



REPORT

Area Permit Application – Yandal Station – Supporting
Environmental Report

Prepared for: D & C Geraghty Pty Ltd

Date: April 2015

Rapallo Environmental is a Western Australian consultancy with a strong reputation for technical excellence, client-focus and innovation. We build long-term alliances through outstanding delivery on a range of services to the resource sector, government and associated industries.



ENVIRONMENTAL

ENGINEERING

CONSTRUCTION &
OPERATIONS
NDT & Inspections

MINING

RESOURCE
MANAGEMENT

Report

Area Permit Application – Yandal Station – Supporting Environmental Report

Prepared for D & C Geraghty Pty Ltd

April 2015

Revision	Revision Detail	Date	Prepared	Reviewed	Approved
	Internal Review	15/04/2015	Brian Donnelly	Kate George	Kate George
A	Issue to Client	15/04/2015	Brian Donnelly	Kate George	Kate George

Rapallo Group

Perth Office

130 Hay Street, Subiaco WA 6008

Phone: (08) 9460 4300

Fax: (08) 9226 2388

PO Box 8190, Subiaco East WA 6008

Kalgoorlie Office

10 Broadwood Street, West Kalgoorlie 6430

Phone: (08) 9460 4300

Fax: (08) 9226 2388

PO Box 1123 Kalgoorlie

ABN: 31 726 506 590

ACN: 009 257 836

www.rapallo.com.au

This document has been prepared based on assumptions as reported throughout and upon information and data supplied by others.

While Rapallo Pty. Ltd. has taken all reasonable care to ensure the facts and opinions expressed in this document are accurate, it does not accept any legal responsibility to any person for any loss or damage suffered by him resulting from his or her use of this report however caused and whether by breach of contract, negligence or otherwise.

© Rapallo Group

Table of Contents

1	Introduction	6
1.1	NVCP Application.....	6
1.2	Area Required For Clearing	6
1.3	Proponent.....	7
1.4	Objectives	7
1.5	Assessment Summary.....	7
2	Background	10
2.1	Location	10
2.2	Pastoral Lease.....	10
2.3	Environmental Setting.....	10
3	Assessment of Clearing Principles.....	11
3.1	Native Vegetation Clearing Principles	11
3.2	Biodiversity Significance	12
3.3	Threatened and Priority Ecological Communities	12
3.4	Conservation Listed Flora	14
3.4.1	Anacampseros sp. Eremaean – Priority 1	14
3.4.2	Austroparmelina macrospora – Priority 3	14
3.4.3	Calytrix uncinata – Priority 3	15
3.4.4	Cratystylis centralis – Priority 3	15
3.4.5	Eremophila gracillima – Priority 3	15
3.4.6	Goodenia modesta – Priority 3.....	15
3.4.7	Thryptomene nealensis – Priority 3	15
3.4.8	Thryptomene sp. Leinster – Priority 3	15
3.4.9	Eremophila pungens – Priority 4	15
3.4.10	Grevillea inconspicua – Priority 4	16
3.4.11	Hemigenia exilis – Priority 4	16
3.5	Conservation Listed Fauna	18
3.5.1	Great Desert Skink – Schedule 1, Vulnerable	18

3.5.2	Northern Marsupial Mole – Schedule 1, Endangered	19
3.5.3	Brush-tailed Mulgara – Priority 4	19
3.5.4	Malleefowl – Schedule 1, Vulnerable	20
3.5.5	Fork-tailed Swift – Schedule 3, Migratory	20
3.5.6	Rainbow Bee-eater – Schedule 3, Migratory.....	20
3.5.7	Common Greenshank – Schedule 3, Migratory	20
3.5.8	Eastern Great Egret – Schedule 3, Migratory	21
3.5.9	Oriental Plover – Schedule 3, Migratory	21
3.5.10	Peregrine Falcon Schedule 4	21
3.5.11	Striated Grasswren (inland) – Priority 4	21
3.5.12	Australian Bustard – Priority 4	22
3.5.13	Princess Parrot – Priority 4, Vulnerable.....	22
3.5.14	Trapdoor Spider: Kwonkan moriartii – Priority 2	23
3.6	Remnant Vegetation	23
3.7	Watercourses or Wetland Environments	23
3.8	Land Degradation	23
3.9	Conservation Estate.....	23
3.10	Ground and Surface Water Quality	23
3.10.1	Underground and Surface Water Quality.....	23
3.10.2	Flooding Potential.....	24
4	Environmental Impact Management	26
4.1	Biodiversity Significance	26
4.1.1	Biological Diversity	26
4.1.2	Threatened Ecological Communities	26
4.1.3	Remnant Vegetation.....	26
4.1.4	Watercourses or Wetland Environments	26
4.2	Land Degradation	26
4.3	Conservation Estate.....	26
4.4	Ground and Surface Water Quality	27

4.4.1	Underground and Surface Water Quality.....	27
4.4.2	Flooding	27
5	References.....	28

Tables

Table 1	NVCP Application Area.....	7
Table 2	Native Vegetation Clearing Principles.....	11
Table 3	Priority Ecological Communities (PECs) identified in the database search	12
Table 4	Conservation significant flora taxa recorded in database search.....	14
Table 5	Conservation significant fauna recorded in the database search	18

Figures

Figure 1	Location of Yandal Station	8
Figure 2	Pivot Bore Locations	9
Figure 3	Threatened and Priority Ecological Communities (TEC-PEC) within 50 km of Pivot Areas ...	13
Figure 4	Threatened and Priority Flora within 50 km of Pivot Areas	17
Figure 5	Threatened and Priority Fauna within 50 km of Pivot Areas.....	25

1 INTRODUCTION

Amendments to the Environmental Protection Act 1986 require clearing permits to be issued for the majority of land clearing activities which includes clearing activities that require a diversification permit from the pastoral lands board. The Land Administration Act 1997 requires that the clearing permit process be completed prior to the Pastoral Lands Board finalising a decision on a pastoral diversification permit application. Such projects where clearing will be conducted within a specified envelope and a specific footprint or over a period of time require an Area Permit to Clear Land.

Yandal Station is a pastoral lease that is owned by D & C Geraghty Pty Ltd (Figure 1). The primary pastoral use of this lease is the grazing of native vegetation with authorised cattle. The lease was purchased in 2014 and currently is stocked with approximately 1500 head of mixed British Breed and Droughtmaster cattle.

1.1 NVCP APPLICATION

This document supports the Area Permit application for irrigation activities on Yandal Station, Leonora. The Area Permit application is for 160 hectares located on the pastoral lease.

Cleared land will be rehabilitated once irrigation activities in the area cease. The Landholding Trust will track the total area cleared and report this in a clearing report submitted to the Department of Environment Regulation (DER) once clearing has been completed.

The NVCP application has been produced in general accordance with the DMP brochure 'Information required to assess your Clearing Permit Application' (DMP 2012a). The contact for any queries or further information for the NVCP application is:

Brian Donnelly

Rapallo Environmental Consulting

Phone: 08 6279 0900

Email: brian.donnelly@rapallo.com.au

There is no Declared Rare Flora or Threatened Ecological Communities known to occur within the application area. A range of environmental management procedures are in place to ensure that clearing associated with the project will be managed such that resulting impacts will be minimised.

1.2 AREA REQUIRED FOR CLEARING

The Area Permit application is for 160 hectares located on the pastoral lease (Figure 2). As such, a Native Vegetation Clearing Permit ('NVCP') application is required under the Environmental Protection Act 1986 ('EP Act'). This document supplies supporting documentation for an NVCP area permit application for the proposed clearing. The total permit area of 160 ha is known as the 'NVCP application area' in this document and is displayed in Table 1.

Table 1 NVCP Application Area

Pivot Area	Area (ha)
Sisters Pivot Bore	80
Central Pivot Bore	80
TOTAL	160

1.3 PROPONENT

D & C Geraghty Pty Ltd owns the pastoral lease over the application area. All compliance and regulatory requirements should be faxed, posted, and couriered or emailed to Mr David Geraghty, owner of Yandal as follows:

D. & C. Geraghty Pty Ltd
(ACN 118 505 043)
3 Kirkham Hill Terrace
Maylands, WA, 6051
Tel: (08) 9329 3810
Mobile: 0400 233 181
Email:geraghty@westnet.com.au

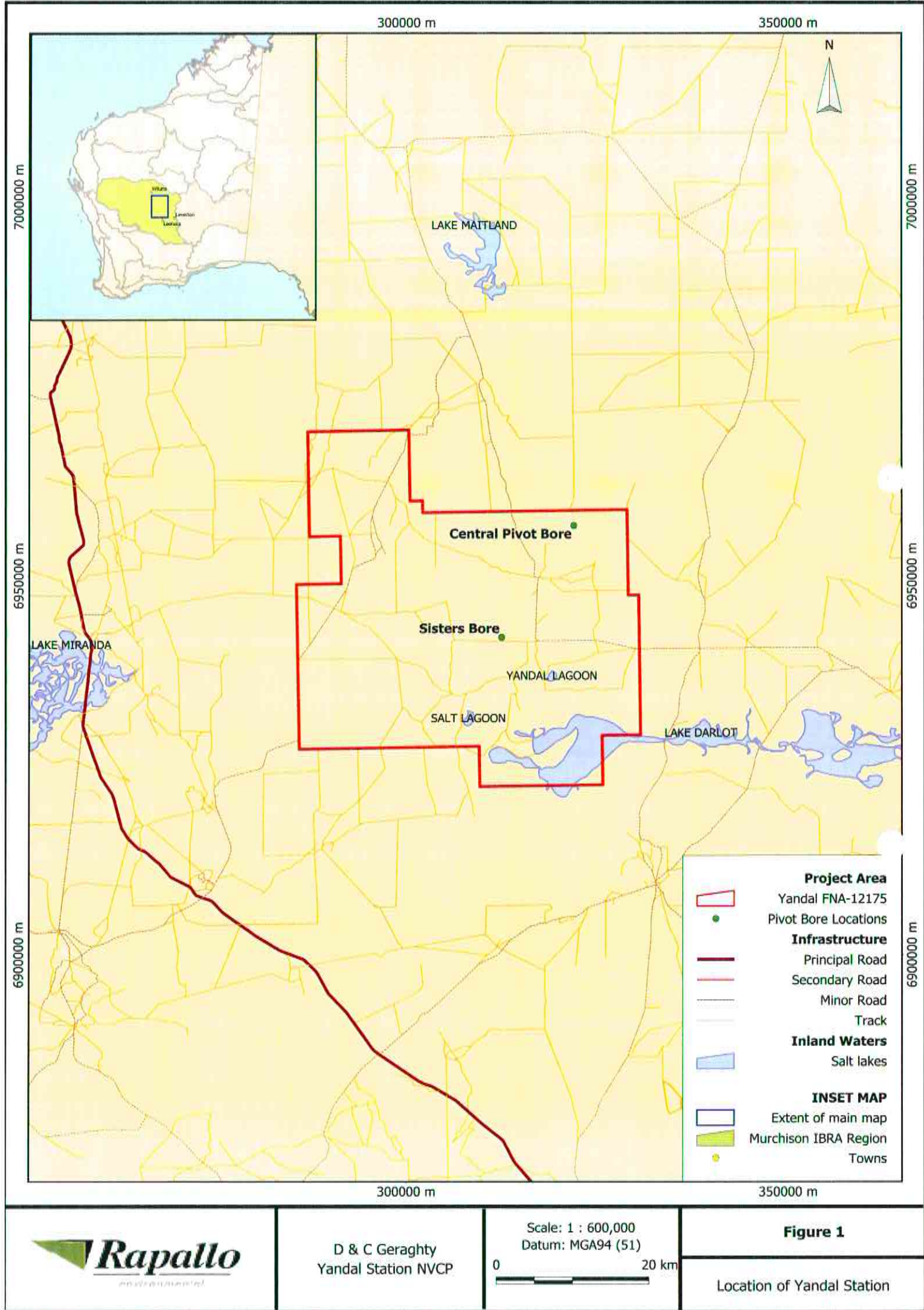
1.4 OBJECTIVES

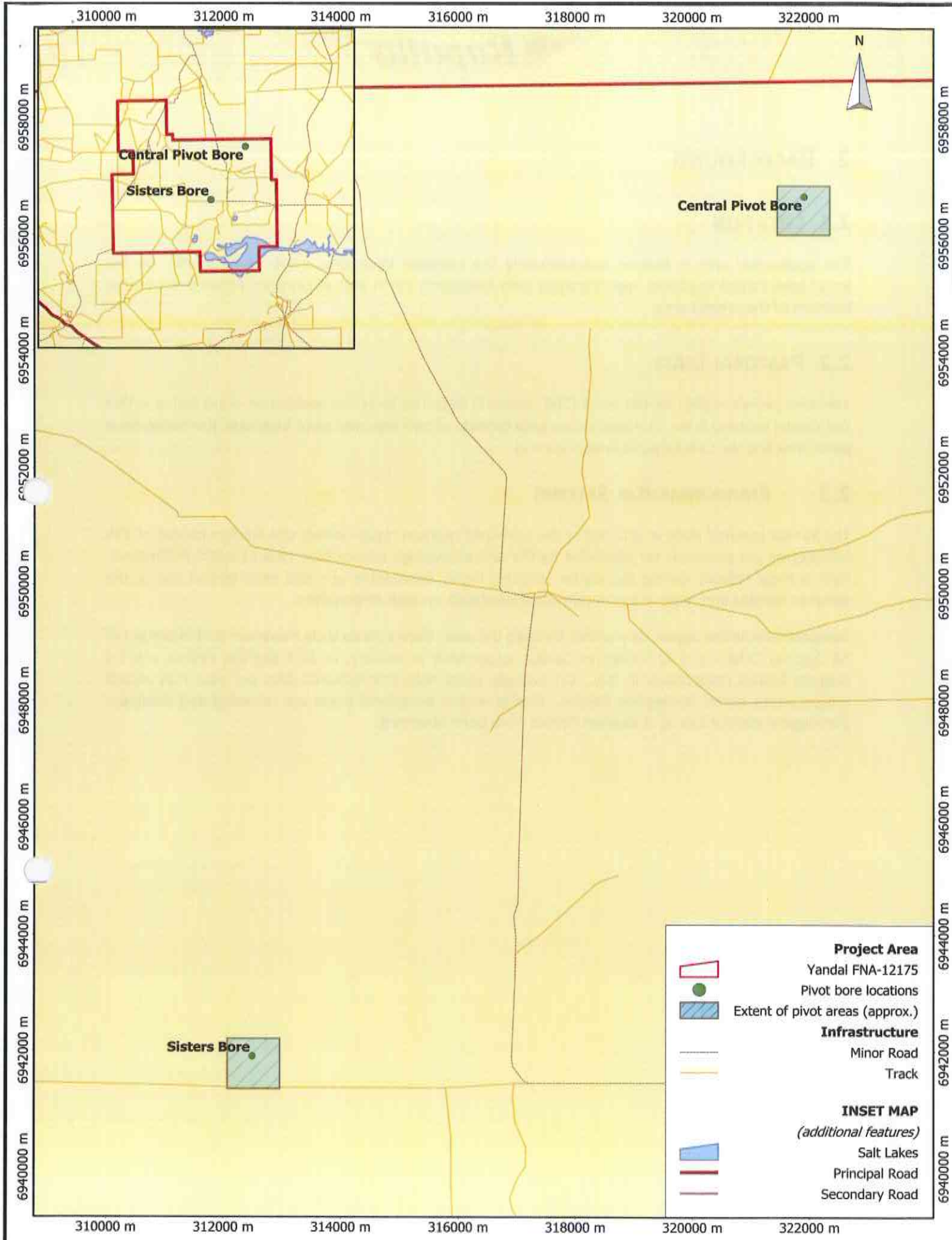
This document outlines Yandal's commitment to managing the impacts of land clearing on the environment of Yandal Pastoral Lease. It supports the landholding trust Native Vegetation Clearing Permit (Area Permit) application.

Section 4 addresses the 10 Land Clearing Principles and provides an assessment of the environmental impact of clearing for each of the clearing principles. Section 8 details management and mitigation practices to minimise the environmental impact of clearing activities.

1.5 ASSESSMENT SUMMARY

An assessment was conducted on the potential environmental impacts associated with vegetation clearing in the application area. There were no significant environmental impacts assessed as being applicable to this project and possible impacts are manageable to acceptable levels. The clearing in the application area is thus considered as being environmentally acceptable





2 BACKGROUND

2.1 LOCATION

The application area is located approximately five hundred kilometres north of Kalgoorlie, on the Barwidgee-Yandal Road and approximately sixty kilometres north east of Leinster. Figure 1 shows the location of the project area.

2.2 PASTORAL LEASE

The area permit applies to 400 acres (160 hectares) (referred to as the application area) falling within the Yandal pastoral lease. The application area consists of two separate pivot locations, the Sisters bore pivot area and the Central pivot area (Figure 2).

2.3 ENVIRONMENTAL SETTING

The Yandal pastoral lease is situated in the semi-arid Leonora region where the median rainfall of 235 millimetres per annum is far exceeded by the annual average evaporation rate of 2,500 millimetres. Rain is most reliable during the winter months; heavy downpours are also experienced during the summer months and these are generally associated with cyclonic depressions.

Temperatures in the region vary widely through the year, from a mean daily maximum and minimum of 38 degrees Celsius and 22.9 degrees Celsius respectively in January, to 19.4 degrees Celsius and 5.4 degrees Celsius respectively in July. On average, more than one hundred days per year may record temperatures above 30 degrees Celsius. During winter, occasional frosts are recorded and minimum overnight temperatures of -2 degrees Celsius have been observed.

3 ASSESSMENT OF CLEARING PRINCIPLES

3.1 NATIVE VEGETATION CLEARING PRINCIPLES

Clearing applications are assessed against principles outlined in Schedule 5 of the Environmental Protection Act 1986 (WA). The principles are outlined in Table 2. These principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way. These principles apply to all lands throughout Western Australia.

The principles address four main environmental areas:

- Biodiversity significance
- Land degradation
- Conservation Estate
- Ground and surface water quality.

Table 2 Native Vegetation Clearing Principles

Environmental Area	Clearing Principle
Biodiversity Significance	
a	Native vegetation should not be cleared if it comprises a high level of biological diversity.
b	Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.
c	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.
d	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.
e	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
f	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
Land Degradation	
g	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
Conservation Estate	
h	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.
Ground and Surface Water Quality	
i.	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.
j.	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

3.2 BIODIVERSITY SIGNIFICANCE

To determine the biodiversity significance within the application area, database searches were undertaken. The database searches identified fourteen conservation listed fauna species, eleven Priority flora taxa, and five Priority Ecological Communities (PECs) within 50 km of Yandal Station. No threatened flora taxa or TECs were recorded in the desktop search.

3.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

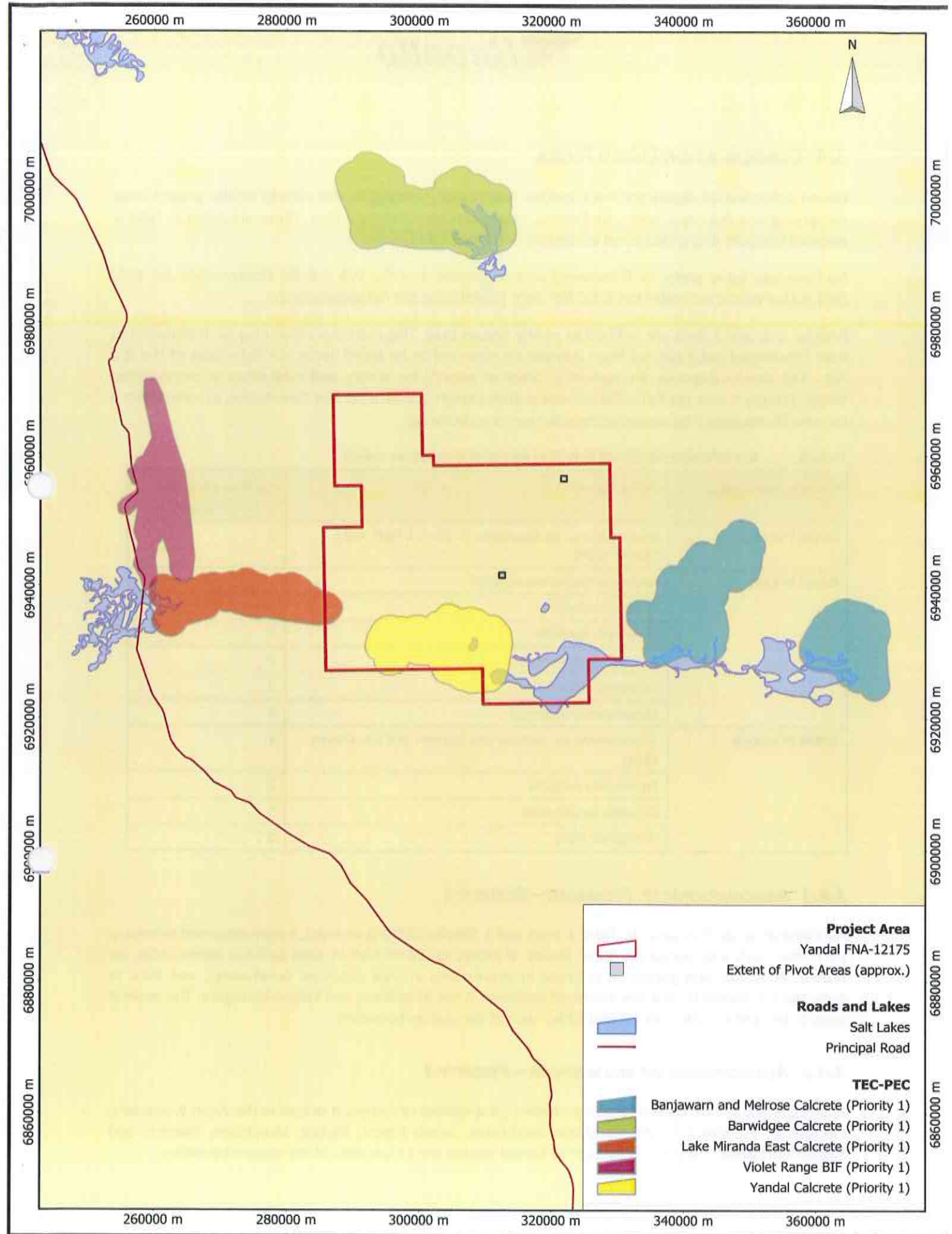
An Ecological Community is defined by the DPaW as a naturally occurring biological assemblage that occurs in a particular type of habitat. A threatened ecological community (TEC) is one which fits into one of the following categories: Presumed totally destroyed, Critically Endangered, and Vulnerable. Possible threatened ecological communities that do not meet survey criteria are added to the DPaW's Priority Ecological Communities (PEC) list under priorities 1, 2 and 3.

Five PECs were recorded within 50 km of the Yandal Station boundaries, all of which are Priority 1. These are listed in Table 3, and shown in Figure 3. Four of these PECs are calcrete communities, which are conservation significant because they harbour unique aquatic invertebrates in the ground waters within the calcretes (stygo fauna). Lake Violet Range, is significant because it contains a unique vegetation community on banded iron formation (BIF).

The Yandal and Lake Miranda East Calcrete communities occurs within the boundaries of Yandal Station. Approximately 80% of the buffer zone of the Yandal Calcrete, and 5% of the Lake Miranda East Calcrete community fall within the Yandal Station Boundaries. Both the pivot bore areas are situated well outside of the PEC buffer zones. Sisters Bore is located 6 km north of the Yandal Calcrete buffer zone, and 25 km west of the Lake Miranda East Calcrete buffer zone. The Central Pivot Bore is located 23 km north-east of the Yandal Calcrete buffer zone, and 29 km north-east of the Lake Miranda East calcrete buffer zone

Table 3 Priority Ecological Communities (PECs) identified in the database search

Community Name	Description	Conservation Status	Distance to Yandal boundary
Lake Miranda East Calcrete	Lake Miranda east calcrete groundwater assemblage types on Carey palaeodrainage on Yakabindie Station	Priority 1	5% of community within Yandal Station boundaries
Banjawarn and Melrose Calcrete	Banjawarn and Melrose (Lake Darlot) calcrete groundwater assemblage type on Carey palaeodrainage on Banjawarn and Melrose Stations.	Priority 1	<1 km west of station boundary
Yandal Calcrete	Yandal calcrete groundwater assemblage type on Carey palaeodrainage on Yandal Station	Priority 1	80% of community within Yandal Station boundaries
Barwidgee Calcrete	Barwidgee calcrete groundwater assemblage type on Carey palaeodrainage on Barwidgee Station	Priority 1	22 km north
Violet Range (Perseverance Greenstone) BIF	Violet Range (Perseverance Greenstone Belt) vegetation complexes (banded ironstone formation)	Priority 1	19 km west of station boundary



3.4 CONSERVATION LISTED FLORA

Eleven conservation significant flora species have been recorded in the vicinity of the project area, comprising one Priority 1 taxon, six Priority 3 taxa, and four Priority 4 taxa. These are listed in Table 4, mapped in Figure 4, and described in sections 3.4.1 to 3.4.11 below.

No flora taxa listed under as Threatened under Schedule 1 of the WA *Wildlife Conservation Act 1950* (WC Act) or protected under the EPBC Act were picked up in the database search.

Priority 1, 2, and 3 flora are defined as poorly known taxa. These are flora that may be threatened or near threatened but have not been adequately surveyed to be listed under the Schedules of the WC Act. The three categories are ranked in order of priority for survey and evaluation of conservation status. Priority 4 taxa are flora that are adequately known, are rare but not threatened, or meet criteria for near threatened. These species require regular monitoring

Table 4 Conservation significant flora taxa recorded in database search

Conservation Listing	Taxon Name	Number of records in database search
DPaW Priority 1	<i>Anacampseros</i> sp. Eremaean (F. Hort, J. Hort and J. Shanks 3248)	3
DPaW Priority 3	<i>Austroparmelina macrospora</i>	3
	<i>Calytrix uncinata</i>	10
	<i>Cratystylis centralis</i>	2
	<i>Eremophila gracillima</i>	2
	<i>Goodenia modesta</i>	2
	<i>Thryptomene nealensis</i>	5
DPaW Priority 4	<i>Thryptomene</i> sp. Leinster (B.J. Lepschi and L.A. Craven 4362)	4
	<i>Eremophila pungens</i>	3
	<i>Grevillea inconspicua</i>	5
	<i>Hemigenia exilis</i>	2

3.4.1 ANACAMPSEROS SP. EREMAEAN – PRIORITY 1

Anacampseros sp. Eremaean (F. Hort, J. Hort and J. Shanks 3248) is an erect, single-stemmed tuberous, perennial, herb with succulent green leaves. It grows to 0.1 m high in sand patches inside rocks, on brown sandy clay and granite. It is found in depressions in rock outcrops, breakaways, and flats. In Australia it is known from a few scattered locations in the Murchison and Yalgoo bioregion. The nearest records to Yandal Station are 10 and 12 km east of the station boundary.

3.4.2 AUSTROPARMELINA MACROSPORA – PRIORITY 3

Austroparmelina macrospora (Elix and J. Johnst.) is a species of lichen. It occurs in the Avon Wheatbelt, Coolgardie, Esperance Plains, Geraldton Sandplains, Jarrah Forest, Mallee, Murchison, Warren, and Yalgoo bioregions. The nearest records to Yandal Station are 17 km west of the station boundary.

3.4.3 CALYTRIX UNCINATA – PRIORITY 3

Calytrix uncinata (Craven, Austral.Syst.Bot. 3:719-720, Fig.1, 1990) is a low shrub 0.3-1 m high. It flowers in August to November. It grows in white or red sand, sandy clay. It is found on granite or sandstone breakaways, and on rocky rises. It occurs in the Murchison and Yalgoo bioregions. The nearest records to Yandal Station are from ten locations 10 km to the east of the station boundary.

3.4.4 CRATYSTYLIS CENTRALIS – PRIORITY 3

Cratystylis centralis (Albr. and Paul G.Wilson, Nuytsia 14:447-449, Figs 1a-c, 2002) is a much-branched, brittle, greyish shrub, to 1 m high. It grows in red sandy loam soil with ironstone gravel. It is found on flat plains, and in breakaway country. It is found in the Murchison bioregion. The closest record to Yandal Station is 28 km to the north of the station boundary.

3.4.5 EREMOPHILA GRACILLIMA – PRIORITY 3

Eremophila gracillima (Chinnock, Eremophila 322-323, Fig. 159, 2007) is a low flat shrub, ca 0.3 m high, 1.2 m wide. It has blue flowers in September. It occurs on stony flats and has been recorded in the Gascoyne and Murchison bioregions. The closest record to Yandal Station are two locations 16 km north of the station boundary.

3.4.6 GOODENIA MODESTA – PRIORITY 3

Goodenia modesta (J.M.Black, Trans. and Proc.Roy.Soc.South Australia 36:172, 1912) is a herb that grows to 0.5 m high. It has yellow flowers from approximately January to December. It is found in the Murchison and Central Ranges, Gibson Desert, Great Sandy Desert, Little Sandy Desert, and Tanami bioregions. It grows in red loam and sandy soil. The closest record to Yandal Station is 20 km east of the station boundary.

3.4.7 THRYPTOMENE NEALENSIS – PRIORITY 3

Thryptomene nealensis (J.W.Green, Nuytsia 3:190-192, 1980) is a shrub to ca 0.3 m high. It has pink flowers in October. It grows on lateritic breakaways. In the Great Victoria Desert and Murchison bioregions. The nearest record to Yandal Station is 4.5 km to the south-west of the station boundary.

3.4.8 THRYPTOMENE SP. LEINSTER – PRIORITY 3

Thryptomene sp. Leinster (B.J. Lepschi and L.A. Craven 4362) is a small shrub. It occurs only in the Murchison bioregion. The nearest record to Yandal Station are 11 km east and 15 km south of the station boundaries.

3.4.9 EREMOPHILA PUNGENS – PRIORITY 4

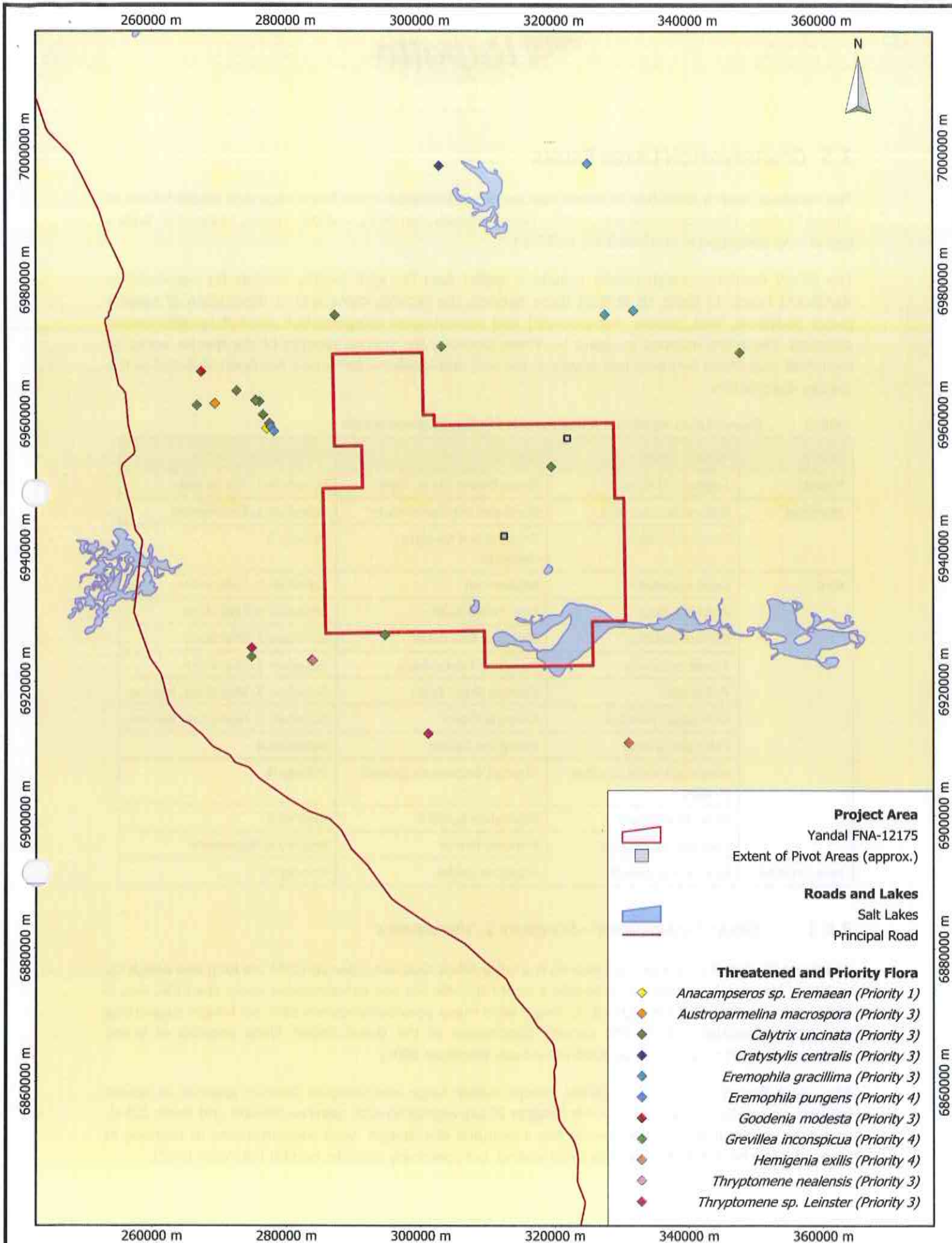
Eremophila pungens (Chinnock, Eremophila 371-373, Fig. 186, 2007) is an erect viscid shrub, 0.5-1.5 m high. It has purple-violet flowers from June to August. It grows on plains, ridges, and breakaways in sandy loam or clayey sand over laterite. It occurs in the Gascoyne and Murchison bioregions. The nearest records to Yandal Station are 9 and 10 km east of the station boundary.

3.4.10 GREVILLEA INCONSPICUA – PRIORITY 4

Grevillea inconspicua, or Diels Cue *Grevillea* (Bot.Jahrb.Syst. 35:153, 1904) is an intricately branched, spreading shrub, 0.6-2 m high. It bears white or white/pink flowers from June to August. It grows along drainage lines, on rocky outcrops, and in creeklines on loamy or gravel soil. It has only been recorded in the Murchison bioregion. This taxon was recorded within Yandal Station, from a locality 4.5 km south-west of the Central Pivot Bore and 12 km north-east of Sisters Bore.

3.4.11 HEMIGENIA EXILIS – PRIORITY 4

Hemigenia exilis (S.Moore, J.Linn.Soc.,Bot. 34:216-217, 1898) is an erect, multi-stemmed shrub, 0.5-2 m high. It bears blue-purple to white flowers in April or September to November. It grows in Laterite soil, breakaways and on slopes. It has only been recorded in the Murchison bioregion. The nearest record to Yandal Station is 13 km south of the station boundary.



3.5 CONSERVATION LISTED FAUNA

The database search identified fourteen species of conservation listed fauna recorded within 50 km of Yandal Station. These comprise one reptile, two mammals, ten birds, and one spider, as listed in Table 5 below, and described in sections 3.5.1 to 3.5.14.

The DPaW database search results include a spatial data file with locality records for conservation significant fauna. In order to protect these species, the records come with a description of species group (mammal, bird, reptile, invertebrate) and conservation category, but without species names attached. These are mapped in Figure 5. Where possible, the species identity of the species could be identified (e.g. there was only one reptile in the list) and locality information has been included in the species descriptions.

Table 5 Conservation significant fauna recorded in the database search

Group	Species name	Common name	Conservation Status
Reptile	<i>Liopholis kintorei</i>	Great Desert Skink, Tjakura	Schedule 1, Vulnerable
Mammal	<i>Notoryctes caurinus</i>	Northern Marsupial Mole	Schedule 1, Endangered
	<i>Dasymercus blythi</i>	Brush-tailed Mulgara, Ampurta	Priority 4
Bird	<i>Leipoa ocellata</i>	Malleefowl	Schedule 1, Vulnerable
	<i>Apus pacificus</i>	Fork-tailed Swift	Schedule 3, Migratory
	<i>Merops ornatus</i>	Rainbow Bee-eater	Schedule 3, Migratory
	<i>Tringa nebularia</i>	Common Greenshank	Schedule 3, Migratory
	<i>Ardea alba</i>	Eastern Great Egret	Schedule 3, Migratory, Marine
	<i>Charadrius veredus</i>	Oriental Plover	Schedule 3, Migratory, Marine
	<i>Falco peregrinus</i>	Peregrine Falcon	Schedule 4
	<i>Amytornis striatus</i> subsp. <i>striatus</i>	Striated Grasswren (inland)	Priority 4
	<i>Ardeotis australis</i>	Australian Bustard	Priority 4
	<i>Polytelis alexandrae</i>	Princess Parrot	Priority 4, Vulnerable
Invertebrate	<i>Kwonkan moriartii</i>	trapdoor spider	Priority 2

3.5.1 GREAT DESERT SKINK – SCHEDULE 1, VULNERABLE

The Great Desert Skink (*Liopholis kintorei*) is a large lizard that can grow up to 44 cm long and weigh up to 350 g. The species is listed as Schedule 1 under the WC Act and as Vulnerable under the EPBC Act. It appears to be declining throughout its range with many previously known sites no longer supporting populations (McAlpin 1997). The current distribution of the Great Desert Skink consists of seven isolated populations and exceeds 5000 individuals (McAlpin 2001).

The Great Desert Skink lives in family groups within large and complex burrow systems in desert habitats on sandy, clay and loamy soils (Cogger 2014) vegetated with spinifex (Wilson and Swan 2013). In regions where it occurs, the species has a clumped distribution, with concentrations of burrows in areas of a few hectares separated by uninhabited, but seemingly suitable, habitat (McAlpin 1997).

Three populations occur in Western Australia at Patjarr (population estimated to be less than 2500 individuals), near the Kiwirrkura community, including the vicinity of Lake Mackay (less than 500 individuals), and in Rudall River National Park (unknown population size).

Sites in Western Australia are dominated by *Triodia basedowii* and *Triodia schinzii* with some *Eremophila leucophylla* shrubs (Pearson *et al.* 2001). Skinks appear to prefer a mosaic landscape of different aged vegetation, preferring habitat with at least 50% bare ground. They inhabit sites that have been burnt in the previous three to fifteen years (McAlpin 1998, 2001). It is believed that a mosaic of regenerating vegetation may provide ample food while unburnt patches provide shelter (Pearson *et al.* 2001).

The DPaW spatial data file holds a single record for the Great Desert Skink (Figure 5: Reptile - T) located 19 km to the east of the Yandal Station boundary.

3.5.2 NORTHERN MARSUPIAL MOLE – SCHEDULE 1, ENDANGERED

The Northern Marsupial Mole (*Notoryctes caurinus*) or Kakarratul is listed as Endangered under the EPBC Act and Schedule 1 under the WC Act. The Marsupial Mole is sparsely distributed across much of arid Australia (Menkhorst and Knight 2011). Marsupial Moles are not capable of travelling far across hard ground and continuity of suitable habitat (sand dunes, swales, sand plains) is likely to be very important for the occurrence of Marsupial Moles in an area (Benshemesh 2004).

The Northern Marsupial Mole occurs across northern Western Australia in areas of suitable habitat. However there is currently very little information on the abundance across its range to given an accurate estimate of population, as records are sparse and the species is difficult to survey.

Marsupial moles are notoriously difficult to detect, being an extremely elusive species that rarely ventures to the surface and whose burrows collapse behind it as it “swims” through the sand (Van Dyck and Strahan 2008). The survey method often used is to dig a trench or pit in the sand with vertical walls, and wait for the backfilled tunnels to appear as the sand dries.

3.5.3 BRUSH-TAILED MULGARA – PRIORITY 4

The Brush-tailed Mulgara (*Dasycercus blythi*) is listed by the DPaw as Priority 4. Until recently the species was clumped with the closely related Crest-tailed Mulgara (*D. cristicauda*), with more than four decades of records not distinguishing between the species. This means that there is ambiguity about the (historical) distribution of both species. The Brush-tailed Mulgara has the widest distribution, and is the only species that occurs in Western Australia, while the Crest-tailed Mulgara is confined to a small area on the border of the Northern Territory and South Australia (Van Dyck and Strahan 2008).

The Brush-tailed Mulgara has a widespread but patchy occurrence in sandy regions of arid central Australia (Menkhorst and Knight 2011). It occurs in a range of vegetation types including spinifex grassland on plains, sand ridges, and mulga shrubland on loamy sand. The principal habitat is mature hummock grasslands of spinifex, especially *Triodia basedowii* and *T. pungens* where it lives in burrows that it digs on the flats between low sand dunes (Van Dyck and Strahan 2008).

The DPaW spatial data file shows 19 records of the Brush-tailed Mulgara (Figure 5: Mammal - P4) located 24 km north-east, 32 km north-east, 22 km north-west, and 13, 20, and 33 km west of the Yandal Station boundaries.

3.5.4 MALLEEFOWL – SCHEDULE 1, VULNERABLE

In Western Australia, the Malleefowl (*Leipoa ocellata*) is listed under the WC Act as Schedule 1: Fauna that is rare or likely to be extinct (Government of Western Australia 2013). Nationally, the species is listed under the EPBC Act as Vulnerable as well as Migratory (Department of the Environment 2013).

The Malleefowl belongs to an ancient family called Megapodiidae whose members build mounds for nesting (Marchant and Higgins 1993). Clearance for agriculture has eliminated and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations. The remaining isolated populations are now mostly in suboptimal habitat, since the mallee on the best soil has been cleared. This makes them vulnerable to catastrophic events, such as bushfires (Garnett *et al.* 2011).

The Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or Acacia species. A sandy substrate and abundance of leaf litter are required for mound construction and heat regulation (Johnstone and Storr 1998).

The DPaW spatial data file shows four locality records of Malleefowl (Figure 5: Bird - T), the nearest of which 300 metres from the northern boundary of Yandal Station, and the others nine, 14, and 17 kilometres north-west of the station boundary.

3.5.5 FORK-TAILED SWIFT – SCHEDULE 3, MIGRATORY

The fork-tailed Swift (*Apus pacificus*) is listed under the WC Act as Schedule 3: Migratory birds protected under an International Agreement, and listed as Migratory under the EPBC Act. The species does not breed in Australia. They visit Australia outside the breeding season, occurring infrequently across most of northern and central Australia. The species feeds and sleeps on the wing, and would be unlikely to land within Yandal Station. Any developments at the station are unlikely to affect this species.

3.5.6 RAINBOW BEE-EATER – SCHEDULE 3, MIGRATORY

The Rainbow Bee-eater (*Merops ornatus*) is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. Under the EPBC Act it is listed as Migratory.

The Rainbow Bee-eater prefers open or lightly timbered areas, often near water. This species has been recorded in dry open sclerophyll forest, open woodlands and shrublands, including mallee, spinifex tussock grassland with scattered trees, chenopod shrubland with scattered trees and riparian or littoral assemblages. It is often seen around disturbed areas such as quarries, road cuttings and mines where exposed bare soil provides suitable breeding sites (Marchant and Higgins 1993). The Rainbow Bee-eater is a migratory bird and will move north from the southern areas of Australia during winter (Johnstone and Storr 1998).

3.5.7 COMMON GREENSHANK – SCHEDULE 3, MIGRATORY

The Common Greenshank (*Tringa nebularia*) is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. Under the EPBC Act it is listed as Migratory. The Common Greenshank is a heavily built, elegant wader 30-35 cm in length, with a wingspan of 55-65 cm. The bill is long and slightly upturned and the legs are long and yellowish-green. The species is seen singly or in small to large flocks (sometimes hundreds) in a variety of coastal and inland wetlands. The common greenshank does not breed in Australia, however it occurs in all wetland types and has the widest distribution of any shorebird in Australia.

3.5.8 EASTERN GREAT EGRET – SCHEDULE 3, MIGRATORY

The Eastern Great Egret (*Ardea modesta*) is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under CAMBA (as *Egretta alba*), and JAMBA (as *Egretta alba*). Under the EPBC Act it is listed as Marine and Migratory.

The Eastern Great Egret can be found throughout Australia, with the exception of the arid regions. It is listed under the EPBC Act as Migratory – Overfly Marine. The Great Egret inhabits terrestrial wetlands, estuarine, littoral habitats and grasslands. It prefers permanent water bodies on floodplains and the shallows of deep permanent lakes (Marchant and Higgins 1993), though it can be seen on any watered area including damp grasslands (Johnstone and Storr 1998).

3.5.9 ORIENTAL PLOVER – SCHEDULE 3, MIGRATORY

The Oriental Plover (*Charadrius veredus*) is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement, and under the EPBC Act as Marine and Migratory.

It is a large plover with distinctive colourations on the breast (in adults). It occurs in Australia only as a wintering (non-breeding) visitor to coastal and inland areas of northern Australia, north of the Tropic of Capricorn. It appears in Australia from late August to early April (Johnstone and Storr 1998) and it is estimated that the entire world population overwinters in Australia (Bishop 2006; Stewart *et al.* 2007). In its main wintering areas it often forms large flocks of up to 200, and sometimes more than 1000 birds. South of the Tropic, it is occasionally recorded as a vagrant (Johnstone and Storr 1998).

3.5.10 PEREGRINE FALCON SCHEDULE 4

The Peregrine Falcon (*Falco peregrinus*) is listed under the WC Act as Schedule 4 - Other Specially Protected Fauna. The species experienced a large population decline as a result of herbicide and pesticide use in the 1950's to the 1970's, which caused major reductions in breeding success. However, since the banning of such chemicals the species population has stabilised and expanded. In Western Australia, populations are stable in areas with granite outcrops and cliffs (Johnstone and Storr 1998). This species is uncommon throughout its range, preferring areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land. In the absence of such habitats, the species is known to nest in trees using the nests of species from the family Corvidae, and occasionally hollows for nesting (Marchant and Higgins 1993).

The DPaW spatial data file shows several records of the Peregrine Falcon (Figure 5: Bird - S), with the nearest record located 500 metres from the Yandal Station boundaries, and the others 23 km west and 23 km east of the station boundaries.

3.5.11 STRIATED GRASSWREN (INLAND) – PRIORITY 4

The Striated Grasswren (*Amytornis striatus*) is a small bird that spends most of its time on the ground hunting insects. It lives in small family groups in areas of mallee over spinifex (*Triodia* sp.) to which it is exceptionally well camouflaged; its presence is often detected only on calls. When it senses danger it can remain silent and motionless for a long time, making them easy to miss if startled. Striated Grasswrens have been shown to recolonise burnt areas after six or seven years, and the habitat remains suitable up to around 40 years after fire (South Australian Department for Environment and Heritage 2006).

The Striated Grasswren occurs in several isolated populations across arid Australia. Four races are distinguished, two of which occur Western Australia. These are the Rufous Grasswren (*Amytornis striatus whitei*) which occurs in the Pilbara, and the Sandhill Grasswren (*A. s. striatus*) which occurs in the central arid zones including parts of the Great Sandy, Gibson, and Great Victoria Desert (Johnstone and Storr 2004).

Recent taxonomic revisions have reclassified the four races as separate species, with the Sandhill Grasswren proposed to be renamed as *Amytornis oweni*. However, this has not yet translated into legislative changes neither nationally nor at a state level. In Western Australia DPaW lists *A. s. striatus* as a protected Priority 4 species. In South Australia the Sandhill Grasswren (also as *A. s. striatus*) is listed as Vulnerable. Neither the species, nor any of its races are listed under the EPBC Act at this point in time, however this may change as taxonomic revisions make their way into law.

Yandal Station is situated in the distribution of the DPaW Priority 4 listed Sandhill Grasswren. The reason for listing is that the race has suffered loss and fragmentation of habitat as a result of clearing during the last century. This has resulted in reduced population size, and the population being scattered in isolated remnants, making them more vulnerable to extinction.

3.5.12 AUSTRALIAN BUSTARD – PRIORITY 4

The Australian Bustard (*Ardeotis australis*) is listed by DPaW as Priority 4 – Taxa in Need of Monitoring. The Australian Bustard is widely distributed, but has suffered massive historical population declines. It is particularly vulnerable to intensive agricultural practices and fox predation (Garnett and Crowley 2000). The species utilises a wide variety of grass habitats; including tussock, Triodia and grassy woodlands. They can also utilise chenopod flats and have been reported in lightly modified habitats such as golf courses. The species feeds on a variety of insects (such as stick insects) and fruits (Johnstone and Storr 1998). Yandal Station falls well within the known distribution of the species (Birdlife Australia 2015, Johnstone and Storr 1998).

3.5.13 PRINCESS PARROT – PRIORITY 4, VULNERABLE

The Princess Parrot (*Polytelis alexandrae*) is a slim, medium-sized parrot that grows to 40 to 45 cm in length (Higgins 1999). It is a colourful bird with a distinctive flight profile and flight movements, and a harsh far-ranging call (Johnstone and Storr 1994). The species is listed by DPaW as Priority 4 and listed as Vulnerable under the EPBC Act.

The Princess Parrot usually occurs singly, in pairs, or in small flocks of up to 30 birds. It occasionally congregates in large, loose flocks that may contain 100 or more birds; it breeds in small colonies of several pairs (Johnstone and Storr 1998). It occurs in lightly wooded country of, open mallee over spinifex, or open marble gum (*Eucalyptus gongylocarpa*) woodland (Johnstone and Storr 1998).

The Princess Parrot is confined to arid regions of Western Australia, the Northern Territory, and South Australia (Barrett *et al.* 2003, Johnstone and Storr 1998). In Western Australia it occurs in a broad band from the Great Sandy Desert in the north, across the Gibson and Tanami Desert to the Great Victoria Desert in the south (Johnstone and Storr 1998, Higgins 1999).

The species is rare and highly nomadic (Pizzey and Knight 2012), occurs over a very large area in remote or rarely visited regions, and its movements are largely unknown (Higgins 1999). These habits make it difficult to determine its exact range, or decide whether there has been a change in its population size and/or range. Historical records paint a picture of large range fluctuations over the decades, but they

do show a decline in the frequency of records from the periphery of its distribution since the 1950 which might indicate a decline in range (Garnett and Crowley 2000).

3.5.14 TRAPDOOR SPIDER: KWONKAN MORIARTII – PRIORITY 2

The trapdoor spider *Kwonkan moriartii* is a species of Mygalomorph spider, an ancient lineage of spiders of which many members (but not all) have a restricted distribution and can be regarded as short-range endemic invertebrates. The desktop search yielded a single record for this species 28 km to the east of the Yandal Station boundary, located within the Violet Range PEC (see section 3.3).

3.6 REMNANT VEGETATION

Vegetation surrounding the Central Bore pivot generally consists of stony plains with *Accia* and *Halophytic* shrublands. The Sisters Bore pivot area is located within mulga shrublands and spinifex. The majority of the Goldfields were cut over for timber early last century to fuel the mining industry and consequently vegetation is largely made up of regrowth timber (Beard 1972). The area has also been grazed by stock since the early 1900's.

3.7 WATERCOURSES OR WETLAND ENVIRONMENTS

There are no known watercourses within the project area, however there are ephemeral creeks that drain indirectly to Lake Darlot and Lake Maitland on a regional scale. There are no wetlands of national significance or sub-regional significance within the project area.

3.8 LAND DEGRADATION

Potential sources of land degradation on the project area include:

- Wind and water erosion from topsoil stripping prior to irrigation species being established
- Water erosion due to changes to the surface flow
- Soil and water contamination from increased use of fertilisers.

3.9 CONSERVATION ESTATE

There are no known conservation estates within the project area, however there are several estates within the region. Wanjarri Nature Reserve number 3390 is located approximately 40km west of the project area.

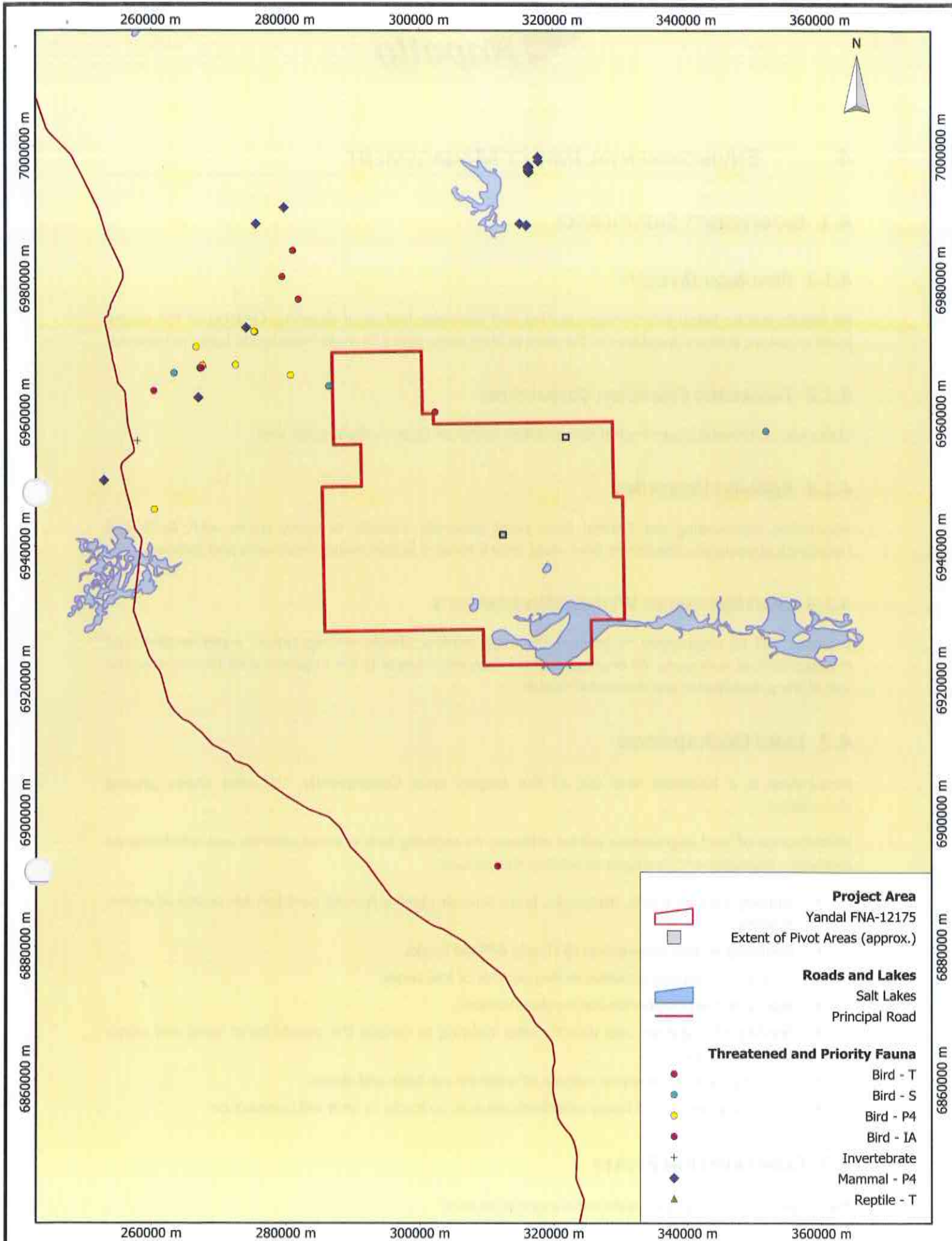
3.10 GROUND AND SURFACE WATER QUALITY

3.10.1 UNDERGROUND AND SURFACE WATER QUALITY

The groundwater of the project area will be utilised by the existing Sisters Bore and Central Bore. Groundwater is approximately 10 metres below the surface. Groundwater monitoring undertaken in January 2014 indicated that the groundwater is potable with electrical conductivity (total dissolved solids) of 280 mg/l and a neutral pH of 6.6.

3.10.2 FLOODING POTENTIAL

There are no permanent waterways that will be affected by this proposal. Ephemeral creeks occur in the project area, the major one is situated to the east of the application area



4 ENVIRONMENTAL IMPACT MANAGEMENT

4.1 BIODIVERSITY SIGNIFICANCE

4.1.1 BIOLOGICAL DIVERSITY

All efforts will be taken to minimise clearing and maximise biological diversity. Clearing of the centre pivot irrigation area will be placed in the area of least disturbance to major vegetation types in the area.

4.1.2 THREATENED ECOLOGICAL COMMUNITIES

There are no threatened ecological communities within or close to the project area.

4.1.3 REMNANT VEGETATION

Vegetation surrounding the Central Bore pivot generally consists of stony plains with Accia and Halophytic shrublands. The Sisters Bore pivot area is located within mulga shrublands and spinifex.

4.1.4 WATERCOURSES OR WETLAND ENVIRONMENTS

Drainage will be engineered to prevent drainage shadow effects on vegetation, water erosion and management of sediment. All drainage will be channelled towards the irrigation area to maximise the use of the groundwater and incidental rainfall.

4.2 LAND DEGRADATION

Pastoralism is a historical land use of the project area. Consequently, the area shows grazing disturbance.

Minimisation of land degradation will be achieved by applying best practice clearing and rehabilitation methods. Management strategies to achieve this include:

- Utilising existing tracks, firebreaks, fence lines or pipeline/power corridors for access wherever possible.
- Confining vehicle movements to clearly defined tracks.
- Conducting clearing activities during periods of low winds.
- Stockpiling vegetation for use in rehabilitation.
- Seeding of irrigation crop directly after clearing to reduce the possibility of wind and water erosion of topsoil
- Locating tracks to minimise erosion of watercourse beds and slopes.
- Minimising amount of heavy vehicle movement on tracks to limit soil compaction.

4.3 CONSERVATION ESTATE

No conservation estates exist within the application area.

4.4 GROUND AND SURFACE WATER QUALITY

4.4.1 UNDERGROUND AND SURFACE WATER QUALITY

Fresh groundwater in the region occurs on extensive alluvial plains with sandy surfaced duplex soils. The water is suitable for stock.

Due to the small area to be cleared it is unlikely that there will be any adverse impacts upon the groundwater quality of the area. Most water used for irrigation purposes that is not taken up by the crop or evaporated will recharge the underlying aquifer.

All irrigation and incidental rainwater will be directed into the crop area and no drainage erosion is expected beyond this localised area.

4.4.2 FLOODING

Due to the ephemeral nature of the creeks on the project area the likelihood of flooding on the project area is low.

Given the small size of the project in a regional context, it is considered the project is unlikely to exacerbate the incidence of flooding.

5 REFERENCES

- Beard, J.S. (1972). The vegetation of the Kalgoorlie area, Western Australia. Vegetation Survey of Western Australia, 1:250 000 Series. Veg map publications, Sydney.
- Beard, J.S. (2005) Pre-European Vegetation - Western Australia (NVIS Compliant version). Arc View Shape files.
- Benshemesh, J. (2000) *National Recovery Plan for Malleefowl*. Department of Environment and Heritage, Adelaide.
- Birdlife Australia. (2015a) Birddata. URL <http://www.birddata.com.au/homecontent.do>
- Birdlife Australia. (2013b) *Starter Kit: Atlas of Australian Birds. Everything You Need to Know to Get Started*.
- Birdlife Australia. (2015) Birdlife Australia website. URL www.birdlife.org.au
- Bureau of Meteorology. (2015) Bureau of Meteorology - Climate data online. URL <http://www.bom.gov.au/>
- Burnside, D. G. (1985). Local flora and fauna – degradation, recovery and management. In: The Goldfields, and its environment WA School of Mines Seminar November 1985.
- Chapman, A. and Kealley, I. (2001). The birds of Kurrawang Nature Reserve – observations of avifaunal change in the eastern goldfields of Western Australia. CALM Science 3(4):513-520 (2001).
- Chapman, A. Kealley, I. McMillan, D. McMillan, P. and Rolland, G. (1991). Biological Surveys of Four Goldfields Reserves. Landnote 1/91. Department of Conservation and Land Management.
- Department of Environment and Conservation. (2014) Department of Environment Regulation. *Native Vegetation Map Viewer*.
- Department of Parks and Wildlife. (2014a) Threatened and Priority Fauna Rankings
- Department of Parks and Wildlife. (2014b) *List of Threatened Ecological Communities Endorsed by the Western Australian Minister for the Environment. Species and Communities Branch*.
- Department of Parks and Wildlife. (2014c) *Threatened Fauna Database*. Department of Parks and Wildlife.
- Department of Parks and Wildlife. (2014d) NatureMap.
- Department of Parks and Wildlife. (2014e) *Priority Ecological Communities for Western Australia. Version 19*. Species and Communities Branch, Department of Parks and Wildlife.
- Department of Sustainability, Environment, Water, Population and Communities. (2014) Protected Matters Search Tool.
- Department of the Environment. (2014) *Leipoa ocellata* - Malleefowl. Species Profile and Threats Database (SPRAT). URL http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=934

Frith, H. J. (1962). The Mallee Fowl. Angus and Robertson, Sydney.

Garnett, S.T. and Crowley G. M. (2000). The Action Plan for Australian Birds 2000. Natural Heritage Trust.

Higgins, P.J. (Ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds - Volume 4 Parrots to Dollar Birds. Oxford University Press, Melbourne.

McKenzie, N.L. and Hall, N.J. (1992). The biological survey of the eastern goldfields of Western Australia. Part 8, Kurnalpi-Kalgoorlie study area. *Records of the Western Australian Museum Supplement* 41, pp. 1-125

Pringle, H.R.H, Van Vreeswyk, A.M.E and Gilligan, S. A. (1994). An inventory and condition survey of the north-eastern Goldfields, Western Australia. Technical Bulletin 87. Department of Agriculture Western Australia.

Thackway, R. and Cresswell, I.D. (eds) (1995). An interim biogeographic regionalisation for Australia: A framework for setting priorities in the national reserves co-operatives programme. Reserves Systems Unit, Australian Nature Conservation Agency, Canberra.

Thompson, G. and Thompson, S. (2002). Terrestrial Fauna Surveys: why, when and how much? In Proceedings of the Goldfields Land Rehabilitation Group Conference 2002.

Wilson, S. & Swan, G. (2013) *A Complete Guide to Reptiles of Australia*, 4th ed. New Holland Publishers, Chatswood, N.S.W. :

