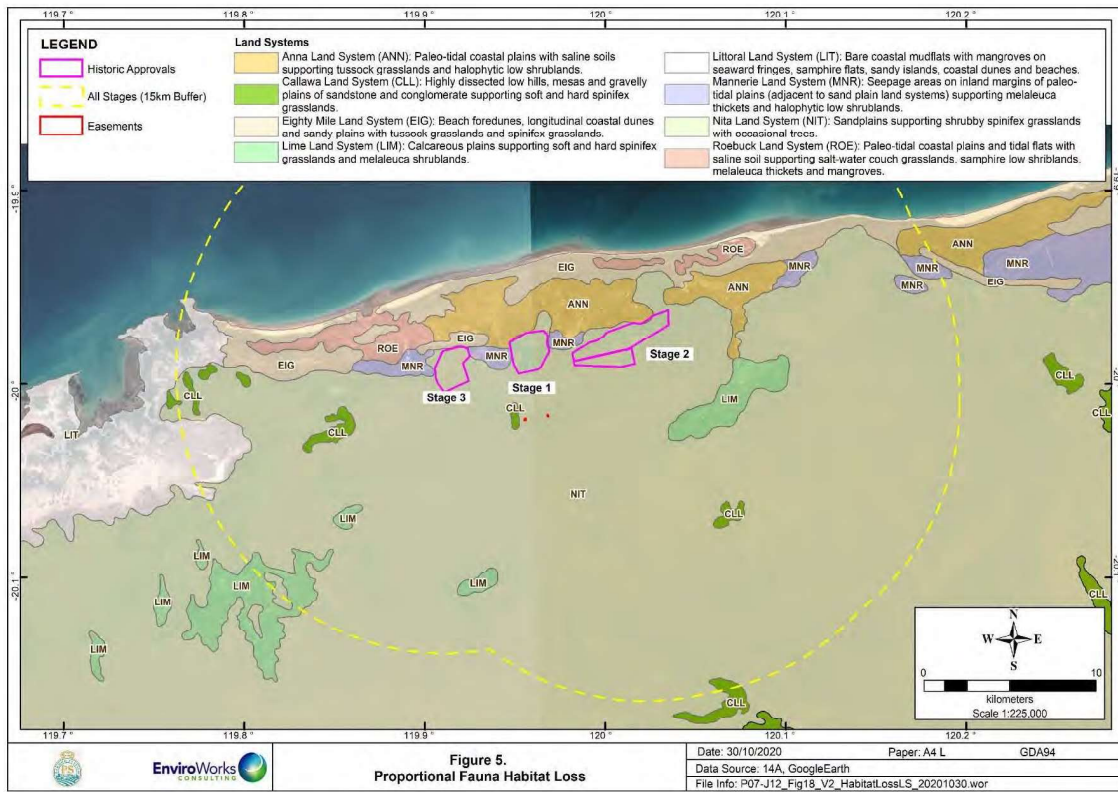


Figure 5. Similar habitat (Nita land system) in a 15 km buffer around project

4 Recommendations

Potential impacts to fauna include:

- mortality during clearing
- mortality from traffic
- weed invasion
- hydrological change
- altered fire regimes.

Because of the small area of clearing involved in a largely intact landscape and management measures to be implemented, potential impacts are mostly considered to be negligible.

Recommendations to manage potential impacts include:

- Appropriate pre-clearing inspections by site personnel and photographs of any burrows sent to an experienced zoologist for interpretation and advice regarding management.
- Displacement of significant fauna (Bilby and Mulgara) that may be present within disturbance footprint with advice from an experienced zoologist.
- Maintain appropriate speed limits.
- Implement/continue standard weed hygiene and monitoring procedures.
- Hydrological management to prevent hydrological impacts (appropriate road design).
- Fire management measures (continue implementation of existing fire management plan).

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6 Appendices

6.1 Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation/substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver et al. 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relict or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Western Australian Wildlife Conservation Act 1950 (Wildlife Conservation Act). In addition, the Western Australian Department of Environment and Conservation (DEC) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The Wildlife Conservation Act uses a series of Schedules to classify status, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of Mace and Stuart (1994).

Conservation Significance (CS) 2: Species listed as Priority by the DEC but not listed under State or Commonwealth Acts.

In Western Australia, the DEC has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the Wildlife Conservation Act but for which the DEC feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population

level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DPaW, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (DEP 2000).

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicida (phreatoicidan crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined below are effectively the ecological processes that can be altered to result in impacts upon fauna.

6.2 Appendix 2. Categories used in the assessment of conservation status.

IUCN categories (based on review by Mace and Stuart 1994) as used for the Environment Protection and Biodiversity Conservation Act 1999 and the Western Australian Wildlife Conservation Act 1950.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	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 (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA Wildlife Conservation Act 1950

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA Department of Biodiversity, Conservation and Attractions Priority species (species not listed under the Wildlife Conservation Act 1950, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
	Taxa in need of monitoring.
Priority 4. (P4)	Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

6.3 Appendix 2. Vertebrate fauna expected to occur in the study area.

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the local area. These are:

- ALA = Atlas of Living Australia, searched July 2018 and April 2020;
- N = Naturemap Database, searched July 2018 and April 2020;
- EPBC = EPBC Protected Matters, searched July 2018 and April 2020;
- DBCA = DBCA Significant species search, searched September 2017;
- Bird Data = Birdlife Australia's Birdata database, searched July 2018 and April 2020;
- **PPS = Previous Pardoo Surveys** (BCE surveys undertaken previously in the general area (BCE database records 1981 to 2018), BCE surveys undertaken previously on Pardoo Station (Bamford *et al.* 2016; Bamford and Shepherd 2017 and Bamford *et al.* 2018 (three reports in 2018)). Includes species records from nearby, stage 2, 3, 4 and in the Ramsar Site.
- Appendix 3, excludes waterbirds of which 51 are expected (these are listed in Appendix 6)

Stage 4 is no longer being considered for development at this time.

Status codes:

- CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 2 for full explanation.
- EPBC Act listings: E = Endangered, V = Vulnerable, Mig = Migratory, Mar = Marine (see Appendix 2).
- Wildlife Conservation Act listings: for all CS1 species S1 to 7 = Schedules 1 to 7 respectively, (see Appendix 2) with rankings shown in square parentheses: [e] = endangered, [v] = vulnerable.
- DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).

Frogs

FROGS		CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
HYLIDAE								
Main's Frog	<i>Cyclorana maini</i>		X					Resident
Green Tree Frog	<i>Litoria caerulea</i>						X	Visitor
Desert Tree Frog	<i>Litoria rubella</i>						X	Resident
MYOBATRACHIDAE								
Northern Burrowing Frog	<i>Neobatrachus aquilonius</i>		X	X				Resident
Desert Spadefoot Toad	<i>Notaden nichollsi</i>							Resident
Total Number of Species Expected:	5	0	2	1	0	0	2	

Reptiles

REPTILES	CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
AGAMIDAE							
Ta-ta, Gilbert's Dragon <i>Amphibolurus gilberti</i>		X					Resident
Long-nosed Dragon <i>Amphibolurus longirostris</i>		X					Resident
Ring-tailed Dragon <i>Ctenophorus caudicinctus</i>		X					Vagrant
Military Dragon <i>Ctenophorus isolepis</i>		X				X	Resident
Central Netted Dragon <i>Ctenophorus nuchalis</i>		X				X	Resident
Pindan Dragon <i>Diporiphora pindan</i>		X					Resident
Dwarf Bearded Dragon <i>Pogona minor mitchelli</i>		X	X			X	Resident
DIPLODACTYLIDAE							
Fat-tailed Gecko <i>Diplodactylus conspicillatus</i>						X	Resident
Crowned Gecko <i>Lucasium stenodactylum</i>		X				X	Resident
Western Beaked Gecko <i>Rhynchoedura ornata</i>							Resident
Northern Spiny-tailed Gecko <i>Strophurus ciliaris aberrans</i>		X					Resident
<i>Strophurus wellingtonae</i>						X	Resident
CARPHODACTYLIDAE							
Smooth Knob-tailed Gecko <i>Nephrurus levis</i>		X					Resident
GEKKONIDAE							
Pilbara Dtella <i>Gehyra pilbara</i>							Resident
Tree Dtella <i>Gehyra variegata</i>							Resident
Common House Gecko <i>Hemidactylus frenatus</i>						X	Vagrant
Bynoe's Gecko <i>Heteronotia binoei</i>		X				X	Resident

REPTILES		CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
PYGOPODIDAE								
Neck-barred Delma	<i>Delma haroldi</i>		X	X				Resident
Excitable Delma	<i>Delma tinctoria</i>						X	Resident
Burton's Legless Lizard	<i>Lialis burtonis</i>							Resident
SCINCIDAE								
Airlie Island Ctenotus	<i>Ctenotus angusticeps</i>	V P3			X	X		Resident
Bar-shouldered Ctenotus	<i>Ctenotus inornatus</i>		X					Resident
Leopard Ctenotus	<i>Ctenotus pantherinus</i>		X					Resident
Rock Ctenotus	<i>Ctenotus saxatilis</i>						X	Resident
North-western Sandy-loam Ctenotus	<i>Ctenotus serventyi</i>							Resident
Mosaic Desert Skink	<i>Eremiascincus musivus</i>		X					Resident
North-western Sandslider	<i>Lerista bipes</i>		X	X				Resident
Dampierland Plain Slider	<i>Lerista separanda</i>	P2				X		Resident
Common dwarf skink	<i>Menetia greyii</i>						X	Resident
Lined Fire-tailed Skink	<i>Morethia ruficauda</i>						X	Resident
Central Blue-tongue	<i>Tiliqua multifasciata</i>		X				X	Resident
VARANIDAE								
Spiny-Tailed Monitor	<i>Varanus acanthurus</i>						X	Resident
Pygmy Desert Monitor	<i>Varanus eremius</i>		X					Resident
Gould's Goanna	<i>Varanus gouldii</i>						X	Resident

REPTILES		CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
TYPHLOPIDAE								
Long-beaked Blind Snake	<i>Anilius grypus</i>		X				X	Resident
BOIDAE								
Stimson's Python	<i>Antaresia stimsoni</i>		X	X				Resident
Black-headed Python	<i>Aspidites melanocephalus</i>						X	Resident
Woma	<i>Aspidites ramsayi</i>	CS3					X	Resident
ELAPIDAE								
Desert Death-adder	<i>Acanthophis pyrrhus</i>		X					Resident
Yellow-faced Whipsnake	<i>Demansia psammophis cupreiceps</i>							Resident
Moon Snake	<i>Furina ornata</i>		X					Resident
Mulga Snake	<i>Pseudechis australis</i>						X	Resident
Western Brown Snake	<i>Pseudonaja mengdeni</i>							Resident
Ringed Brown Snake	<i>Pseudonaja modesta</i>		X	X				Resident
Desert Banded Snake	<i>Simoselaps anomalus</i>						X	Resident
Total Number of Species Expected:	45	3	23	5	1	2	20	

Birds Note: This Appendix excludes waterbirds of which 51 are expected (listed in Appendix 6).

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
CASUARIIDAE								
Emu <i>Dromaius novaehollandiae</i>								Irregular Visitor
PHASIANIDAE								
Brown Quail <i>Coturnix ypsilophora</i>		X				X	x	Regular Visitor
TURNICIDAE								
Little Button-quail <i>Turnix velox</i>		X	X			X	X	Resident
COLUMBIDAE								
Diamond Dove <i>Geopelia cuneata</i>		X	X			X	X	Resident
Bar-shouldered Dove <i>Geopelia humeralis</i>			X					Regular Visitor
Peaceful Dove <i>Geopelia placida</i>		X				X		Regular visitor
Spinifex Pigeon <i>Geophaps plumifera</i>								Vagrant
Crested Pigeon <i>Ocyphaps lophotes</i>		X	X			X	X	Resident
Common Bronzewing <i>Phaps chalcoptera</i>							X	Resident
Flock Bronzewing <i>Phaps histrionica</i>							X	Vagrant
CUCULIDAE								
Pallid Cuckoo <i>Cacomantis pallidus</i>		X	X			X	X	Migrant
Pheasant Coucal <i>Centropus phasianinus</i>		X				X	X	Resident

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Horsfield's Bronze-Cuckoo <i>Chalcites basalis</i>		X				X	X	Migrant
Black-eared Cuckoo <i>Chrysococcyx osculans</i>							X	Migrant
APODIDAE								
Fork-tailed Swift <i>Apus pacificus</i>	M S5	X	X	X	X	X	X	Migrant
GLAREOLIDAE								
Oriental Pratincole <i>Glareola maldivarum</i>	M S5			X	X	X		Migrant
Australian Pratincole <i>Stiltia isabella</i>				X		X	X	Regular visitor
GRUIDAE								
Brolga <i>Grus rubicunda</i>		X	X			X	X	Resident
OTIDIDAE								
Australian Bustard <i>Ardeotis australis</i>		X	X			X	X	Irregular visitor
BURHINIDAE								
Bush Stone-curlew <i>Burhinus grallarius</i>	CS3	X					X	Resident
PLATALEIDAE								
Straw-necked Ibis <i>Threskiornis spinicollis</i>		X	X			X	X	Regular visitor
ACCIPITRIDAE								
Collared Sparrowhawk <i>Accipiter cirrocephalus</i>								Resident

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Brown Goshawk <i>Accipiter fasciatus</i>							X	Resident
Wedge-tailed Eagle <i>Aquila audax</i>		X	X			X	X	Regular visitor
Swamp Harrier <i>Circus approximans</i>								Vagrant
Spotted Harrier <i>Circus assimilis</i>		X	X			X	X	Resident
Black-shouldered Kite <i>Elanus axillaris</i>		X				X	X	Resident
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>		X		X		X		Vagrant
Brahminy Kite <i>Haliastur indus</i>		X				X		Vagrant
Whistling Kite <i>Haliastur sphenurus</i>		X	X			X	X	Resident
Black-breasted Buzzard <i>Hamirostra melanosternon</i>		X	X			X		Regular visitor
Little Eagle <i>Hieraaetus morphnoides</i>							X	Regular visitor
Black Kite <i>Milvus migrans</i>		X	X			X	X	Resident
Eastern Osprey <i>Pandion cristatus</i>	M 55			X				Vagrant
FALCONIDAE								
Brown Falcon <i>Falco berigora</i>		X	X			X	X	Resident
Nankeen Kestrel <i>Falco cenchroides</i>		X	X			X	X	Resident
Australian Hobby <i>Falco longipennis</i>		X				X	X	Resident
Peregrine Falcon <i>Falco peregrinus</i>	S7				X			Irregular visitor
STRIGIDAE								
Southern Boobook <i>Ninox baobook</i>						X		Resident

BIRDS		CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Morepork	<i>Ninox novaeseelandiae</i>		X						
Barking Owl	<i>Ninox connivens</i>								Irregular visitor
TYTONIDAE									
Barn Owl	<i>Tyto alba</i>							X	Regular visitor
Eastern Grass Owl	<i>Tyto longimembris</i>	CS3							Vagrant
CAPRIMULGIDAE									
Spotted Nightjar	<i>Eurostopodus argus</i>							X	Resident
MEROPIIDAE									
Rainbow Bee-eater	<i>Merops ornatus</i>	CS3	X	X	X	X	X	X	Resident
ALCEDINIDAE									
Collared Kingfisher	<i>Todiramphus chloris</i>								Vagrant
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>		X	X			X	X	Regular visitor
Sacred Kingfisher	<i>Todiramphus sanctus</i>		X				X		Irregular visitor
CACATUIDAE									
Little Corella	<i>Cacatua sanguinea</i>						X	X	Regular visitor
Galah	<i>Eolophus roseicapilla</i>		X	X			X	X	Regular visitor
Cockatiel	<i>Nymphicus hollandicus</i>		X	X			X	X	Regular visitor

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
PSITTACIDAE								
Budgerigar <i>Melopsittacus undulatus</i>		X	X			X	X	Regular visitor
Night Parrot <i>Pezoporus occidentalis</i>	E S1			X				Locally extinct??
PTILONORHYNCHIDAE								
Western Bowerbird <i>Ptilonorhynchus guttatus</i>		X				X		Vagrant
MALURIDAE								
Variegated Fairy-wren <i>Malurus lamberti</i>		X	X			X	X	Resident
White-winged Fairy-wren <i>Malurus leucopterus</i>		X	X			X	X	Resident
Red-backed Fairy-wren <i>Malurus melanocephalus</i>		X	X			X		Irregular visitor
MELIPHAGIDAE								
Spiny-cheeked Honeyeater <i>Acanthagenys rufogularis</i>		X				X		Irregular visitor
Pied Honeyeater <i>Certhionyx variegatus</i>						X		Regular visitor
Orange Chat <i>Epthianura aurifrons</i>								Irregular visitor
Crimson Chat <i>Epthianura tricolor</i>						X	X	Resident
Singing Honeyeater <i>Gavicalis virescens</i>		X				X	X	Resident
Brown Honeyeater <i>Lichmera indistincta</i>		X	X			X	X	Resident

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Yellow-throated Miner <i>Manorina flavigula</i>		X	X			X	X	Resident
Red-headed Honeyeater <i>Myzomela erythrocephala</i>								Vagrant
Grey-headed Honeyeater <i>Ptilotula keartlandi</i>								Irregular visitor
White-plumed Honeyeater <i>Ptilotula penicillata</i>		X				X	X	Regular visitor
Black Honeyeater <i>Sugomel niger</i>		X				X	X	Regular visitor
Little Friarbird <i>Philemon citreogularis</i>		X						Irregular visitor
PARDALOTIDAE								
Red-browed Pardalote <i>Pardalotus rubricatus</i>						X	X	Regular visitor
ACANTHIZIDAE								
Weebill <i>Smicronis brevirostris</i>								Irregular visitor
POMATOSTOMIDAE								
Grey-crowned Babbler <i>Pomatostomus temporalis</i>		X					X	Resident
CAMPEPHAGIDAE								
Black-faced Cuckoo-shrike <i>Coracina novaehollandiae</i>		X	X			X	X	Resident
White-winged Triller <i>Lalage tricolor</i>		X				X	X	Resident
PACHYCEPHALIDAE								

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Grey Shrike-thrush <i>Colluricincla harmonica</i>								Resident
Rufous Whistler <i>Pachycephala rufiventris</i>		X	X			X	X	Resident
OREOICIDAE								
Crested Bellbird <i>Oreoica gutturalis</i>		X				X		Regular visitor
ARTAMIDAE								
Black-faced Woodswallow <i>Artamus cinereus</i>		X	X			X	X	Resident
White-breasted Woodswallow <i>Artamus leucorhynchus</i>		X				X		Regular visitor
Masked Woodswallow <i>Artamus personatus</i>						X	X	Regular visitor
Pied Butcherbird <i>Cracticus nigrogularis</i>		X	X			X	X	Resident
Australian Magpie <i>Cracticus tibicen</i>		X	X			X	X	Regular visitor
RHIPIDURIDAE								
Grey Fantail <i>Rhipidura fuliginosa</i>								Regular visitor
Willie Wagtail <i>Rhipidura leucophrys</i>		X	X			X	X	Resident
Northern Fantail <i>Rhipidura rufiventris</i>								Vagrant
CORVIDAE								

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Little Crow <i>Corvus bennetti</i>								Regular visitor
Torresian Crow <i>Corvus orru</i>		X	X			X	X	Resident
MONARCHIDAE								
Magpie-lark <i>Grallina cyanoleuca</i>		X	X			X	X	Resident
NECTARINIIDAE								
Mistletoebird <i>Dicaeum hirundinaceum</i>								Regular visitor
ESTRILDIDAE								
Painted Finch <i>Emblema pictum</i>		X	X					Vagrant
Zebra Finch <i>Taeniopygia guttata</i>		X	X			X	X	Resident
MOTACILLIDAE								
Australasian Pipit <i>Anthus novaeseelandiae</i>		X				X	X	Resident
Grey Wagtail <i>Motacilla cinerea</i>	M S5			X				Vagrant
Yellow Wagtail <i>Motacilla flava</i>	M S5			X		X		Vagrant
ALAUDIDAE								
Horsfield's Bushlark <i>Mirafrja javanica</i>						X	X	Resident
LOCUSTELLIDAE								
Brown Songlark <i>Cincloramphus cruralis</i>							X	Resident
Rufous Songlark <i>Cincloramphus mathewsi</i>		X				X		Resident
HIRUNDINIDAE								

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BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Welcome Swallow <i>Hirundo neoxena</i>								Irregular visitor
Barn Swallow <i>Hirundo rustica</i>	M S5		X	X	X	X		Regular migrant
Fairy Martin <i>Petrochelidon ariel</i>		X	X			X	X	Regular visitor
Tree Martin <i>Petrochelidon nigricans</i>		X	X			X	X	Regular visitor
ZOSTEROPIDAE								
Yellow White-eye <i>Zosterops luteus</i>		X					X	Regular visitor
Total Number of Species Expected:	101	11	61	39	10	5	66	61

Mammals

MAMMALS	CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
TACHYGLOSSIDAE							
Echidna <i>Tachyglossus aculeatus</i>						X	Resident
DASYURIDAE							
Brush-tailed Mulgara <i>Dasyercus blythi</i>	P4					X	Regular visitor
Northern Quoll <i>Dasyurus hallucatus</i>	E S2			X	X		Vagrant
Stripe-faced Dunnart <i>Sminthopsis macroura</i>							Resident
THYLACOMYIDAE							
Greater Bilby <i>Macrotis lagotis</i>	V S3		X	X	X	X	Regular visitor
PERAMELIDAE							
Golden Bandicoot <i>Isoodon auratus</i>	V S3						Locally Extinct
PHALANGERIDAE							
Northern Brushtail Possum <i>Trichosurus arnhemensis</i>	S3					X	Irregular visitor
POTOROIDAE							
Boodie <i>Bettongia lesueur</i>	Ex V S4 S6						Locally Extinct
MACROPODIDAE							
Spectacled Hare-Wallaby <i>Lagorchestes conspicillatus</i>	P3				X	X	Regular visitor
Agile Wallaby <i>Macropus agilis</i>						X	Resident

MAMMALS		CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
Red Kangaroo	<i>Macropus rufus</i>							Irregular visitor
Euro	<i>Macropus robustus</i>						X	Resident
PTEROPODIDAE								
Little Red Flying-fox	<i>Pteropus scapulatus</i>						X	Irregular visitor
EMBALLONURIDAE								
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>							Regular visitor
Common Sheath-tailed Bat	<i>Taphozous georgianus</i>							Regular visitor
MEGADERMATIDAE								
Ghost Bat	<i>Macroderma gigas</i>	V S3			X	X		Vagrant
HIPPOSIDERIDAE								
Pilbara Leaf-nosed Bat	<i>Rhinonictis aurantia (Pilbara form)</i>	V S3 P4			X			Vagrant
MOLOSSIDAE								
White-striped Free-tailed Bat	<i>Austronomus australis</i>							Regular migrant
Northern Free-tailed Bat	<i>Chaerephon jobensis</i>							Regular visitor
Beccari's Free-tailed Bat	<i>Mormopterus beccari</i>							Irregular visitor
VESPERTILIONIDAE								

MAMMALS		CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>							Regular visitor
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>							Resident
Northern Long-eared Bat	<i>Nyctophilus arnhemensis</i>							Regular visitor
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>							Resident
Little Broad-nosed Bat	<i>Scotorepens greyii</i>							Regular visitor
MURIDAE								
Spinifex Hopping Mouse	<i>Notomys alexis</i>		X	X			X	Resident
Lakeland Downs Mouse	<i>Leggadina lakedownensis</i>	P4					X	Irregular visitor
Western Chestnut Mouse	<i>Pseudomys nanus</i>							Irregular visitor
Sandy Inland Mouse/Mingiri	<i>Pseudomys hermansbergensis</i>						X	Resident
INTRODUCED MAMMALS								
Dromedary Camel	<i>Camelus dromedarius</i>	Int.			X			Regular visitor
Dog, Dingo	<i>Canis lupus dingo</i>	Int.			X		X	Resident
Horse	<i>Equus caballus</i>	Int.					X	Regular visitor

MAMMALS	CS	ALA	N	EPBC	DBCA	PPS	Expected status in project area
Donkey <i>Equus asinus</i>	Int.			X			Regular visitor
Cat <i>Felis catus</i>	Int.			X		X	Resident
House Mouse <i>Mus musculus</i>	Int.	X	X	X			Resident
Pig <i>Sus scrofa</i>	Int.			X			Vagrant
Red Fox <i>Vulpes vulpes</i>	Int.			X		X	Regular visitor
Total Number of Native Species Expected:	38	18	2	3	11	4	15

6.4 Appendix 3. Vertebrate species returned in database searches but unlikely to occur in the project area

Database searches often return species found nearby but that are unlikely to be present in the study area due to lack of suitable habitat (e.g. aquatic species) or ecological barriers preventing them from reaching the area (e.g. island species). There are also some errors, out-of-date Latin names, zoo specimens and subtleties of distribution that are not recognised in databases. The species listed below are considered highly unlikely to be found in the study area (although some species could occur as very rare vagrants).

Note – Full species list of waterbirds potentially occurring in the greater region and recorded in previous surveys at the Ramsar Site and Wetland are listed in Appendix 6.

Common name	Scientific name
FISH	
Helen's Pygmy Pipehorse	<i>Acentronura larsonae</i>
Narrow Sawfish	<i>Anoxypristis cuspidata</i>
Braun's Pughead Pipefish	<i>Bulbonaricus brauni</i>
Three-keel Pipefish	<i>Campichthys tricarinatus</i>
Great White Shark	<i>Carcharodon carcharias</i>
Pacific Short-bodied Pipefish	<i>Choeroichthys brachysoma</i>
Muiron Island Pipefish	<i>Choeroichthys latispinosus</i>
Pig-snouted Pipefish	<i>Choeroichthys suillus</i>
Banded Pipefish	<i>Doryrhamphus dactyliophorus</i>
Cleaner Pipefish	<i>Doryrhamphus janssi</i>
Many-banded Pipefish	<i>Doryrhamphus multiannulatus</i>
Flagtail Pipefish	<i>Doryrhamphus negrosensis</i>
Ladder Pipefish	<i>Festucalex scalaris</i>
Tiger Pipefish	<i>Filicampus tigris</i>
Spotted Moray Eel	<i>Gymnothorax isingteena</i>
Brock's Pipefish	<i>Halicampus brocki</i>
Mud Pipefish	<i>Halicampus grayi</i>
Glittering Pipefish	<i>Halicampus nitidus</i>
Spiny-snout Pipefish	<i>Halicampus spinostris</i>

Common name	Scientific name
Ribboned Pipehorse	<i>Haliichthys taeniophorus</i>
Beady Pipefish	<i>Hippichthys penicillus</i>
Western Spiny Seahorse	<i>Hippocampus angustus</i>
Spiny Seahorse	<i>Hippocampus histrix</i>
Spotted Seahorse	<i>Hippocampus kuda</i>
Flat-face Seahorse	<i>Hippocampus planifrons</i>
Three-spot Seahorse	<i>Hippocampus trimaculatus</i>
Shortfin Mako	<i>Isurus oxyrinchus</i>
Longfin Mako	<i>Isurus paucus</i>
Reef Manta Ray	<i>Manta alfredi</i>
Giant Manta Ray	<i>Manta birostris</i>
Tidepool Pipefish	<i>Micrognathus micronotopterus</i>
Black Rock Pipefish	<i>Phoxocampus belcheri</i>
Dwarf Sawfish	<i>Pristis clavata</i>
Freshwater Sawfish	<i>Pristis pristis</i>
Green Sawfish	<i>Pristis zijsron</i>
Whale Shark	<i>Rhincodon typus</i>
Pallid Pipehorse	<i>Solegnathus hardwickii</i>
Gunther's Pipehorse	<i>Solegnathus lettiensis</i>
Robust Ghostpipefish	<i>Solenostomus cyanopterus</i>
Rough-snout Ghost Pipefish	<i>Solenostomus paegnius</i>
Double-end Pipehorse	<i>Syngnathoides biaculeatus</i>
Bentstick Pipefish	<i>Trachyrhamphus bicoarctatus</i>
Straightstick Pipefish	<i>Trachyrhamphus longirostris</i>
REPTILES	
Horned Seasnake	<i>Acalyptophis peronii</i>
Short-nosed Seasnake	<i>Aipysurus apraefrontalis</i>
Dubois' Seasnake	<i>Aipysurus duboisii</i>
Spine-tailed Seasnake	<i>Aipysurus eydouxii</i>
Olive Seasnake	<i>Aipysurus laevis</i>

Common name	Scientific name
Brown-lined Seasnake	<i>Aipysurus tenuis</i>
Stokes' Seasnake	<i>Astrotia stokesii</i>
Loggerhead Turtle	<i>Caretta caretta</i>
Green Turtle	<i>Chelonia mydas</i>
Leatherback Turtle	<i>Dermochelys coriacea</i>
Spectacled Seasnake	<i>Disteira kingii</i>
Olive-headed Seasnake	<i>Disteira major</i>
Turtle-headed Seasnake	<i>Emydocephalus annulatus</i>
North-western Mangrove Seasnake	<i>Ephalophis greyi</i>
Hawksbill Turtle	<i>Eretmochelys imbricata</i>
Black-ringed Seasnake	<i>Hydrelaps darwiniensis</i>
Elegant Seasnake	<i>Hydrophis elegans</i>
	<i>Hydrophis mcdowelli</i>
Spotted Seasnake	<i>Hydrophis ornatus</i>
Flatback Turtle	<i>Natator depressus</i>
Yellow-bellied Seasnake	<i>Pelamis platurus</i>
	<i>Aipysurus laevis</i>
	<i>Ephalophis greyi</i>
Olive Python (Pilbara subspecies)	<i>Liasis olivaceus barroni</i>
BIRDS	
Oriental Cuckoo	<i>Cuculus optatus</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>
Greater Sand Plover	<i>Charadrius leschenaultii</i>
Lesser Sand Plover	<i>Charadrius mongolus</i>
Pacific Golden Plover	<i>Pluvialis fulva</i>
Grey Plover	<i>Pluvialis squatarola</i>
Whimbrel	<i>Numenius phaeopus</i>
Ruff	<i>Philomachus pugnax</i>
Grey-tailed Tattler	<i>Tringa brevipes</i>
Spotted Redshank	<i>Tringa erythropus</i>
Common Sandpiper	<i>Actitis hypoleucos</i>
Ruddy Turnstone	<i>Arenaria interpres</i>

Common name	Scientific name
Sanderling	<i>Calidris alba</i>
Red Knot	<i>Calidris canutus</i>
Great Knot	<i>Calidris tenuirostris</i>
Asian Dowitcher	<i>Limnodromus semipalmatus</i>
Bar-tailed Godwit	<i>Limosa lapponica menzbieri</i>
Black-tailed Godwit	<i>Limosa limosa</i>
Eastern Curlew	<i>Numenius madagascariensis</i>
Common Redshank	<i>Tringa totanus</i>
Terek Sandpiper	<i>Xenus cinereus</i>
Red-tailed Tropicbird	<i>Phaethon rubricauda</i>
Streaked Shearwater	<i>Calonectris leucomelas</i>
Southern Giant-Petrel	<i>Macronectes giganteus</i>
Wedge-tailed Shearwater	<i>Puffinus pacificus</i>
Common Noddy	<i>Anous stolidus</i>
Caspian Tern	<i>Hydroprogne caspia</i>
Little Tern	<i>Sternula albifrons</i>
Roseate Tern	<i>Sterna dougallii</i>
Common Tern	<i>Sterna hirundo</i>
Lesser Crested Tern	<i>Thalasseus bengalensis</i>
Crested Tern	<i>Thalasseus bergii</i>
Beach Stone-curlew	<i>Esacus magnirostris</i>
Striated Heron	<i>Butorides striata</i>
Eastern Reef Egret	<i>Egretta sacra</i>
Lesser Frigatebird	<i>Fregata ariel</i>
Great Frigatebird	<i>Fregata minor</i>
Brown Booby	<i>Sula leucogaster</i>
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Pied Cormorant	<i>Phalacrocorax varius</i>
Australasian Darter	<i>Anhinga novaehollandiae</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
White-bellied Cuckoo-Shrike	<i>Coracina papuensis</i>

Common name	Scientific name
MAMMALS	
Northern Marsupial Mole	<i>Notoryctes caurinus</i>
Loria's Mastiff Bat	<i>Ozimops loriae</i>
Western Pebble-mound Mouse	<i>Pseudomys chapmani</i>
Bryde's Whale	<i>Balaenoptera edeni</i>
Blue Whale	<i>Balaenoptera musculus</i>
Common Dolphin	<i>Delphinus delphis</i>
Dugong	<i>Dugong dugon</i>
Risso's Dolphin	<i>Grampus griseus</i>
Humpback Whale	<i>Megaptera novaeangliae</i>
Orca	<i>Orcinus orca</i>
Indo-Pacific Humpback Dolphin	<i>Sousa chinensis</i>
Spotted Dolphin	<i>Stenella attenuata</i>
Spotted Bottlenose Dolphin	<i>Tursiops aduncus</i>
Bottlenose Dolphin	<i>Tursiops truncatus s. str.</i>
Total Number of Species:	126

6.5 Appendix 4. Annotated species list

Annotated Bird species list for study area – from previous lists in Pivot areas of Stage 2 and 3 which are within the study area.

1. Australian White Ibis. One along road near current pivots.
2. Australian Bustard. One seen and few tracks.
3. Black Kite. Several seen regularly.
4. Whistling Kite. Few around pivots; more common along highway.
5. Little Eagle. One over pivot 11.
6. Spotted Harrier. One or two seen regularly.
7. Wedge-tailed Eagle. One dead along nearby highway and one over Pivot 12 (29/06/17).
8. Australian Hobby. Seen occasionally over pivots.
9. Brown Falcon. Several around pivot.
10. Nankeen Kestrel. Several around pivots.
11. Black-shouldered Kite. One seen over pivots.
12. Common Bronzewing. One on highway near pivots.
13. Crested Pigeon. Flocks of up to 10 around pivots.
14. Diamond Dove. Flocks of up to 10 around pivots.
15. Galah. About 30 over pivots in evening of 29/06.
16. Budgerigar. Flocks of up to 200 regularly.
17. Cockatiel. Flocks of up to 20 regularly.
18. Little Button-quail. Abundant in groups of two or three; flushed regularly.
19. Pallid Cuckoo. One at Pivot 12 (29/06).
20. Horsfield's Bronze-Cuckoo. Two on fence line north of Pivot 15.
21. White-winged Fairy-wren. Few parties; <1 in each pivot.
22. Variegated Fairy-wren. Party in pivot 10.
23. Yellow-throated Miner. Few parties.
24. Singing Honeyeater. Few in each pivot.
25. Crimson Chat. Flock of about 10 near pivot 10 (all uncoloured).
26. Rufous Whistler. Heard in Pivot 12 (30/06).
27. Magpie-lark. One near current pivots (30/06).
28. Willie Wagtail. Pairs throughout.
29. Black-faced Woodswallow. Occasional birds throughout.
30. Pied Butcherbird. Few pairs; perhaps one pair in each pivot.
31. Torresian Crow. Pairs and small groups throughout.
32. Horsfield's Bushlark. Common along tracks and in nearby shrubland. Up to three at once.
33. Zebra Finch. Flocks of 2-10 regularly.
34. Red-backed Kingfisher. One individual observed perched on vegetation north of Pivot 15.
35. Australian Magpie. Four observed foraging in paddock to north of development area.
36. Rainbow Bee-eater. Two individuals flying over Pivots 15 and 18.
37. Barn Owl. Eight seen among Tamarisk trees to the east of Pivot 16.
38. Bush Stone-curlew. Tracks seen along pivot # 18.
39. Brolgas. Flock of seven seen flying just north of Pivot 16. Tracks throughout.
40. *Diplodactylus conspicillatus*. A couple of distinctive shed skins under Tamarisk trees (south east of Pivot 16)
41. *Ctenophorus isolepis*. Throughout Stage 3.

42. *Varanus acanthurus*. One at Tamarisk Grove and one seen down goanna hole in Stage 3 near Pivot 15.
43. *Menetia greyii*. One under tin at Tamarisk Grove.
44. *Pseudechis australis*. One at Tamarisk Grove.
45. Agile Wallaby – tracks eastern end of pivot 16.
46. Cat/Dingo tracks throughout all stages.
47. Bilby see Table 7.
48. Brush-tailed Mulgara – see Table 7.
49. Camel. Tracks at wetland south of Great Northern Hwy and four seen.
50. *Notomys alexis* Hopping Mouse. Burrows throughout.

Wetland Waterbird Bird list (South of Great Northern Hwy).

1. Pink-eared Duck. Flock of 18 on southern wetland (16/07). 20 present on 18/07.
2. Grey Teal. Flock of 15 on southern wetland (16/07). 17 present on 18/07.
3. Pacific Black Duck. Two on southern wetland (16/07 and 18/07).
4. White-necked Heron. Four on southern wetland (16/07).
5. White-faced Heron. One on southern wetland (18/07).
6. Glossy Ibis. One on southern wetland (18/07).
7. Banded Lapwing. Two on southern wetland (16/07).
8. Hoary-headed Grebe. One on southern wetland (16/07). Two present on 18/07.
9. Black-winged Stilt. Five on southern wetland (16/07); 13 present on 18/07.
10. Red-kneed Dotterel. One on southern wetland (16/07); two present on 18/07.
11. Wood Sandpiper. One on southern wetland (16/07).
12. Brolga. Flock of 14 on southern wetland (16/07). On 18/07, 85 on southern wetland; flew in from north in evening.

6.6 Appendix 6 - Waterbirds – unsuitable habitat in study area but may fly over area.

(Previous survey records were made in areas adjacent and close to but not within the habitats of the NDPA)

X=confirmed record in the Previous Pardoo project Surveys

W= record from the wetland.

BIRDS	CS	ALA	N	EPBC	DFCA	BA	PPS	Expected status in project area
ANATIDAE								
Grey Teal <i>Anas gracilis</i>		X	X			X	W	Vagrant
Pacific Black Duck <i>Anas superciliosa</i>		X	X			X	W	Vagrant
Hardhead <i>Aythya australis</i>		X	X			X		Vagrant
Black Swan <i>Cygnus atratus</i>								Vagrant
Plumed Whistling-Duck <i>Dendrocygna eytoni</i>		X	X			X		Vagrant
Pink-eared Duck <i>Malacorhynchus membranaceus</i>		X	X			X	W	Vagrant
PODICIPEDIDAE								
Hoary-headed Grebe <i>Poliiocephalus poliocephalus</i>			X			X	W	Vagrant
Australasian Grebe <i>Tachybaptus novaehollandiae</i>		X	X			X		Vagrant
RALLIDAE								
Banded Rail <i>Gallirallus philippensis</i>								Vagrant
Purple Swamphen <i>Porphyrio porphyrio</i>								Vagrant
Australian Spotted Crake <i>Porzana fluminea</i>								Vagrant

BIRDS	CS	ALA	N	EPBC	DFCA	BA	PPS	Expected status in project area
Spotless Crake <i>Porzana tabuensis</i>								Vagrant
RECURVIROSTRIDAE								
Black-winged Stilt <i>Himantopus leucocephalus</i>			X	X		X	W	Vagrant
Red-necked Avocet <i>Recurvirostra novaehollandiae</i>			X	X		X		Vagrant
CHARADRIIDAE								
Red-capped Plover <i>Charadrius ruficapillus</i>		X	X	X		X		Irregular visitor
Oriental Plover <i>Charadrius veredus</i>	M S5		X	X	X	X	X	Migrant
Black-fronted Dotterel <i>Euseyonis melanops</i>			X			X		Irregular visitor
Red-kneed Dotterel <i>Erythronyx cinctus</i>			X			X	W	Irregular visitor
Masked Lapwing <i>Vanellus miles</i>		X	X			X	X	Resident
Banded Lapwing <i>Vanellus tricolor</i>							W	
SCOLOPACIDAE								
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	M S5			X	X			Vagrant
Broad-billed Sandpiper <i>Calidris falcinellus</i>	M S5			X	X			Vagrant
Curlew Sandpiper <i>Calidris ferruginea</i>	Cr M S3 S5	X	X	X	X	X		Vagrant
Pectoral Sandpiper <i>Calidris melanotos</i>	M S5			X				Vagrant
Red-necked Stint <i>Calidris ruficollis</i>	M S5	X	X	X	X	X		Vagrant
Swinhoe's Snipe <i>Gallinago megala</i>	M S5			X				Vagrant

BIRDS		CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Pin-tailed Snipe	<i>Gallinago stenura</i>	M S5			X				Vagrant
Little Curlew	<i>Numenius minutus</i>	M S5			X		X		Migrant
Wood Sandpiper	<i>Tringa glareola</i>	M S5				X		W	Vagrant
Common Greenshank	<i>Tringa nebularia</i>	M S5	X	X	X	X	X		Vagrant
Marsh Sandpiper	<i>Tringa stagnatilis</i>	M S5			X	X			Vagrant
ROSTRATULIDAE									
Australian Painted Snipe	<i>Rostratula australis</i>	E S2			X				Vagrant
LARIDAE									
Whiskered Tern	<i>Chlidonias hybrida</i>		X				X		Vagrant
White-winged Black Tern	<i>Chlidonias leucopterus</i>	M S5	X	X			X		Vagrant
Silver Gull	<i>Chroicocephalus novaehollandiae</i>		X				X		Vagrant
Australian Gull-billed Tern	<i>Gelochelidon macrotarsa</i>	M S5	X				X		Vagrant
CICONIIDAE									
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>						X		Vagrant
ARDEIDAE									
Eastern Great Egret	<i>Ardea modesta</i>				X	X			Irregular visitor

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Cattle Egret <i>Ardea ibis</i>				X				Irregular visitor
Intermediate Egret <i>Ardea intermedia</i>		X				X		Irregular visitor
White-necked Heron <i>Ardea pacifica</i>		X	X			X	w	Irregular visitor
Little Egret <i>Egretta garzetta</i>						X		Irregular visitor
White-faced Heron <i>Egretta novaehollandiae</i>							w	Irregular visitor
PLATALEIDAE								
Royal Spoonbill <i>Platalea regia</i>								Vagrant
Glossy Ibis <i>Plegadis falcinellus</i>	M S5				X		w	Vagrant
White Ibis <i>Threskiornis molucca</i>							X	Regular visitor
ACANTHIZIDAE								
Dusky Gerygone <i>Gerygone tenebrosa</i>		X				X		Vagrant
PACHYCEPHALIDAE								
White-breasted Whistler <i>Pachycephala lanioides</i>						X		Vagrant
Mangrove Golden Whistler <i>Pachycephala melanura</i>		X						Vagrant
RHIPIDURIDAE								
Mangrove Grey Fantail <i>Rhipidura phasiana</i>						X		Vagrant
PETROICIDAE								
Mangrove Robin <i>Eopsaltria pulverulenta</i>								Vagrant

Pardoo Irrigation Project Fauna Assessment

BIRDS	CS	ALA	N	EPBC	DBCA	BA	PPS	Expected status in project area
Total Number of Species Expected: 51	16	19	19	17	10	29	14	