



**WestGold**  
Location 45  
Flora and Fauna Assessment

May 2018

# Executive summary

WestGold Group (WestGold) owns the South Kalgoorlie Operations (SKO) located approximately 40 kilometres (km) south of Kalgoorlie in the Coolgardie region of Western Australia. As part of the SKO WestGold is proposing to undertake exploration and mine development activities on one of its tenements, Location 45. GHD Pty Ltd (GHD) was engaged by WestGold to undertake a vegetation, flora and fauna assessment of the tenement area to identify key ecological constraints and support future approvals documentation.

## **Vegetation and flora key findings**

Broad scale vegetation mapping by Beard (1972) indicates two vegetation associations within the survey area:

- Medium woodland; Coral Gum and Goldfields Blackbutt (association 9)
- Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468)

Both vegetation associations at the State, IBRA bioregion, IBRA subregion and Local Government Authority (LGA) scales have greater than 96 % of their pre- European extents remaining.

The survey area comprised seven vegetation types. Six vegetation types describe variations in *Eucalyptus* spp. woodlands, the seventh vegetation type identified modified vegetation associated with and surrounding man made water sources. The GHD vegetation types are not representative of any Commonwealth or State listed Threatened and Priority Ecological Communities. Within the survey area are several minor ephemeral drainage lines, two larger ones flow southwards to Lake Lefroy. The vegetation recorded within the larger drainage lines supported *Eucalyptus* spp. over a suite of shrubs, herbs and grasses commonly found within the larger survey area, therefore is not considered representative of riparian, or wetland vegetation

The vegetation condition within the survey area ranged from Excellent to Good. The majority of the survey area was in Excellent condition. Good condition vegetation was associated with vegetation surrounding man-made water sources within the survey area.

Eighty four flora taxa were recorded during the field survey, which comprised 81 native flora taxa and three introduced taxa. One of the introduced flora is listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007*. No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Wildlife Conservation Act 1950* (WC Act) or Department of Biodiversity, Conservation and Attractions (DBCA) Priority-listed flora taxa were recorded within the survey area during the field survey.

Desktop searches identified the presence/ potential presence of seven conservation significant flora taxa. The likelihood of occurrence assessment of these seven taxa concluded one taxon is likely to occur, two may possibly occur and the remaining four taxa are unlikely to occur within the survey area. The taxon likely to occur was *Eremophila arachnoides* subsp. *tenera* (P1)

## **Fauna key findings**

There were seven broad habitat types identified within the survey area, five habitat types represented various *Eucalyptus* woodlands, one was associated with artificial water sources and the last represented cleared areas such as roads and tracks. No habitat types recorded are considered to be exclusive to the survey area. Locally and regionally, the habitat within the survey area is well connected to the habitat in surrounding areas and the broader region.

During the field survey, thirty seven fauna species were recorded; 26 birds, seven mammals and four reptiles. Four of these were introduced fauna species. No conservation significant fauna were recorded within the survey area during the field survey. Desktop searches identified the presence/ potential presence of ten conservation significant fauna within the study area. An assessment on the likelihood of occurrence deemed two of these conservation significant fauna species were considered likely to occur within the survey area, the remaining fauna species were unlikely or highly unlikely to occur. The fauna species likely to occur were; The Rainbow Bee-eater (*Merops ornatus*), listed as International Agreement under the WC Act and Malleefowl (*Leipoa ocellata*), listed as Vulnerable under the EPBC Act.

Ten transects (9 km in total) were traversed throughout multiple habitat types within the survey area to record habitat trees; 141 habitat trees - 72 with hollows - were identified within the ten transect lines. This equates to approximately 4 habitat trees per ha, with an average of three hollows per tree.

### ***Assessment against the 10 clearing principles***

An assessment of proposed clearing against the 10 clearing principles determined that clearing of the survey area is not likely to be at variance with any principles.

*This report is subject to, and must be read in conjunction with, the limitations set out in section 1.6 and the assumptions and qualifications contained throughout the Report.*

# Table of contents

1.	Introduction.....	<b>Error! Bookmark not defined.</b>
1.1	Project background.....	<b>Error! Bookmark not defined.</b>
1.2	Purpose of this report.....	<b>Error! Bookmark not defined.</b>
1.3	Scope of works .....	<b>Error! Bookmark not defined.</b>
1.4	Relevant legislation, conservation codes and background information....	<b>Error! Bookmark not defined.</b>
1.5	Report assumptions and limitations.....	<b>Error! Bookmark not defined.</b>
2.	Methodology.....	<b>Error! Bookmark not defined.</b>
2.1	Desktop assessment.....	<b>Error! Bookmark not defined.</b>
2.2	Field survey.....	<b>Error! Bookmark not defined.</b>
2.3	Limitations.....	<b>Error! Bookmark not defined.</b>
3.	Desktop assessment.....	<b>Error! Bookmark not defined.</b>
3.1	Climate.....	<b>Error! Bookmark not defined.</b>
3.2	Regional biogeography.....	<b>Error! Bookmark not defined.</b>
3.3	Landforms and soils.....	<b>Error! Bookmark not defined.</b>
3.4	Hydrology.....	<b>Error! Bookmark not defined.</b>
3.5	Land use .....	<b>Error! Bookmark not defined.</b>
3.6	Vegetation and flora.....	<b>Error! Bookmark not defined.</b>
3.7	Fauna.....	<b>Error! Bookmark not defined.</b>
4.	Results .....	<b>Error! Bookmark not defined.</b>
4.1	Vegetation and flora.....	<b>Error! Bookmark not defined.</b>
4.2	Fauna.....	<b>Error! Bookmark not defined.</b>
5.	Ten clearing principals assessment.....	<b>Error! Bookmark not defined.</b>
6.	References.....	<b>Error! Bookmark not defined.</b>

# Table index

Table 1	Survey constraints and limitations .....	<b>Error! Bookmark not defined.</b>
Table 2	Broad vegetation association extents .....	<b>Error! Bookmark not defined.</b>
Table 3	Recorded vegetation types for the survey area.....	<b>Error! Bookmark not defined.</b>
Table 4	Extent of vegetation condition ratings mapped within the survey area ....	<b>Error! Bookmark not defined.</b>
Table 5	Fauna habitat types within the survey area .....	<b>Error! Bookmark not defined.</b>
Table 6	Summary of fauna likelihood of occurrence.....	<b>Error! Bookmark not defined.</b>

# Figure index

Figure 1	Project location .....	<b>Error! Bookmark not defined.</b>
Figure 2	Environmental constraints .....	<b>Error! Bookmark not defined.</b>
Figure 3	Vegetation types and sample locations .....	<b>Error! Bookmark not defined.</b>
Figure 4	Vegetation condition and significant weeds.....	<b>Error! Bookmark not defined.</b>
Figure 5	Fauna habitats and habitat tree transects .....	<b>Error! Bookmark not defined.</b>

# Appendices

- Appendix A - Figures
- Appendix B – Background information, relevant legislation and conservation codes
- Appendix C – Desktop searches
- Appendix D – Flora data
- Appendix E – Fauna data
- Appendix F – Ten clearing principals assessment

# 1. Introduction

## 1.1 Project background

WestGold Group (WestGold) owns the South Kalgoorlie Operations (SKO) located approximately 40 kilometres (km) south of Kalgoorlie in the Coolgardie region of Western Australia (WA). As part of the SKO WestGold is proposing to undertake exploration and mine development activities on one of its tenements, Location 45.

GHD Pty Ltd (GHD) was engaged by WestGold to undertake a vegetation, flora and fauna assessment of the tenement area to identify key ecological constraints and support future approvals documentation.

## 1.2 Purpose of this report

This report details a reconnaissance vegetation and flora survey and a Level 1 fauna assessment of Location 45. The purpose of the survey was to identify key ecological constraints within the tenement area to inform and support a native vegetation clearing permit application.

## 1.3 Survey area

The Location 45 tenement (referred to as the 'survey area') is located approximately 37 km south-east of Kalgoorlie in the Goldfields region of WA. The survey area is approximately 12 km long, 6.5 km wide and covers 7,168.32 hectares (ha). The location of the survey area is indicated on Figure 1, Appendix A.

A study area was defined for the biological desktop searches and includes a 20 km buffer of the survey area.

## 1.4 Scope of works

The scope of works, as detailed in the WestGold brief and GHD proposal was to:

- Undertake a desktop assessment of relevant ecological aspects and constraints
- Undertake an enhanced reconnaissance vegetation and flora survey of the survey area to provide:
  - Description and mapping of vegetation units and condition
  - Inventory of vascular flora taxa
  - Location and counts of conservation significant flora (Threatened and Priority Flora) and any Declared Pest taxa
- Undertake a Level 1 fauna survey of the survey area to provide:
  - Description and mapping of fauna habitat types
  - Inventory of vertebrate fauna taxa
  - Assessment of existing and potential habitat trees (DBH  $\geq$ 500 mm), including tree height, height to hollow and hollow sizes
  - An indication of the presence or likelihood of occurrence of conservation significant fauna within the survey areas
- Prepare a report on the findings of the surveys
- Undertake an assessment of the survey area against the 10 Clearing Principles.

## **1.5 Relevant legislation, conservation codes and background information**

In WA significant communities, and flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory bodies also provide a range of guidance and information on expected standards and protocols for environmental surveys.

An overview of key legislation and guidelines, conservation codes and background information relevant to this biological assessment are provided in Appendix B.

## **1.6 Report assumptions and limitations**

This report has been prepared by GHD for WestGold and may only be used and relied on by WestGold for the purpose agreed between GHD and WestGold as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than WestGold arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by WestGold and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report has assessed the flora and fauna within the survey area (Figure 1, Appendix A). Should the survey area change or be refined, further assessment may be required.

## 2. Methodology

### 2.1 Desktop assessment

Prior to the commencement of the field survey a desktop assessment was undertaken to identify relevant environmental information pertaining to the study area and to assist in survey design.

This included a review of:

- The Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST) to identify communities and species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) potentially occurring within the study area (DEE 2018a) (Appendix C)
- The Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Ecological Communities (TEC/PEC) database to determine the potential for TECs or PECs present within the study area
- The DBCA *NatureMap* database for flora and fauna species previously recorded within the study area (DBCA 2007–) (Appendix C)
- The DBCA Threatened (Declared Rare) and Priority Flora (TPFL) and WA Herbarium database (WAHERB) and for Threatened and Priority flora species listed under the *Wildlife Conservation Act 1950* (WC Act) and listed as priority by DBCA, previously recorded within the study area
- Identification of Environmentally Sensitive Areas and DBCA-managed conservation estates and reserves
- Existing datasets including previous broad-scale vegetation mapping of the survey area, aerial photography, geology/soils and hydrology information to provide background information on the variability of the environment, likely vegetation units and fauna habitats and to identify areas with the potential to contain TECs, PECs, and Threatened and Priority listed flora and fauna species.

### 2.2 Field survey

#### 2.2.1 Vegetation and flora

GHD botanist Angela Benkovic (flora license no. SL012111) conducted an enhanced reconnaissance survey of the survey area from 15-18 March 2018. An enhanced reconnaissance survey involves moderate intensity sampling. The survey was undertaken to verify the results of the desktop assessment, determine the current composition and condition of vegetation present within the survey area, and identify and record vascular flora taxa present at the time of survey. In addition, an assessment of the potential for conservation flora to occur within the survey area was also undertaken.

The survey methodology employed by GHD was undertaken with reference to the Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a).

#### Data collection

Field assessment methodology involved traversing the survey area by vehicle and on foot to assess the vegetation present within the survey area. Thirty one relevé (R) locations and three photo points (PP) were used to gather information during the survey. An approximate 20 m unbound radius was surveyed around each R location. Field data at each R location was

recorded on a pro-forma data sheet and included the parameters detailed in Table 1. Photo points were used to identify the dominant flora taxa from each structural layer at various locations to assist in vegetation mapping.

**Table 1 Data collected during the field survey**

Aspect	Measurement
Collection attributes	Personnel/recorder; date and photograph at R point.
Physical features	Aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately $\pm 5$ m.
Vegetation condition	Vegetation condition was assessed using the condition rating scale adapted by EPA (2016a) for the South West and Interzone Botanical Province.
Disturbance	Level and nature of disturbances (e.g. weed presence, fire and time since last fire, impacts from grazing, exploration activities).
Flora	List of dominant flora from each structural layer. List of most species within the R including average height and cover (using the National Vegetation Information System (NVIS))

A flora inventory was compiled from taxa recorded within the survey area and is provided in Appendix D.

### Vegetation units

Vegetation units were identified and boundaries delineated using a combination of aerial photography, topographical features, previous mapping (Beard 1972) and field data.

Vegetation units were described based on structure, dominant taxa and cover characteristics as defined by RA data and field observations. Vegetation unit descriptions follow NVIS and are consistent with NVIS Level V (Association). At Level V up to three taxa per stratum are used to describe the association (ESCAVI 2003).

### Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (devised by Keighery (1994) and adapted by EPA (2016a)). The scale recognises the intactness of vegetation and consists of six rating levels. The vegetation condition rating scale is outlined in Appendix B.

### Flora identification and nomenclature

Species well known to the survey botanist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. Plant species were identified with the use of local and regional flora keys and by comparison with the named species held at the Western Australian (WA) Herbarium.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–) and the EPBC Act Threatened species database provided by DEE (2018b). Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium 1998–).

## 2.2.2 Fauna

GHD zoologist Melissa Jensen conducted a single season Level 1 (reconnaissance) fauna survey of the survey area on 15-18 March 2018. The field survey was undertaken to verify the accuracy of the desktop study, identify fauna habitat types, identify and record fauna taxa present at the time of survey and assess habitat value and connectivity. An assessment of the

likelihood of occurrence of conservation significant fauna and their habitats occurring within the survey area was also undertaken post field survey.

The majority of the survey area was traversed on foot and by vehicle over the course of nine days. The survey methodology employed by GHD was undertaken with reference to the EPA *Technical Guidance – Sampling methods for terrestrial vertebrate fauna* (EPA 2016b) and *Technical Guidance – Terrestrial Fauna Surveys* (EPA 2016c).

### Habitat assessment

The survey area was assessed for habitat type, structural complexity, connectivity, disturbance, type and extent of resource availability and value for fauna. Specifically, the assessment included:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, midstorey, understorey, and ground cover).
- Presence/absence of refuge including: fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/breakaways, and the type and extent of each refuge
- Location of the habitat within the survey area in comparison to the habitat within the surrounding landscape
- Habitat connectivity and identification of wildlife corridors within and immediately adjacent to the survey area
- Identification and evaluation of key habitat features and types identified during the desktop assessment relevant to fauna of conservation significance
- Evaluation of the likelihood of occurrence of conservation significant fauna within the habitat (based on presence of suitable habitat)
- A representative photograph of each habitat type.

### Opportunistic observations

Opportunistic fauna searches were conducted throughout the survey area and focussed on the following:

- Searching the survey area for tracks, scats, pellets, bones, diggings, feathers, nests and feeding areas indicating the current or recent presence of native and feral fauna
- Searching through microhabitats within the survey area, including turning over rocks and ground debris (e.g. leaf litter) and examining tree hollows (from the ground) and hollow logs for vertebrate fauna
- Opportunistic observations of species in the survey area, including visual and aural sightings
- Observed fauna were recorded and where conservation significant fauna were identified, photographs, GPS points and habitat data were recorded.

### Habitat tree assessment

Habitat trees that contain hollows, or are of a suitable diameter at breast height (DBH) to develop a hollow in the future, are important breeding habitat for many native fauna species. For most tree species, suitable DBH is 500 mm. For Salmon Gum (*Eucalyptus salmonophloia*) and other smooth barked species, suitable DBH is 300 mm. Opportunistic searches for habitat trees were conducted along transects throughout the survey area to identify and record the locations of existing and potential habitat trees. Transects were either 500 m or 1 km long and all habitat trees which contained, or have the potential to develop, hollows suitable for native fauna were

identified and measured within 20 m either side of the transect line. Due to the mosaic nature of the landscape, transects were not restricted to one particular habitat type and instead traversed through multiple habitat types.

For each habitat tree, details of the tree species, DBH, tree height, the height to each hollow and the hollow sizes were recorded. The location of each habitat tree was recorded via GPS. Hollows were classified as either small (1-10 cm diameter), medium (11-20 cm diameter) or large (greater than 20 cm diameter). Evidence of hollow use and any other significant observations were also recorded.

### **Fauna nomenclature**

Nomenclature used in this report follows that used by the WA Museum as reported on *NatureMap*. This nomenclature is deemed the most up-to-date species information for WA fauna, with the exception of birds, which follows Christidis and Boles (2008).

### **Fauna species identification**

Identification of fauna species was made in the field using available field guides and electronic guides (e.g. Morcombe 2014). Where identification was not possible, photographs of specimens were collected to be later identified.

## **2.3 Limitations**

### **2.3.1 Desktop limitations**

The EPBC Act PMST is based on bioclimatic modelling for the potential presence of species. As such, this does not represent actual records of the species within the area. The records from the DBCA searches of threatened flora and fauna provide more accurate information for the general area. However, some records of collections, sightings or trappings cannot be dated and often misrepresent the current range of threatened species.

### **2.3.2 Field survey limitations**

The EPA (2016a, 2016b) Technical Guides state that flora and fauna survey reports for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used. The limitations and constraints associated with this field survey are discussed in Table 2.

**Table 2 Survey constraints and limitations**

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area, this includes: <ul style="list-style-type: none"> <li>• Broad scale (1:250 000) mapping by Beard (1972) and digitised by Shepherd <i>et al.</i> (2002)</li> <li>• Regional biogeography (Cowan 2001)</li> </ul>
Scope (what life forms were sampled etc.)	Nil	Vascular flora and terrestrial vertebrate fauna were sampled during the survey. Non-vascular flora, invertebrate and aquatic fauna were not assessed as part of survey although opportunistic records were taken of invertebrate fauna when observed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Nil	<p>The reconnaissance vegetation and flora survey was undertaken 15-18 March 2018. The flora recorded from the field survey is detailed in section 3.6.3 and a full flora species list is provided in Appendix D. The portion of flora collected and identified was considered high, however, it is likely the survey under-recorded some grass species (Poaceae) and herb (annual/ ephemeral) species due to survey timing.</p> <p>The fauna survey was undertaken on 15-18 March 2018 and involved a Level 1 reconnaissance vertebrate fauna survey. The fauna assessment sampled those species that can be easily seen, heard or has distinctive signs, such as tracks, scats, diggings, etc. Many cryptic species would not have been identified during a reconnaissance survey and seasonal variation within species often requires targeted surveys at a particular time of the year. Of the fauna species recorded during the survey, all species were identified to a species level.</p> <p>The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No targeted sampling for invertebrates or aquatic species occurred. Where fresh water fish and crustacean fauna were recorded opportunistically, these findings are mentioned in this report. However, this report is limited to an assessment of terrestrial vertebrate fauna, as the information available on the identification, distribution and conservation status fresh water fish and crustacean is generally less extensive than that of vertebrate species.</p>
Flora determination	Minor	<p>Flora determination was undertaken by the survey botanist in the field and at the WA Herbarium.</p> <p>Two flora collections could only be identified to family, four were identified to genus and two were tentatively identified to species level only due to lack of flowering and fruiting material required for identification. These collections showed no resemblance to any Threatened or Priority flora identified in the desktop assessment. Additionally, some species, particularly grasses (Poaceae) annuals and ephemerals, may have been overlooked due to lack of material; however this is unlikely to affect the results of the survey.</p> <p>The taxonomy and conservation status of the WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time report development, but it should be noted this may change in response to ongoing research and review of International Union for Conservation of Nature criteria.</p>

Aspect	Constraint	Comment
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Moderate	The majority of the survey area was accessed on foot or by vehicle over the survey period. Information gained from the survey was extrapolated across those sections of the survey area not accessed by foot or vehicle during the field survey to assist with determining the vegetation and habitat types for the entire survey area. These areas consisted of remote sections of the survey area not accessible by vehicle and or a significant distance away by foot
Mapping reliability	Nil	The vegetation was mapped using high resolution ESRI aerial imagery obtained from Landgate and field data. The distribution of sample sites is considered adequate for the definition of vegetation within the survey area. Data was recorded in the field using hand-held GPS tools (e.g. Samsung tablet and Garmin GPS). Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. The Garmin GPS units used for this survey are accurate to within $\pm 5$ m on average. Therefore the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/season/cycle	Minor	<p>The field survey was conducted in March 2018. In the three months prior to the survey (December to February), Kalgoorlie-Boulder Airport weather station (No. 012038, Bureau of Meteorology (BoM) 2018 – located approximately 37 km from the survey area) recorded a total of 113.6 millimetres (mm) of rainfall. This rainfall total is greater than the Long Term Average (LTA) for the same period (December to February; 75.7 mm) (BoM 2018).</p> <p>The weather conditions during the March field survey (according to BoM weather station No. 012038) included:</p> <ul style="list-style-type: none"> <li>• Daily maximum temperature ranging from 25.2 to 36.7 °C</li> <li>• Daily minimum temperature ranging from 9.4 to 24.3 °C</li> <li>• Daily rainfall – 0.2 mm of rainfall was recorded during the survey period</li> </ul> <p>The weather conditions recorded during the survey periods are considered unlikely to have impacted the vegetation, flora and fauna survey.</p> <p>The vegetation and flora survey was conducted during Autumn. Autumn is generally not considered the most optimal time of year for flora and fauna surveys in the Coolgardie Region, However, above average rainfall was received in January and February 2018.</p>
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	No natural events or disturbances impacted the survey during the site visit.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled in accordance with the EPA (2016a) Technical guidance and terrestrial fauna sampled in accordance to EPA (2016b, 2016c) as required by the scope of works. The survey area was sufficiently covered by one botanist and one zoologist during the survey.
Resources	Nil	Adequate resources were employed during the field survey. A total of 8 person days were spent undertaking the survey using one dedicated botanist and one zoologist.

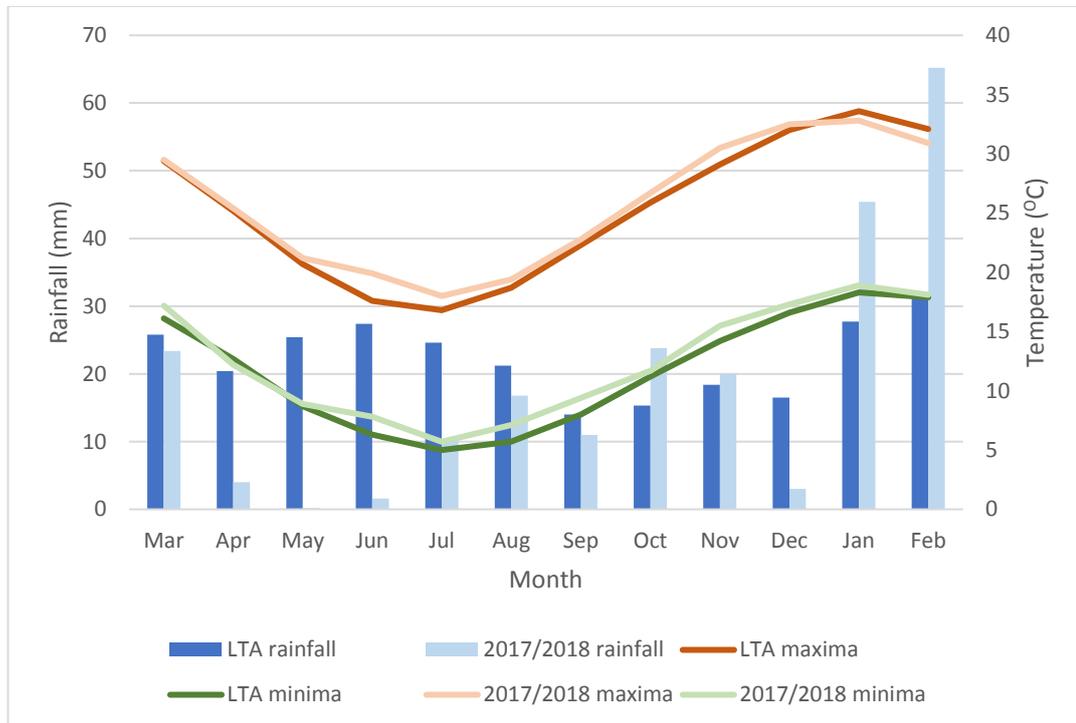
Aspect	Constraint	Comment
Access restrictions	Minor	No access restrictions were encountered during the field survey. The majority of the survey area was accessed on foot or by vehicle over the survey period. Information gained from the survey was extrapolated across those small sections of the survey area not accessed by foot or vehicle during the field survey to assist with determining the vegetation and habitat types for the entire survey area. These areas consisted of remote sections of the survey area not accessible by vehicle and or a significant distance away by foot.
Experience levels	Nil	The botanist and zoologist who executed the surveys were practitioners suitably qualified in their respective fields. Melissa Jensen (zoologist) has nine years' experience undertaking fauna surveys throughout Australia. Angela Benkovic (botanist) has over 11 years' experience undertaking flora and vegetation surveys within WA.

# 3. Desktop assessment

## 3.1 Climate

The climate of the Goldfields region is mostly hot and dry, with highly variable rainfall throughout the year. Kalgoorlie has a semi-arid climate with hot summers and mild winters, and an average rainfall of 267 mm relatively evenly distributed throughout the year. Rainfall can however be highly erratic year to year (BoM 2018).

The closest Bureau of Meteorology (BoM) weather recording station to the survey area with the most current available data is the Kalgoorlie-Boulder Airport (station number: 012038). A summary of the climatic data for this weather station in the 12 months preceding the survey (March 2017 – February 2018) are presented in Plate 1 along with long-term average climatic statistics (BoM 2018).



**Plate 1 Climate data for Kalgoorlie-Boulder Airport (BoM 2018)**

## 3.2 Regional biogeography

The survey area is situated in the Eremaean Botanical Province of Western Australia (Beard 1990), within the Coolgardie bioregion and the Eastern Goldfields subregion as described by the Interim Biogeographic Regionalisation of Australia (IBRA).

The Eastern Goldfields subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrains' and comprises gently undulating plains interrupted in the west by low hills and ridges and a series of large playa lakes. The underlying geology of the subregion is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group and cover much of the plains and greenstone areas (Cowan 2001). The Eastern Goldfields subregion is dominated by Mallees, *Acacia* thickets and shrubheaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys and dwarf shrublands of samphire are common in salt areas (Cowan 2001).

The survey area is also located in the Great Western Woodlands, which is the largest area of intact temperate woodland remaining on earth. The Woodlands cover almost 16 million

hectares, stretching from the edge of the Wheatbelt to Kalgoorlie-Boulder in the north, to inland deserts to the north east and the Nullarbor Plain to the east. The area has high floral diversity with more than 3000 species recorded and is a centre for eucalypt diversity (Watson *et al.* 2008, Thomas-Dans *et al.* 2012).

### **3.3 Landforms and soils**

The survey area is located in the Southern Cross Zone of the Kalgoorlie Province. The Southern Cross Zone is described as rises and low hills on Archaean greenstones, with broad valleys often containing salt lake chains. Soils are usually red, loamy to clayey and calcareous (Schoknecht *et al.* 2004).

Soil landscape mapping (GoWA 2018a) indicates that five soil landscape types occur within the survey area:

- Moriarty - Low greenstone rises and stony plains supporting Chenopod shrublands with patchy Eucalypt overstoreys
- Gumland - Extensive pedeplains supporting Eucalypt woodlands with halophytic and non-halophytic shrub understoreys
- Graves - Basalt and greenstone rises and low hills supporting Eucalypt woodlands with prominent Saltbush and Bluebush understoreys
- Bevon - Irregular low ironstone hills with stony lower slopes supporting Mulga shrublands
- Gundockerta System - Extensive, gently undulating calcareous stony plains supporting Bluebush shrublands

### **3.4 Hydrology**

Several minor ephemeral drainage lines intersect the survey area. In general, the drainage lines flow in a south-east direction toward Lake Lefroy. No wetlands intersect the survey area.

### **3.5 Land use**

#### **3.5.1 DBCA-managed lands**

No DBCA managed lands occur within the survey area or immediately adjacent to the survey area. Three DBCA managed lands occur within 20 km of the survey area and consist of Majestic Timber Reserve 13 km to the north-east, Kambalda Nature Reserve 14 km to the south-west and Lakeside Timber Reserve 17 km to the north-west.

#### **3.5.2 Environmentally Sensitive Areas**

No Environmentally Sensitive Areas occur within or adjacent to the survey area.

### **3.6 Vegetation and flora**

#### **3.6.1 Broad vegetation associations and extent**

Broad scale (1:250,000) vegetation mapping of the area was completed by Beard (1972) at an association level. Beard mapping indicates that two vegetation associations are present within the survey area. These vegetation associations include:

- Medium woodland; Coral Gum (*Eucalyptus torquata*) and Goldfields Blackbutt (*E. lesouefii*) (association 9) - intersects the middle of the survey area

- Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468) – intersects the northern and southern sections of the survey area

Beard mapping has been adapted and digitised by Shepherd *et al.* (2002). The extent of Beard's (1972) vegetation associations have been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update December 2017 – GoWA, 2018b). As shown in Table 3, both vegetation associations at the State, IBRA bioregion, IBRA subregion and Local Government Authority (LGA) scales have greater than 96 % of their pre-European extents remaining.

### **3.6.2 Conservation significant ecological communities**

A search of the EPBC *Protected Matters* database did not identify any federally listed TECs within the study area. Similarly, a search of the DBCA TEC/PEC databases did not identify any TECs or PECs within the study area.

**Table 3 Extents of vegetation associations mapped with the survey area (GoWA 2018b)**

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% current extent in all DBCA managed lands
9	State: WA	240,509.33	235,161.94	97.78	8.07
	IBRA bioregion: Coolgardie	240,441.99	235,100.97	97.78	8.07
	IBRA subregion: Eastern Goldfields	235,047.15	229,757.07	97.75	8.26
	LGA: City of Kalgoorlie Boulder	38,706.67	37,223.28	96.17	0.00
468	State: WA	592,022.31	583,902.76	98.63	23.15
	IBRA bioregion: Coolgardie	583,357.71	575,360.61	98.63	22.72
	IBRA subregion: Eastern Goldfields	482,361.84	474,364.74	98.34	22.42
	LGA: City of Kalgoorlie Boulder	303,529.42	2996,698.80	97.75	4.67

### **3.6.3 Flora diversity**

A search of the *NatureMap* database identified 109 plant taxa representing 32 families and 59 genera that have previously been recorded the study area. This total comprised 95 native flora taxa and 14 naturalised (non-native) flora taxa. Dominant families within this search included Myrtaceae (17 taxa), Chenopodiaceae (13 taxa) and Fabaceae (12 taxa).

### **3.6.4 Conservation significant flora**

Desktop searches identified the presence/potential presence of seven conservation significant flora taxon within the study area. The desktop searches recorded:

- Two taxa listed as Threatened under the EPBC Act, one of which is listed as Declared Rare Flora under the WC Act, the other as a Priority 1 taxon by DBCA
- Six Priority 1 taxa, one of these is listed as Vulnerable under the EPBC Act.

## **3.7 Fauna**

### **3.7.1 Fauna diversity**

The *NatureMap* database search identified 86 terrestrial vertebrate fauna species previously recorded within the study area. This total included 72 birds and 14 reptiles. The remainder of species identified in each search were invertebrates and were not considered as part of this survey.

### **3.7.2 Conservation significant fauna**

The EPBC Act PMST and *NatureMap* database identified the presence/potential presence of ten conservation significant fauna species within the study area. The desktop searches recorded:

- Nine EPBC Act/WC Act listed species
- One species listed as International Agreement under WC Act

These results exclude marine species as no marine habitat is present within the survey area.

# 4. Results

## 4.1 Vegetation and flora

### 4.1.1 Vegetation types

Seven vegetation types were identified and described for the survey area (Table 4 and Figure 3, Appendix A). Six vegetation types describe variations in *Eucalyptus* spp. woodlands, the seventh vegetation type identified modified vegetation associated with and surrounding man made water sources.

Vegetation types *Eucalyptus salmonophloia*, *E. lesouefii* and *E. transcontinentalis* open woodland over Chenopodiaceae open shrubland (VT01) and Mosaic *Eucalyptus* spp. woodland (VT03) dominated the survey area (2,669.57 ha and 3,481.07 ha, respectively). VT03 had localised patches of stony to cobbly quartz, which covered 2-30 % of the substrate surface. The substrate of VT01 was either loose silty orange soil with or without iron cemented / stained conglomerate sandstone rocks or gravel.

Vegetation type *Eucalyptus salmonophloia* and *E. griffithsii* open woodland over a tall sparse shrubland (VT04) (226.96 ha) was associated with drainage lines within the survey area. Vegetation type *Eucalyptus oleosa* subsp. *oleosa* and *E. griffithsii* woodland over *Triodia* sp. (VT05) (307.77 ha) was unique in that it was the only vegetation type with *Triodia* sp. present in the understorey. The most restricted unaltered vegetation type was *Eucalyptus salmonophloia* with *E. lesouefii*, *E. oleosa* subsp. *oleosa* and *E. torquata* woodland over *Eremophila* spp. shrubland (VT02) (258.95 ha), which was generally located along rocky outcrops and slopes.

**Table 4 Recorded vegetation types for the survey area**

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
<i>Eucalyptus salmonophloia</i> , <i>E. lesouefii</i> and <i>E. transcidentalis</i> open woodland over Chenopodiaceae open shrubland (VT01)	<i>Eucalyptus salmonophloia</i> <i>E. lesouefii</i> , <i>E. transcidentalis</i> open woodland over <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> , <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i> sparse tall shrubland over <i>Atriplex nummularia</i> subsp. <i>spathulata</i> , <i>Maireana sedifolia</i> mid chenopod shrubland	Plains with silty orange soils, occasional conglomerate sandstone rocks	2,669.57	Association: 468 Relevés: 10 & 18 Photo Point: 1, 2 & 31	
Occasional <i>Eucalyptus salmonophloia</i> with <i>E. lesouefii</i> <i>E. oleosa</i> subsp. <i>oleosa</i> and <i>E. torquata</i> woodland over <i>Eremophila</i> spp. shrubland (VT02)	<i>Eucalyptus salmonophloia</i> isolated trees with <i>E. lesouefii</i> , <i>E. oleosa</i> subsp. <i>oleosa</i> , <i>E. torquata</i> woodland over <i>Eremophila interstans</i> subsp. <i>virgata</i> tall sparse shrubland over <i>E. scoparia</i> , <i>E. glabra</i> subsp. <i>glabra</i> , <i>E. parvifolia</i> subsp. <i>auricampa</i> low to mid shrubland	Slopes and outcrops with a combination of quartz and conglomerate sandstone rocks over silty orange soil	258.95	Association: 9 Relevés: 23, 26, 29 & 30	
Mosaic <i>Eucalyptus</i> spp. woodland (VT03)	<i>Eucalyptus</i> spp. woodland over <i>E. ravidia</i> isolated clumps of trees over <i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i> and/or <i>Melaleuca sheathiana</i> tall isolated shrubs over <i>Atriplex nummularia</i> subsp. <i>spathulata</i> , <i>Tecticornia halocnemoides</i> low to mid shrubland	Combination of plains and slopes localised patches of 2-30 % quartz cobbles/ stones over silty orange soil	3,481.07	Associations: 9 & 468 Relevés: 1, 2, 3b, 4, 5, 7, 9, 11, 12, 13, 15, 17, 19, 20, 21, 24, 27, 28 & 68	

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
<i>Eucalyptus salmonophloia</i> and <i>E. griffithsii</i> open woodland over a tall sparse shrubland (VT04)	<i>Eucalyptus salmonophloia</i> , <i>E. griffithsii</i> open woodland over <i>Acacia jennerae</i> tall sparse shrubland over variable open grassland/ hermland	Drainage line, silty orange soil	226.96	Associations: 9 & 468 Relevés: 8 & 22	
<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i> and <i>E. griffithsii</i> woodland over <i>Triodia</i> sp. open hummock grassland (VT05)	<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i> , <i>E. griffithsii</i> woodland over <i>Acacia</i> spp. tall open shrubland over <i>Scaevola spinescens</i> , <i>Frankenia interioris</i> var. <i>interioris</i> , <i>Dodonaea microzyga</i> var. <i>acrolobata</i> low shrubland over <i>Triodia</i> sp. open hummock grassland	Upper slopes with conglomerate sandstone rocks over silty orange soil	307.77	Association: 9 Relevés: 14 & 16	
<i>Eucalyptus salmonophloia</i> , <i>E. stricklandii</i> and <i>E. celastroides</i> subsp. <i>celastroides</i> over variable open shrubland (VT06)	<i>Eucalyptus salmonophloia</i> , <i>E. stricklandii</i> , <i>E. celastroides</i> subsp. <i>celastroides</i> open woodland over <i>Acacia</i> spp., <i>Eremophila</i> spp., <i>Ptilotus</i> spp. mixed mid to low shrubland	Ironstone gravel over silty orange soil	184.54	Association: 9 Relevé: 6	

Vegetation type	Vegetation Type Description	Landform and Substrate	Extent (ha)	Vegetation Association, relevé and photo point reference	Photograph
Variable shrubland/ herbland (VT07)	<i>Acacia jennerae</i> , * <i>Nicotiana glauca</i> tall shrubland over *DP <i>Xanthium spinosum</i> , <i>Swainsona canescens</i> herbland	Silty orange soils	10.45	Associations: 9 & 468 Relevés: NA	
Water Source	NA		0.54		
Cleared/ track/ road	NA		28.47		

### 4.1.2 Vegetation condition

The vegetation condition within the survey area was rated Excellent to Good in condition. The extents of the vegetation condition ratings mapped within the survey area are detailed in Table 5 and mapped in Figure 4, Appendix A.

The majority of the survey area was in Excellent condition with very little weed invasion. Dirt tracks and fencing were the only major disturbances observed and these had little effect on the vegetation structure. Vegetation type VT04 was rated as Very Good due to the increased presence of weeds in the area. VT04 is associated with a drainage line and weeds are able to travel and establish more easily during the wetter months. Vegetation surrounding man made water sources were in Good condition. These areas had been historically cleared and were also under pressure from cattle using the water source. As a result, the area was dominated by opportunistic shrubs and weeds.

**Table 5 Extent of vegetation condition ratings mapped within the survey area**

Vegetation Condition	Extent in survey area (ha)
Excellent	6,901.90
Very Good	226.96
Good	10.45
Not rated – cleared, roads, tracks etc.	29.01
<b>Total</b>	<b>7,168.32</b>

### 4.1.3 Conservation significant ecological communities

The GHD vegetation types identified within the survey area during the field survey do not align with any known Commonwealth or State listed TECs or PECs.

### 4.1.4 Other significant vegetation

No other significant vegetation as defined by the EPA (2016a) was identified within the survey area. VT04 grows in association with ephemeral drainage lines that feed into Lake Lefroy in the south of the survey area. No water was present within the drainage lines during the field survey. Additionally the vegetation within VT04 is not considered to be wetland or riparian in nature. The drainage lines supported *Eucalyptus* spp. over a suite of shrubs, herbs and grasses commonly found within the larger survey area. The flora taxa most likely opportunistically dispersed and established along the drainage lines during the wetter months. Therefore the vegetation of VT04 is not deemed riparian and not significant vegetation as defined by EPA (2016a).

## 4.2 Flora diversity

Eighty four flora taxa (including subspecies and varieties) representing 20 families and 40 genera were recorded from the survey area during the field survey. This total comprised of 81 native taxa and three introduced flora taxa.

Dominant families recorded from the survey area included:

- Scrophulariaceae (15 taxa)
- Chenopodiaceae (14 taxa)
- Myrtaceae (11 taxa).

The survey area is considered representative of the floristic diversity in the area. The highest floristic diversity was recorded in VT03 (62 taxa). A taxa list for the survey area is provided in Appendix D.

#### **4.2.1 Conservation significant flora**

No EPBC Act, WC Act or DBCA Priority-listed flora were recorded within the survey area during the field survey.

##### **Likelihood of occurrence**

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant flora taxa identified in the desktop assessment (Appendix D). This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species.

The likelihood of occurrence assessment concluded one taxon is likely to occur, two may possibly occur and the remaining four taxa are unlikely to occur within the survey area. The taxon likely to occur was *Eremophila arachnoides* subsp. *tenera* (P1). VT01 and VT03 are considered suitable habitat for this taxon, there was 6,150.64 ha of suitable habitat within the survey area. Records at the WA Herbarium show the flowering period for this taxon as September and December (WA Herbarium 1998–); this would suggest that the survey was undertaken outside the reported flowering period for this taxon and so it may have been overlooked during the field survey.

#### **4.2.2 Other significant flora**

No other significant flora as defined by the EPA (2016a) was identified within the survey area.

#### **4.2.3 Introduced flora**

Three introduced flora taxa were recorded from the survey area. Of the introduced taxa recorded, one is listed as Declared Pest under the *Biosecurity and Agriculture Management Act 2007*: \**Xanthium spinosum* (Bathurst Burr) – Declared Pest.

No Weeds of National Significance (WONS) were recorded during the field survey. The remaining two introduced taxa recorded are considered environmental weeds and have been previously recorded within the Coolgardie IBRA bioregion. The locations of Bathurst Burr within the survey area is mapped in Figure 4, Appendix A.

### **4.3 Fauna**

#### **4.3.1 Fauna habitats**

Seven broad fauna habitat types were identified in the survey area during the field survey. The broad habitat types correspond closely with the vegetation associations listed above and include:

- Mixed *Eucalyptus* woodland over chenopod
- Mixed *Eucalyptus* woodland over mixed shrubs
- Mixed *Eucalyptus* woodland over spinifex
- Mixed *Eucalyptus* woodland over rocky hillslopes
- Eucalypt-lined creek lines
- Artificial water source
- Cleared areas.

No habitat types were recorded that are considered to be exclusive to the survey area. The fauna habitats are described in Table 6 and mapped in Figure 5, Appendix A.

**Table 6 Fauna habitat types within the survey area**

Habitat type	Extent (ha)	Indicative photograph
<p><b>Mixed <i>Eucalyptus</i> woodland over chenopod</b></p> <p>This habitat incorporates vegetation types: VT01</p> <p>This habitat is dominated by open Eucalypt woodland consisting of <i>Eucalyptus salmonophloia</i>, <i>E. lesouefii</i> and <i>E. transcontinentalis</i> over sparse shrubland dominated by <i>Atriplex</i>, <i>Eremophila</i> and <i>Maireana</i> species. Very little leaf litter is available in this habitat type, however there is some woody debris. These low shrublands provide foraging opportunities and smaller refuge areas for ground-dwelling fauna such as reptiles. Seasonal inundation is likely to provide seasonal variation in the micro-habitat features available to fauna species. This habitat type shows little evidence of disturbance, and is well-represented throughout the region.</p> <p><u>Conservation significant species</u></p> <p>No conservation significant species were recorded in this habitat type during this field survey, although the Rainbow Bee-eater (<i>Merops ornatus</i>) may opportunistically use this habitat for foraging.</p>	<p>2669.57</p>	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Mixed <i>Eucalyptus</i> woodland over mixed shrubs</b></p> <p>This habitat incorporates vegetation types: VT06</p> <p>The majority of the survey area comprised a mosaic of <i>Eucalyptus</i> woodlands, consisting of <i>Eucalyptus salmonophloia</i>, <i>E. stricklandii</i> and <i>E. celastroides</i> subsp. <i>celastroides</i> over mixed shrubs, including <i>Eremophila</i> spp. The diversity of shrubby understory species provides a variety of different shelter and food resources, thereby increasing the availability of food sources for fauna throughout the year. There is a broad structural diversity in the survey area, including variation in tree canopy height and density, a variety of structural layers (trees, large and small shrubs, scattered grasses and herbs), a wide range of age classes in most flora species and ground cover/ refuge including logs, branches, patches of leaf litter (in a variety of patch size, type and thickness). Most of the <i>Eucalyptus</i> species in this woodland habitat readily form hollows that are utilised by fauna, particularly birds (owls and parrots). Where these hollow branches fall to the ground, the fallen timber provides a valuable micro-habitat feature for ground-dwelling fauna. Fallen logs, branches and leaf litter are critical habitat components for many fauna species and are readily available in this habitat type throughout the survey area. This habitat type is well represented in the survey area and broader area.</p> <p><u>Conservation significant fauna</u></p> <p>No conservation significant fauna were recorded in this habitat type during this field survey, however the Rainbow Bee-eater may opportunistically use this habitat for foraging. This habitat is also suitable Malleefowl (<i>Leipoa ocellata</i>) foraging and breeding habitat.</p>	<p>184.54</p>	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Mixed <i>Eucalyptus</i> woodland over spinifex</b></p> <p>This habitat incorporates vegetation types: VT05</p> <p>This habitat is dominated by mallee eucalypts over a mid-layer of shrubs and spinifex. A range of age classes in most flora species and ground cover/ refuge including some logs, branches, patches of leaf litter (in a variety of patch size, type and thickness) was present. There is a range of micro-habitat features in this habitat type including fallen logs, branches and patches of leaf litter and the low growing clumps of <i>Triodia</i>. This habitat type is well represented in the survey area and broader area.</p> <p><u>Conservation significant fauna</u></p> <p>No conservation significant fauna were recorded in this habitat type during this field survey, although the Rainbow Bee-eater may opportunistically use this habitat for foraging. This habitat is also suitable Malleefowl foraging and breeding habitat.</p>	307.77	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Mixed <i>Eucalyptus</i> woodland over rocky hillslopes</b></p> <p>This habitat incorporates vegetation types: VT02, VT03</p> <p>This habitat is dominated by patches of low broken rocky formations where the topography is slightly elevated, which add diversity to the micro-habitats available. There are some larger Eucalypt trees, including <i>Eucalyptus salmonophloia</i>, <i>E. lesouefii</i>, <i>E. oleosa subsp. oleosa</i> and <i>E. torquata</i> in this habitat type with the shrub layers including a mosaic of tall shrubs and lower shrubs. The vegetation in this habitat type ranges from sparse to dense and provides good cover for fauna species in areas and there is continuous connectivity between this habitat type and other habitats within the survey area. The value of this habitat has been impacted by historical disturbance particularly felling of timbers for mining and grazing. This habitat type is well represented in the survey area and broader area.</p> <p><u>Conservation significant fauna</u></p> <p>No conservation significant fauna were recorded in this habitat type during this field survey, although the Rainbow Bee-eater may opportunistically use this habitat for foraging.</p>	3,740.02	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Eucalypt-lined creek lines</b></p> <p>This habitat incorporates vegetation types: VT04</p> <p>This habitat is dominated by <i>Eucalyptus salmonophloia</i> and <i>E. griffithsii</i> open woodland over a tall sparse shrubland adjacent to dry creeklines and drainage areas. The Eucalypts were often present in dense patches along the creeklines with scattered patches of dense shrubby understory and leaf litter. Few of the Eucalypt species in this habitat contained hollows. High numbers of birds and bird species were recorded using this habitat type. Feral cat tracks were also recorded along the creekline.</p> <p><u>Conservation significant fauna</u></p> <p>No conservation significant fauna were recorded in this habitat type during this field survey, although the Rainbow Bee-eater may opportunistically use this habitat for foraging.</p>	226.96	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Artificial water source</b></p> <p>This habitat incorporates vegetation types: Water source, VT07</p> <p>There are two artificial water sources within Location 45, one in the centre of the survey area and one in the north-west corner. This habitat is dominated by shrubs, herbs and trees surrounding the water sources, both of which contained water. These water sources provide habitat and water for native fauna, including birds. A suite of water birds recorded during the survey were only recorded in this habitat. Artificial water sources also provide water for introduced fauna, including cattle which were sighted at both dams during the field survey.</p>	11.00	

Habitat type	Extent (ha)	Indicative photograph
<p><b>Cleared areas</b></p> <p>This habitat incorporates vegetation types: Cleared/ track/ road</p> <p>Throughout the survey area there are highly modified areas that have been cleared or disturbed in the past for the development of mining access tracks, haul roads and fence lines. These areas cover a small percentage of the survey area and provide little to no habitat value for fauna species, and are largely devoid of native vegetation. There are trees and shrubs alongside these areas that provide cover for birds and reptiles. Dingo tracks were recorded along vehicle access tracks throughout the survey area.</p>	<p>28.47</p>	

### ***Fauna habitat disturbance***

With the exception of haul roads, access tracks, fence lines and man-made dams, disturbance within the survey area is minimal.

### ***Habitat quality and connectivity***

Habitat connectivity is important to allow animals to move between areas of resource availability. They are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction. Locally, the habitat within the survey area is well connected to habitat in the surrounding area and broader region. There has been minimal clearing within the survey area, with the exception of clearing for infrastructure (such as the haul roads, access tracks and fence lines). Several tracks intersect the survey area. All of these tracks are relatively minor and unlikely to restrict the movement of fauna. In addition, the majority of the fences within the survey area are also minor and unlikely to substantially restrict the movement of fauna. The fauna habitat quality and connectivity within the survey area is considered to be high, intact and contiguous within the region.

#### **4.3.2 Fauna diversity**

A total of 37 species, consisting of 26 birds, seven mammals and four reptiles were recorded within the survey area during the field survey. A fauna species list is provided in Appendix E.

#### **4.3.3 Introduced fauna**

A total of four introduced species were recorded within the survey area during the field survey, namely the Feral Cat (*Felis catus*), Cow (*Bos taurus*), Feral Goat (*Capra hircus*) and European Rabbit (*Oryctolagus cuniculus*).

#### **4.3.4 Conservation significant fauna**

No conservation significant fauna were recorded within the survey area during the field survey. The Rainbow Bee-eater, which is listed as Schedule 5 (International Agreement) under the WC Act, is considered likely to occur within the survey area. The timing of the field survey coincided with when bee-eaters migrate to northern Australia (between February and April) and may be the reason why this species was not recorded during the field survey.

Malleefowl (listed as Vulnerable under the EPBC Act) was not recorded at this site during the field survey, however, Malleefowl were recorded within Location 53 West (nearby to the survey area). Suitable similar habitat is present within this survey area and it is considered likely that the Malleefowl does occur within the survey area. A total of 30.3 km was traversed on foot throughout the survey area in search of Malleefowl evidence, with a focus on suitable habitat, particularly mixed *Eucalyptus* woodland over mixed shrubs.

#### **4.3.5 Habitat tree assessment**

Ten transects (4 x 500 m transects, 4 x 1 km and 2 x 1.5 km transects = 9 km in total) were traversed throughout multiple habitat types within the survey area to record habitat trees. Habitat trees were identified and measured within approximately 20 m either side of the transect line. One hundred and forty one habitat trees were identified within the ten transect lines. This equates to approximately 4 habitat trees per ha. Of the 141 trees identified, 72 contained hollows, with an average of three hollows per tree. This equates to approximately six hollows per ha. The habitat trees consisted of one stag and seven *Eucalyptus* species, including *Eucalyptus stricklandii*, *E. salmonophloia*, *E. lesouefii*, *E. torquata*, *E. griffithsii*, *E. ravidata*, and *E. transcontinentalis*.

Extrapolated across the survey area in areas of *Eucalyptus* woodland (7,128.85 ha), it is estimated there is 28,515 habitat trees present.

### **Likelihood of occurrence**

An assessment on the likelihood of conservation significant species occurring within the survey area was undertaken post-field survey via searches of the EPBC Act PMST and *NatureMap* databases (Appendix E). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat, as determined during the field survey, and records of the species in the survey area and surrounding area.

Two conservation significant fauna species were present or considered likely to occur within the survey area, with the remaining species considered either unlikely or highly unlikely to occur. It is considered unlikely that the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of the species deemed 'unlikely' to occur and that these other species may occasionally use the habitats of the survey area for temporary refuge and dispersal between other areas of habitat. Table 7 summarises the species of conservation significance present or considered likely to occur in the survey area.

**Table 7 Summary of fauna likelihood of occurrence**

Species	Status		Source	Likelihood of occurrence
	WC Act/ DBCA	EPBC Act		
<b>Birds</b>				
Malleefowl ( <i>Leipoa ocellata</i> )	Vu	Vu	<i>NatureMap</i> EPBC PMST	<b>Likely</b> Species known from the region. Suitable habitat present.
Rainbow Bee-eater ( <i>Merops ornatus</i> )	IA	Ma	<i>NatureMap</i>	<b>Likely</b> Species known from the region. Suitable habitat present.

## **5. Assessment against the Ten Clearing Principles**

In accordance with Section 20 of the EP Act, the Department of Mines, Industry Regulation and Safety (DMIRS), has been delegated authority for the administration of applications to clear native vegetation for mineral and petroleum activities regulated under the *Mining Act 1978*, the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum Pipelines Act 1969*, the *Petroleum (Submerged Lands) Act 1982*, and activities under State Agreements administered by the Department of State Development, in WA.

An assessment of the survey area against the 10 clearing principles was undertaken to determine whether the project is likely to be at variance to the Principles (Appendix F). These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The assessment determined that the clearing of native vegetation within the survey areas is unlikely to be at variance to any principle.

## 6. References

- Beard, JS 1990, *Plant Life of Western Australia*, Perth, Australia, Kangaroo Press.
- Beard, JS 1972, *The vegetation of the Kalgoorlie area, Western Australia*, 1:250,000 vegetation series, map and explanatory notes, University of Western Australia Press, Western Australia.
- BoM 2018, *Climate Data Online*, retrieved March 2018, from <http://www.bom.gov.au/climate/data>
- Christidis, L and Boles, WE 2008, *Systematics and Taxonomy of Australian Birds*, Melbourne, CSIRO Publishing.
- Cowan, M 2001, *Coolgardie 3 (COO3 – Eastern Goldfields subregion)*, in Department of Conservation and Land Management (ed), *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, pp 724.
- Department of Biodiversity, Conservation and Attractions (DBCA) 2007–, *NatureMap: Mapping Western Australia's Biodiversity*, retrieved February 2018, from <https://naturemap.dpaw.wa.gov.au/>
- Department of the Environment and Energy (DEE) 2018a, *Environmental Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool Results*, retrieved February 2018, from <http://www.environment.gov.au/epbc/pmst/index.html>.
- Department of the Environment and Energy (DEE) 2018b, *Environment Protection and Biodiversity Act 1999 List of Threatened Flora*, retrieved February 2018, from <http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora>
- Environmental Protection Authority (EPA) 2016a, *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Perth, Environmental Protection Authority.
- Environmental Protection Authority (EPA) 2016b, *Technical Guidance – Sampling methods for Terrestrial Vertebrate Fauna Surveys*, Perth, Environmental Protection Authority.
- Environmental Protection Authority (EPA) 2016c, *Technical Guidance – Terrestrial Fauna Surveys*, Perth, Environmental Protection Authority.
- Executive Steering Committee for Australian Vegetation Information (ESCAVI) 2003, *Australian Vegetation Attribute Manual: National Vegetation Information System*, Version 6.0, Canberra, Department of the Environment and Heritage.
- Government of Western Australia (GoWA) 2018a, *data.wa.gov.au*, retrieved March 2018, from <https://data.wa.gov.au/>.
- Government of Western Australia (GoWA) 2018b, *2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full report)*, Current as of December 2017, Perth, Australia, Department of Biodiversity, Conservation and Attractions, retrieved March 2017, from <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>.
- Keighery, BJ 1994, *Bushland Plant Survey: a Guide to Plant Community Survey for the Community*, Nedlands, Wildflower Society of WA (Inc.).
- Morcombe, M, 2014, *Morcombe eGuide to Australian Birds*, V1.4, PDA Solutions.
- Schoknecht N, Tille, P and Purdie, B 2004, *Soil-landscape mapping in South-western Australia, Resource Management Technical Report 280*, Perth, Western Australia, Department of Agriculture.

Shepherd, DP, Beeston, GR, and Hopkins, AJM 2002, *Native Vegetation in Western Australia – Extent, Type and Status, Resource Management Technical Report 249*, Department of Agriculture, Western Australia.

Thomas-Dans, C, Storrie, A, Brown, A, Chapman, A, Copp, I, Ennis, A, Friend, T, Gleeson, D, Keighery, K, Herford, I, Hunter, J, Hussey, P, Keally, I, Pearson, D, Pronk, G, Winfield, C and Wentzel, K 2012, *Guide to the Great Western Woodlands*, Bentley, Department of Environment and Conservation, pp 160.

Watson, A, Judd, S, Watson, J, Lam, A and Mackenzie, D 2008, *The Great Western Woodlands*, The Environmental Printing Company.

Western Australian Herbarium 1998–, *FloraBase—the Western Australian Flora*, Department of Parks and Wildlife, retrieved February 2018, from <http://florabase.dpaw.wa.gov.au/>.

# Appendices

# **Appendix A – Figures**

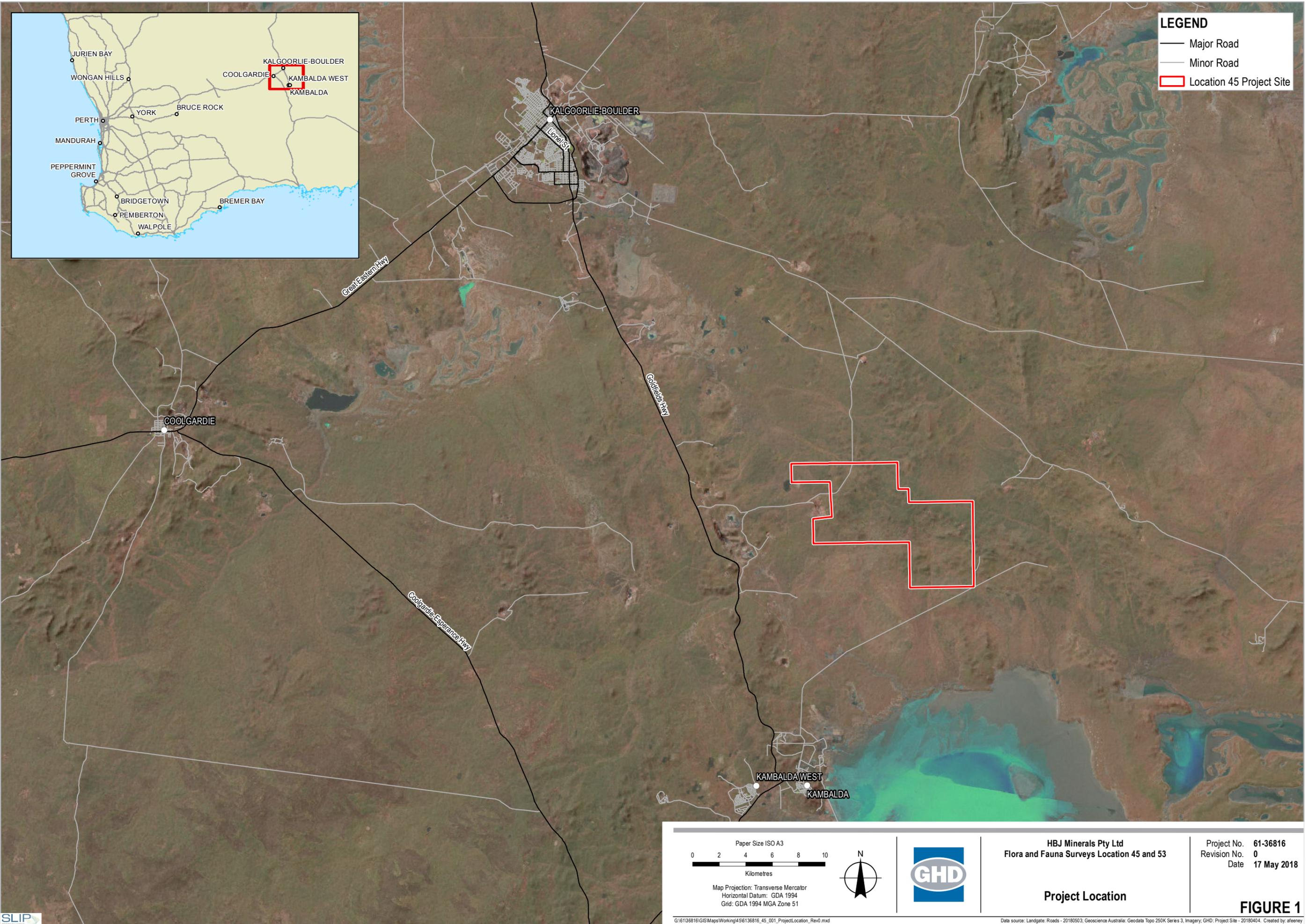
**Figure 1 Project location**

**Figure 2 Environmental constraints**

**Figure 3 Vegetation types and sample locations**

**Figure 4 Vegetation condition and significant weeds**

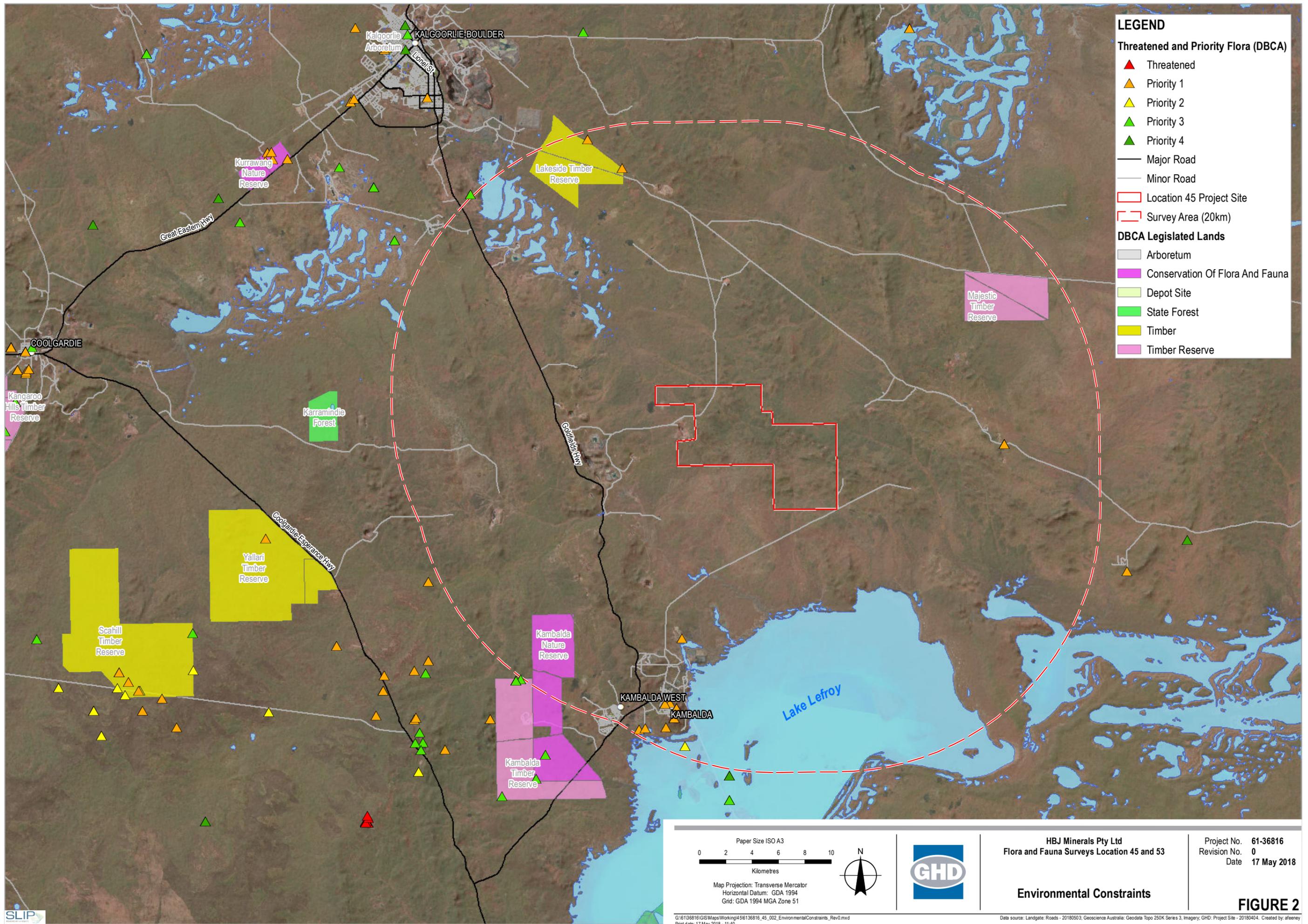
**Figure 5 Fauna habitats and habitat tree transects**



**LEGEND**

- Major Road
- Minor Road
- Location 45 Project Site

<p>Paper Size ISO A3</p> <p>Kilometres</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA 1994 Grid: GDA 1994 MGA Zone 51</p>			<p><b>HBJ Minerals Pty Ltd</b> Flora and Fauna Surveys Location 45 and 53</p>	<p>Project No. <b>61-36816</b> Revision No. <b>0</b> Date <b>17 May 2018</b></p>
			<p><b>Project Location</b></p>	<p><b>FIGURE 1</b></p>



**LEGEND**

**Threatened and Priority Flora (DBCA)**

- ▲ Threatened
- ▲ Priority 1
- ▲ Priority 2
- ▲ Priority 3
- ▲ Priority 4

— Major Road  
— Minor Road

▭ Location 45 Project Site  
▭ Survey Area (20km)

**DBCA Legislated Lands**

- ▭ Arboretum
- ▭ Conservation Of Flora And Fauna
- ▭ Depot Site
- ▭ State Forest
- ▭ Timber
- ▭ Timber Reserve

Paper Size ISO A3

0 2 4 6 8 10  
Kilometres

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 51

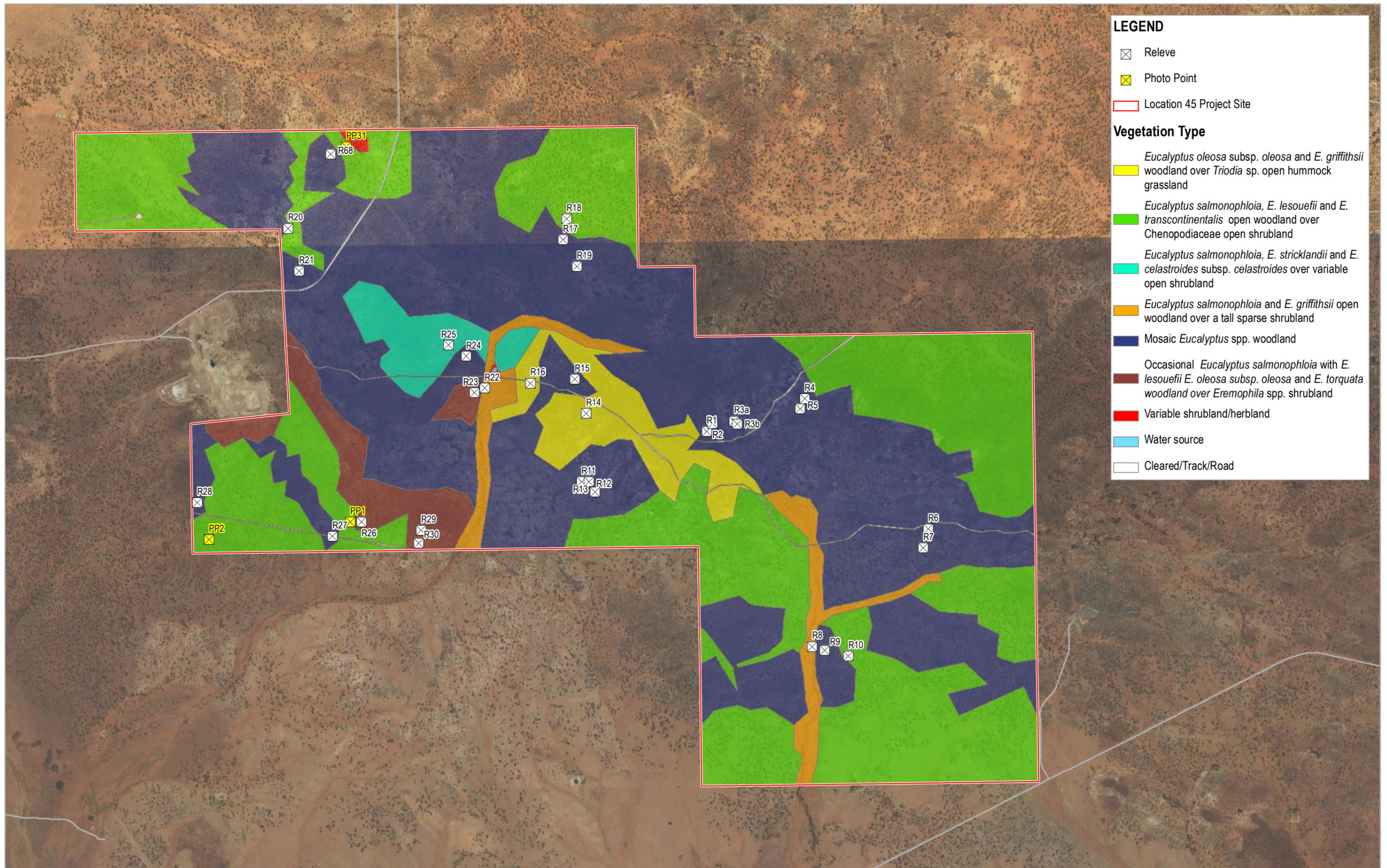


**HBJ Minerals Pty Ltd**  
Flora and Fauna Surveys Location 45 and 53

Project No. **61-36816**  
Revision No. **0**  
Date **17 May 2018**

**Environmental Constraints**

**FIGURE 2**

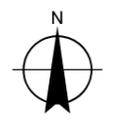
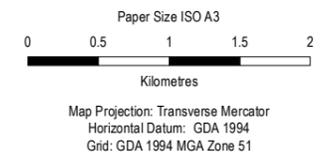


**LEGEND**

- ⊗ Releve
- ⊗ Photo Point
- Location 45 Project Site

**Vegetation Type**

- *Eucalyptus oleosa* subsp. *oleosa* and *E. griffithsii* woodland over *Triodia* sp. open hummock grassland
- *Eucalyptus salmonophloia*, *E. lesouefii* and *E. transcintentalis* open woodland over *Chenopodiaceae* open shrubland
- *Eucalyptus salmonophloia*, *E. stricklandii* and *E. celastroides* subsp. *celastroides* over variable open shrubland
- *Eucalyptus salmonophloia* and *E. griffithsii* open woodland over a tall sparse shrubland
- Mosaic *Eucalyptus* spp. woodland
- Occasional *Eucalyptus salmonophloia* with *E. lesouefii* *E. oleosa* subsp. *oleosa* and *E. torquata* woodland over *Eremophila* spp. shrubland
- Variable shrubland/herbland
- Water source
- Cleared/Track/Road



HBJ Minerals Pty Ltd  
Flora and Fauna Surveys Location 45 and 53

**Vegetation Units and Sample Locations**

Project No. 61-36816  
Revision No. 0  
Date 17 May 2018

**FIGURE 3**

**LEGEND**

**Significant Weed**

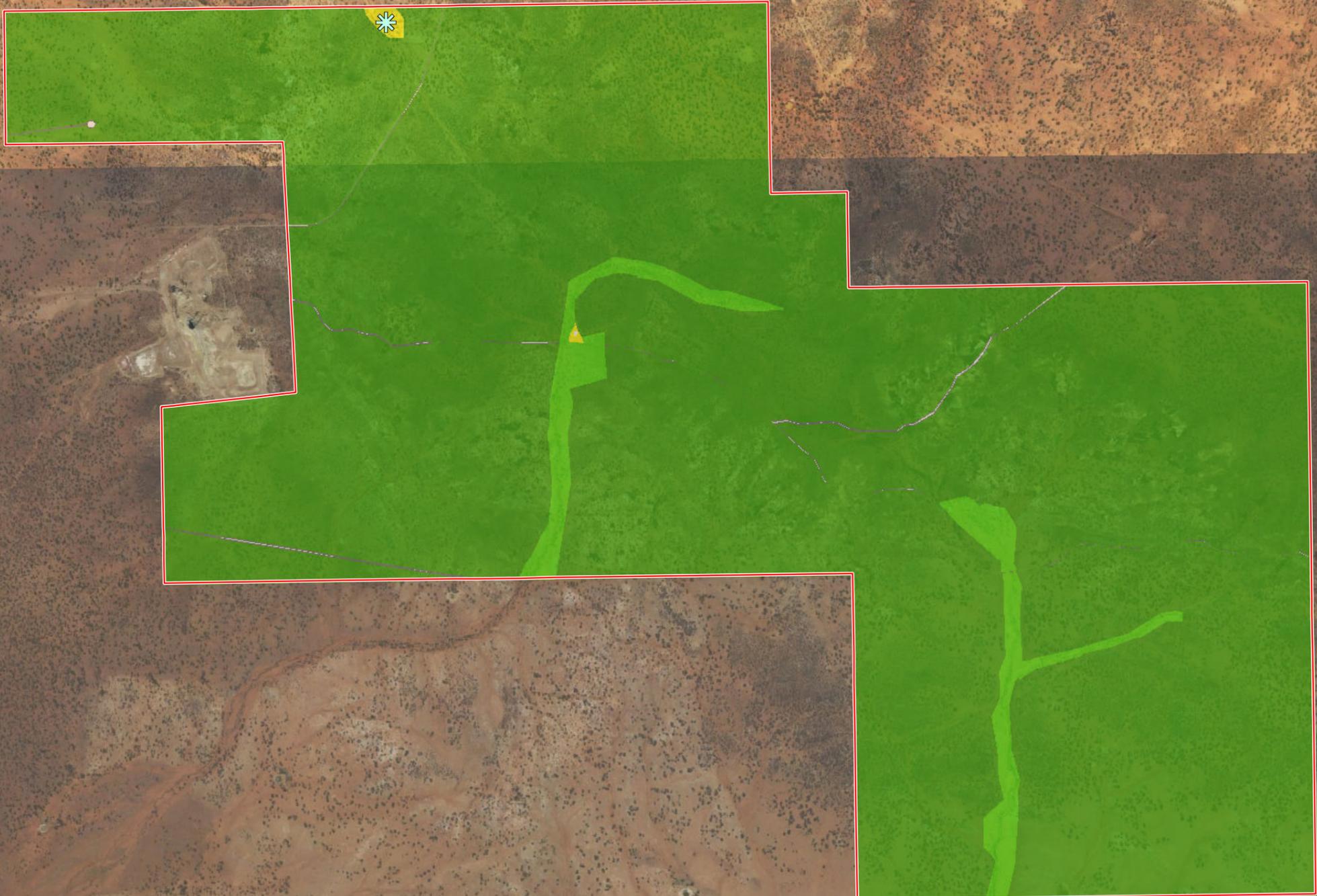
-  \*DP *Xanthium spinosum*

**Location 45 Project Site**

- 

**Vegetation Condition**

-  Excellent
-  Very Good
-  Good
-  Not Rated

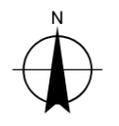


Paper Size ISO A3



Kilometres

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 51

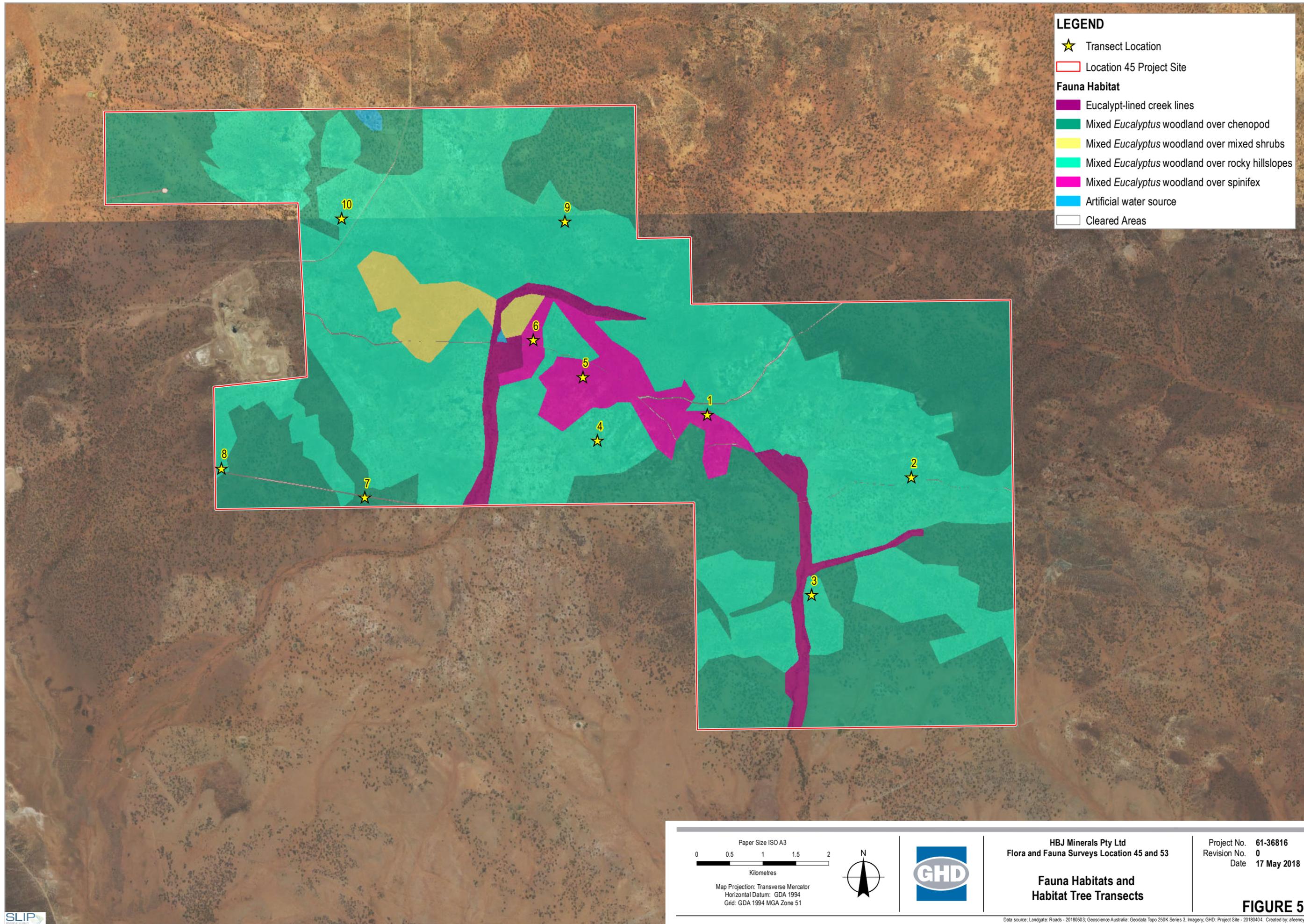


**HBJ Minerals Pty Ltd**  
Flora and Fauna Surveys Location 45 and 53

**Vegetation Condition**

Project No. **61-36816**  
Revision No. **0**  
Date **17 May 2018**

**FIGURE 4**



## **Appendix B** – Background information, relevant legislation and conservation codes

## Relevant legislation

### **Federal *Environment Protection and Biodiversity Conservation Act 1999***

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Federal Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as Matters of National Environmental Significance (MNES).

The biological aspects listed as MNES include:

- Nationally threatened flora and fauna species and ecological communities
- Migratory species

A person must not undertake an action that has, will have, or is likely to have a significant impact (direct or indirect) on MNES, without approval from the Federal Minister for the Environment.

The EPBC Act is administered by the Department of the Environment and Energy (DoEE).

### **State *Environmental Protection Act 1986***

The *Environmental Protection Act 1986* (EP Act) is the primary legislative Act dealing with the protection of the environment in Western Australia. The Act allows the Environmental Protection Authority (EPA), to prevent, control and abate pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing. Part IV of the EP Act is administered by the EPA and makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals and land use planning schemes.

The Department of Water and Environment Regulation (DoWER) is responsible for administering the clearing provisions of the EP Act (Part V). Clearing of native vegetation in Western Australia requires a permit from the DoWER, unless exemptions apply. Applications for clearing permits are assessed by the Department and decisions are made to grant or refuse the application in accordance with the Act. When making a decision the assessment considers clearing against the ten clearing principles as specified in Schedule 5 of the EP Act:

- a) Native vegetation should not be cleared if it comprises a high level of biodiversity.
- b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significance 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 part of native vegetation in an area that has been extensively cleared.
- 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.
- g) 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.
- h) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

- 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.

Exemptions for clearing include clearing that is a requirement of a written law or authorised under certain statutory processes (listed in Schedule 6 of the EP Act) and exemptions for prescribed low impact day-to-day activities (prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004); these exemptions do not apply in environmentally sensitive areas (ESAs).

### **State Biodiversity and Conservation Act 2016**

The Biodiversity Conservation Bill 2015 was introduced to State Parliament in November 2015, and passed in September 2016. The Bill became the *Biodiversity Conservation Act 2016* (BC Act) upon receiving Assent on 21 September 2016. The BC Act will eventually fully replace both the *Wildlife Conservation Act 1950* (WC Act) and the *Sandalwood Act 1929* (Sandalwood Act).

Several parts of the BC Act were proclaimed by the State Governor in the Government Gazette and came into effect on 3 December 2016. However, provisions that replace those existing under the WC Act and Sandalwood Act (including threatened species listings and controls over the taking and keeping of native species) and their associated Regulations cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been made. It is hoped the new Regulations will be completed and ready to commence by late 2017.

### **State Wildlife Conservation Act 1950**

The WC Act provides for the conservation and protection of wildlife. It is administered by the Department of Biodiversity, Conservation and Attractions (DBCA) and applies to both flora and fauna. Any person wanting to capture, collect, disturb or study fauna requires a permit to do so. A permit is required under the WC Act if removal of threatened species is required.

### **State Biosecurity and Agriculture Management Act 2007**

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and associated regulations are administered by the Department of Primary Industries and Regional Development (DPIRD) and replace the repealed *Agriculture and Related Resources Protection Act 1976*. The main purposes of the BAM Act and its regulations are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering WA
- Manage the impact and spread of those pests already present in the state
- Safely manage the use of agricultural and veterinary chemicals
- Increased control over the sale of agricultural products that contain violative chemical residues

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act. A Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) of the Act is in force. Declared Pests may be assigned a control category including: C1 (exclusion), C2 (eradication) and C3 (management). The category may apply to the whole of the State, LGAs, districts, individual properties or even paddocks, and all landholders are obliged to comply with the specific category of control. Categories of control are defined below.

## DPIRD Categories for Declared Pests under the BAM Act

Control class code	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

## Background information

### Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005.

#### Aspects of ESAs

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the EPBC Act.
An area that is included on the Register of the National Estate (RNE), because of its natural values, under the <i>Australian Heritage Commission Act 1975</i> of the Commonwealth (the RNE was closed in 2007 and is no longer a statutory list – all references to the RNE were removed from the EPBC Act on 19 February 2012).
A defined wetland and the area within 50 m of the wetland. Defined wetlands include Ramsar wetlands, conservation category wetlands and nationally important wetlands.
The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
The area covered by a Threatened Ecological Community.
A Bush Forever Site listed in “Bush Forever” Volumes 1 and 2 (2000), published by the Western Australia Planning Commission, except to the extent to which the site is approved to be developed by the Western Australia Planning Commission.
The areas covered by the <i>Environmental Protection (Gnangara Mound Crown Land) Policy 1992</i> .
The areas covered by the <i>Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002</i> .
The areas covered by the lakes to which the <i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i> (EPP Lakes) applies.
Protected wetlands as defined in the <i>Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998</i> .

### Reserves and conservation areas

#### Department of Biodiversity, Conservation and Attractions managed lands and waters

DBCA manages lands and waters throughout Western Australia to conserve ecosystems and species, and to provide for recreation and appreciation of the natural environment. DBCA managed lands and waters include national parks, conservation parks and reserves, marine parks and reserves, regional parks, nature reserves, State forest and timber reserves. DBCA managed conservation estate, is vested with the Conservation Commission of Western Australia. Access to, or through, some areas of DBCA managed lands may require a permit or could be restricted due to management activities. Proposed land use changes and development proposals that abut DBCA managed lands will generally be referred to DBCA throughout the assessment process.

#### Wetlands

Wetlands include not only lakes with open water, but areas of seasonally, intermittently or permanently waterlogged soil.

## Ramsar Listed Wetlands

The Convention of Wetlands of International Importance was signed in 1971 at the Iranian town of Ramsar. The Convention has since been referred to as the Ramsar Convention. Ramsar Listed wetlands are “sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity ... because of their ecological, botanical, zoological, limnological or hydrological importance” (DoEE 2017b). Once a Ramsar Listed Wetland is designated, the country agrees to manage its conservation and ensure its wise use. Under the Convention, wise use is broadly defined as “maintaining the ecological character of a wetland” (DoEE 2017b).

## Nationally important wetlands

Wetlands of national significance are listed under the Directory of Important Wetlands in Australia. Nationally important wetlands are wetlands which meet at least one of the following criteria (DoEE 2017a):

- It is a good example of a wetland type occurring within a biogeographic region in Australia
- It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex
- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail
- The wetland supports one percent or more of the national populations of any native plant or animal taxa
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level
- The wetland is of outstanding historical or cultural significance

## Vegetation extent and status

The National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001) recognise that the retention of 30 percent or more of the pre-clearing extent of each ecological community is necessary if Australia’s biological diversity is to be protected. This is the threshold level below which species loss appears to accelerate exponentially and loss below this level should not be permitted. This level of recognition is in keeping with the targets recommended in the review of the National Strategy for the Conservation of Australia’s Biological Diversity (ANZECC 2000).

The extent of remnant native vegetation in WA has been assessed by Shepherd et al. (2002) and the GoWA (2016), based on broadscale vegetation association mapping by Beard (various publications). The GoWA produces Statewide Vegetation Statistics Reports that are used for a number of purposes including conservation planning, land use planning and when assessing development applications. The reports are updated at least every two years.

## Vegetation condition

The vegetation condition can be assessed in accordance with the vegetation condition rating scale for the South West and Interzone Botanical Provinces (EPA 2016A). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

## Vegetation condition rating scale for the South West and Interzone Botanical Provinces

Condition	South West and Interzone Botanical Provinces description
Pristine	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

## Conservation codes

Species of significant flora, fauna and communities are protected under both Federal and State Acts. The Federal EPBC Act provides a legal framework to protect and manage nationally important flora and communities. The State WC Act is the primary wildlife conservation legislation in Western Australia. Information on the conservation codes is summarised in the following sections.

### Ecological communities

#### Conservation significant communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English and Blyth 1997). Federally listed Threatened Ecological Communities (TECs) are protected under the EPBC Act. The DBCA also maintains a list of TECs for Western Australia; some of which are also protected under the EPBC Act. TECs are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable.

Possible TECs that do not meet survey criteria are added to the DBCA Priority Ecological Community (PEC) List under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in Priority 5. PECs are not listed under any formal Federal or State legislation, however, may be listed as TECs under the EPBC Act.

#### Conservation codes and definitions for TECs listed under the EPBC Act or endorsed by the WA Minister for the Environment

Categories	Definition
<b>Federal Government Conservation Categories (EPBC Act)</b>	
Critically Endangered (CR)	An ecological community if, at that time, is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)
Endangered (EN)	An ecological community if, at that time: <ul style="list-style-type: none"> <li>A) is not critically endangered; and</li> <li>B) is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)</li> </ul>
Vulnerable (VU)	An ecological community if, at that time: <ul style="list-style-type: none"> <li>A) is not critically endangered or endangered; and</li> <li>B) is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000)</li> </ul>
<b>Western Australia Conservation Categories</b>	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

Categories	Definition
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

### Conservation categories and definitions for PECS as listed by the DBCA

Category	Description
Priority 1	<p>Poorly known ecological communities.</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally <math>\leq 5</math> occurrences or a total area of <math>\leq 100</math> ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority 2	<p>Poorly known ecological communities.</p> <p>Communities that are known from few occurrences with a restricted distribution (generally <math>\leq 10</math> occurrences or a total area of <math>\leq 200</math> ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority 3	<p>Poorly known ecological communities.</p> <ul style="list-style-type: none"> <li>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</li> <li>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;</li> <li>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</li> </ul> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Description
Priority 4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority 5	<p>Conservation Dependent ecological communities.</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

### Other significant vegetation

Vegetation may be significant for a range of reasons other than a statutory listing. The EPA (2016b) states that significant vegetation may include vegetation that includes the following:

- Restricted distribution
- Degree of historical impact from threatening processes
- Local endemism in restricted habitats
- Novel combinations of taxa
- A role as a refuge
- A role as a key habitat for Threatened species or large population representing a significant proportion of the local to regional total population of a species
- Being representative of a vegetation unit in 'pristine' condition in a highly cleared landscape, recently discovered range extensions, or isolated outliers of the main range)
- Being poorly reserved

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

### Flora and fauna

#### Conservation significant flora and fauna

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the WC Act can warrant referral to the DoEE and/or the EPA.

The Federal conservation level of flora and fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for Conservation of Nature (IUCN).

The EPBC Act also protects land and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II)
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China–Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea–Australia Migratory Bird Agreement (ROKAMBA)

The State conservation level of Threatened flora and fauna has been published as Specially Protected under the WC Act, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2015 for Threatened Fauna and under Schedules 1 to 4 of the Wildlife Conservation (Rare Flora) Notice 2015 for Threatened (Declared Rare) Flora. The schedules align with the categories of the EPBC Act Threatened Fauna and Threatened Flora Lists. Threatened species are those species which have been adequately searched for and are deemed to be, in the wild, either rare, under identifiable threat of extinction, or otherwise in need of special protection, and have been gazetted as such.

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DBCA Priority species are considered conservation significant.

### **Conservation categories and definitions for EPBC Act listed flora and fauna species**

Conservation category	Definition
Extinct	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A) A species known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or B) A species that has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A species facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria (as outlined in Environment Protection and Biodiversity Conservation Regulations 2000).
Endangered	A) A species not critically endangered; and B) A species facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Conservation category	Definition
Vulnerable	A) A species not critically endangered or endangered; and B) A species facing a high risk of extinction in the wild in the medium-term, as determined in accordance with the prescribed criteria.
Conservation Dependent	A) The species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or B) The following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that Section 180 provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

### Conservation codes and descriptions for WC Act listed flora and fauna species

Conservation category	Schedule and definition
Threatened species (T)	Published as Specially Protected under the WC Act, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.  <b>Threatened fauna</b> is that subset of ‘Specially Protected Fauna’ declared to be ‘likely to become extinct’ pursuant to section 14(4) of the WC Act.  <b>Threatened flora</b> is flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F(2) of the WC Act.
Critically Endangered (CR)	Schedule 1: Threatened species considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Schedule 2: Threatened species considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Schedule 3: Threatened species considered to be facing a high risk of extinction in the wild.
Presumed Extinct (EX)	Schedule 4: Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
International Agreement (IA)	Schedule 5: Migratory birds protected under an international agreement
Conservation Dependent (CD)	Schedule 6: Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Other Specially Protected (OS)	Schedule 7: Fauna otherwise in need of special protection to ensure their conservation.

## Conservation codes for DBCA listed Priority flora and fauna

Priority category	Definition
Priority 1	<p>Poorly-known taxa</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 2	<p>Poorly-known taxa</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 3	<p>Poorly-known taxa</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
Priority 4	<p>Rare, Near Threatened and other taxa in need of monitoring</p> <p>A. Rare: Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.</p> <p>B. Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>C. Taxa that have been removed from the list of threatened taxa during the past five years for reasons other than taxonomy.</p>

### Other significant flora

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than a statutory listing. The EPA (2016b) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened or Priority flora or fauna species, or large populations representing a considerable proportion of the local or regional total population of a species
- Relictual status, being representation of taxonomic or physiognomic groups that no longer occur widely in the broader landscape
- Anomalous features that indicate a potential new discovery
- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)

- The presence of restricted subspecies, varieties, or naturally occurring hybrids
- Local endemism (a restricted distribution) or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- Being poorly reserved

### **Other significant fauna**

Fauna species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed (EPA 2010).

### **Introduced plants (weeds)**

#### **Declared Pests**

Information on species considered to be Declared Pests is provided under *State Biosecurity and Agriculture Management Act 2007*.

#### **Weeds of National Significance**

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WoNS) is based on four major criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

Australian state and territory governments have identified thirty-two Weeds of National Significance (WoNS); a list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

## References

- ANZECC 2000, *Core Environmental Indicators for Reporting on the State of Environment*, ANZECC State of the Environment Reporting Task Force.
- Commonwealth of Australia 2001, *National Targets and Objectives for Biodiversity Conservation 2001–2005*, Canberra, AGPS.
- DoEE 2017a, *Criteria for determining nationally important wetlands*, retrieved 2017, from <http://www.environment.gov.au/topics/water/water-our-environment/wetlands/australian-wetlands-database/directory-important>.
- DoEE 2017b, *The Ramsar Convention on Wetlands*, retrieved 2017, from <http://www.environment.gov.au/topics/water/water-our-environment/wetlands/ramsar-convention-wetlands>.
- English, V and Blyth, J 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, Perth, Department of Conservation and Land Management.
- EPA 2010, *Technical Guide – Terrestrial Fauna Surveys*, EPA, Perth, WA.
- EPA 2016a, *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment*, EPA, Perth, WA.
- EPA 2016b, *Environmental Factor Guideline - Flora and Vegetation*, EPA, Perth, WA.
- GoWA 2018, *Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full report)*, Current as of December 2017, Perth Western Australia, Department of Environment and Conservation, retrieved March 2018 from <https://www2.landgate.wa.gov.au/web/guest/downloader>.
- Shepherd, DP, Beeston, GR & Hopkins, AJM 2002, *Native Vegetation in Western Australia – Extent, Type and Status, Resource Management Technical Report 249*, Perth, Department of Agriculture.

## **Appendix C** – Desktop searches

EPBC Act PMST report

*NatureMap* flora report (20 km radius)

*NatureMap* fauna report (20 km radius)



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 22/02/18 19:02:32

[Summary](#)

[Details](#)

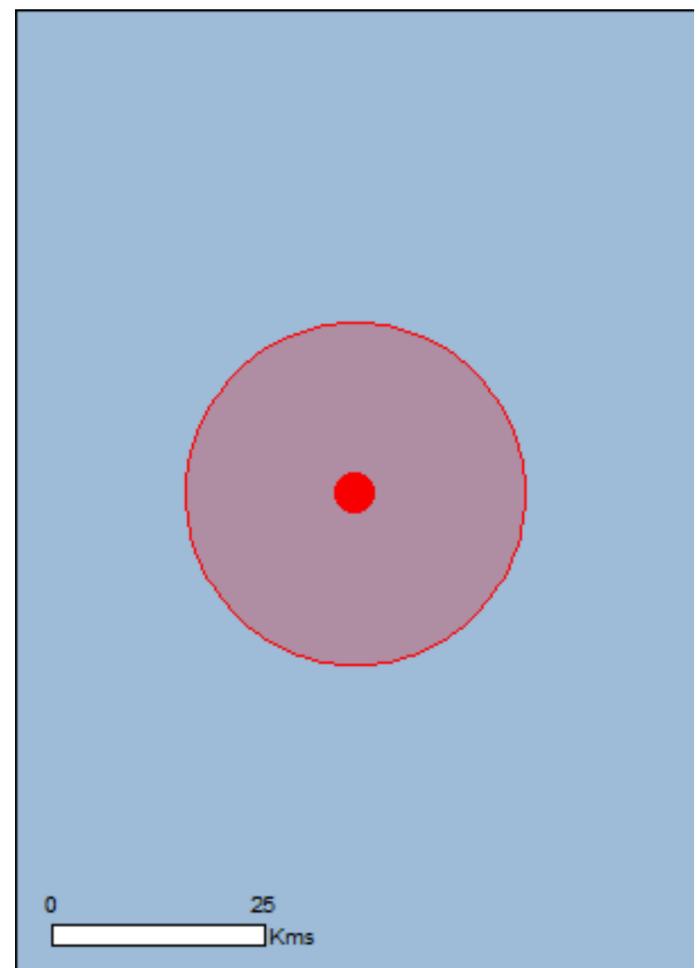
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

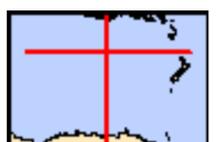
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 20.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	6
<a href="#">Listed Migratory Species:</a>	6

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	1
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	10
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	11
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Species [\[ Resource Information \]](#)

Name	Status	Type of Presence
------	--------	------------------

#### Birds

<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
---	-----------------------	--

<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
---	------------	---

<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
--	------------	--

#### Mammals

<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
---	------------	--

#### Plants

<a href="#">Gastrolobium graniticum</a> Granite Poison [14872]	Endangered	Species or species habitat likely to occur within area
---	------------	--

<a href="#">Tecticornia flabelliformis</a> Bead Glasswort [82664]	Vulnerable	Species or species habitat may occur within area
--	------------	--

### Listed Migratory Species [\[ Resource Information \]](#)

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
------	------------	------------------

#### Migratory Marine Birds

<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
---	--	--

#### Migratory Terrestrial Species

<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
---	--	--

#### Migratory Wetlands Species

<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
--	--	--

<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
--	--	--

Name	Threatened	Type of Presence
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

### Commonwealth Land [\[ Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

### Listed Marine Species [\[ Resource Information \]](#)

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat may occur within area

## Extra Information

### Invasive Species [\[ Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Carrichtera annua Ward's Weed [9511]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-31.00432 121.7332

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

# NatureMap Species Report

Created By Guest user on 22/02/2018

Kingdom Plantae  
Current Names Only Yes  
Core Datasets Only Yes  
Method 'By Circle'  
Centre 121° 43' 59" E, 31° 00' 16" S  
Buffer 20km  
Group By Family

Family	Species	Records
Aizoaceae	1	1
Amaranthaceae	2	2
Asphodelaceae	1	3
Asteraceae	11	20
Boraginaceae	1	1
Brassicaceae	3	3
Cactaceae	1	2
Casuarinaceae	1	5
Chenopodiaceae	13	14
Cucurbitaceae	1	1
Euphorbiaceae	1	1
Fabaceae	12	13
Frankeniaceae	2	3
Geraniaceae	2	2
Goodeniaceae	1	1
Haloragaceae	2	2
Lamiaceae	2	3
Loranthaceae	1	1
Malvaceae	6	8
Myrtaceae	17	44
Pittosporaceae	1	1
Plantaginaceae	1	1
Poaceae	1	1
Polygonaceae	1	1
Pottiaceae	1	1
Primulaceae	1	1
Proteaceae	5	5
Resedaceae	1	1
Sapindaceae	3	5
Scrophulariaceae	11	16
Solanaceae	1	1
Zygophyllaceae	1	1
<b>TOTAL</b>	<b>109</b>	<b>165</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Aizoaceae</b>				
1.	2807 <i>Gunnopsia quadrifida</i> (Sturts Pigface)			
<b>Amaranthaceae</b>				
2.	2732 <i>Ptilotus holosericeus</i>			
3.	43203 <i>Surreya diandra</i>			
<b>Asphodelaceae</b>				
4.	1366 <i>Bulbine semibarbata</i> (Leek Lily)			
<b>Asteraceae</b>				
5.	7836 <i>Angianthus tomentosus</i> (Camel-grass)			
6.	7847 <i>Asteridea chaetopoda</i>			
7.	7910 <i>Carduus tenuiflorus</i> (Slender Thistle, Winged Slender Thistle, Sheep Thistle)	Y		
8.	15447 <i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>			
9.	44490 <i>Leontodon rhagadioloides</i>	Y		
10.	8107 <i>Minuria cunninghamii</i> (Bush Minuria)			
11.	8140 <i>Olearia muelleri</i> (Goldfields Daisy)			
12.	20661 <i>Oncosiphon suffruticosum</i> (Calomba Daisy)	Y		
13.	13301 <i>Rhodanthe floribunda</i>			
14.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
15.	8238 <i>Streptoglossa liatroides</i>			
<b>Boraginaceae</b>				
16.	6710 <i>Heliotropium europaeum</i> (Common Heliotrope)	Y		

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Brassicaceae</b>				
17.	3008 <i>Carrichtera annua</i> (Ward's Weed)	Y		
18.	3069 <i>Sisymbrium erysimoides</i> (Smooth Mustard)	Y		
19.	3070 <i>Sisymbrium irio</i> (London Rocket)	Y		
<b>Cactaceae</b>				
20.	20759 <i>Cylindropuntia fulgida</i> var. <i>mamillata</i>	Y		
<b>Casuarinaceae</b>				
21.	12658 <i>Casuarina pauper</i> (Black Oak)			
<b>Chenopodiaceae</b>				
22.	2449 <i>Atriplex acutibractea</i> (Toothed Saltbush)			
23.	2453 <i>Atriplex codonocarpa</i> (Flat-topped Saltbush)			
24.	11516 <i>Atriplex nummularia</i> subsp. <i>spathulata</i> (Old Man Saltbush)			
25.	2479 <i>Atriplex stipitata</i> (Mallee Saltbush)			
26.	2481 <i>Atriplex vesicaria</i> (Bladder Saltbush)			
27.	2487 <i>Chenopodium curvispicatum</i>			
28.	2533 <i>Maireana amoena</i>			
29.	2542 <i>Maireana erioclada</i>			
30.	2557 <i>Maireana platycarpa</i> (Shy Bluebush)			
31.	2568 <i>Maireana trichoptera</i> (Downy Bluebush)			
32.	2581 <i>Rhagodia drummondii</i>			
33.	2612 <i>Sclerolaena eurotioides</i> (Fluffy Bindii)			
34.	2625 <i>Sclerolaena obliquicuspis</i> (Limestone Bindii)			
<b>Cucurbitaceae</b>				
35.	7369 <i>Citrullus colocynthis</i>	Y		
<b>Euphorbiaceae</b>				
36.	4598 <i>Beyeria lechenaultii</i> (Pale Turpentine Bush)			
<b>Fabaceae</b>				
37.	3200 <i>Acacia acuminata</i> (Jam, Mangard)			
38.	3217 <i>Acacia aneura</i> (Mulga, Wanari)			
39.	37260 <i>Acacia aptaneura</i>			
40.	16120 <i>Acacia donaldsonii</i>			
41.	3324 <i>Acacia erinacea</i>			
42.	3366 <i>Acacia hemiteles</i>			
43.	16164 <i>Acacia inceana</i> subsp. <i>inceana</i>			
44.	14610 <i>Acacia kalgoorliensis</i>			
45.	3452 <i>Acacia murrayana</i> (Sandplain Wattle)			
46.	3495 <i>Acacia prainii</i> (Prain's Wattle)			
47.	12315 <i>Senna pleurocarpa</i> var. <i>angustifolia</i>			
48.	4217 <i>Swainsona beasleyana</i>			
<b>Frankeniaceae</b>				
49.	11592 <i>Frankenia interioris</i> var. <i>interioris</i>			
50.	5212 <i>Frankenia setosa</i> (Bristly Frankenia)			
<b>Geraniaceae</b>				
51.	4333 <i>Erodium cicutarium</i> (Common Storksbill)	Y		
52.	4335 <i>Erodium cygnorum</i> (Blue Heronsbill)			
<b>Goodeniaceae</b>				
53.	13155 <i>Dampiera latealata</i>			
<b>Haloragaceae</b>				
54.	6174 <i>Haloragis gossei</i>			
55.	6180 <i>Haloragis trigonocarpa</i>			
<b>Lamiaceae</b>				
56.	6771 <i>Dicrastylis parvifolia</i>			
57.	6929 <i>Salvia verbenaca</i> (Wild Sage)	Y		
<b>Loranthaceae</b>				
58.	2383 <i>Amyema preissii</i> (Wireleaf Mistletoe)			
<b>Malvaceae</b>				
59.	4999 <i>Brachychiton gregorii</i> (Desert Kurrajong, Ngalta)			
60.	4959 <i>Lawrencia squamata</i>			
61.	31351 <i>Malva preissiana</i>			
62.	4964 <i>Radyera farragei</i> (Knobby Hibiscus)			
63.	4970 <i>Sida calyxhymania</i> (Tall Sida)			
64.	16924 <i>Sida spodochroma</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Myrtaceae</b>				
65.	14300 <i>Eucalyptus celastroides</i> subsp. <i>celastroides</i> (Mirret)			
66.	5665 <i>Eucalyptus griffithsii</i> (Griffith's Grey Gum)			
67.	5673 <i>Eucalyptus horistes</i>			
68.	5697 <i>Eucalyptus lesouefii</i> (Goldfields Blackbutt)			
69.	20091 <i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>			
70.	13520 <i>Eucalyptus polita</i>			
71.	12380 <i>Eucalyptus ravida</i> (Silver-topped Gimlet)			
72.	5766 <i>Eucalyptus salmonophloia</i> (Salmon Gum, Wurak)			
73.	5767 <i>Eucalyptus salubris</i> (Gimlet)			
74.	5780 <i>Eucalyptus stricklandii</i> (Strickland's Gum)			
75.	5792 <i>Eucalyptus torquata</i> (Coral Gum)			
76.	5793 <i>Eucalyptus transcontinentalis</i> (Redwood, Pungul)			
77.	5802 <i>Eucalyptus yilgarnensis</i> (Yorrell)			
78.	15603 <i>Melaleuca fulgens</i> subsp. <i>fulgens</i>			
79.	5925 <i>Melaleuca lateriflora</i> (Gorada)			
80.	5966 <i>Melaleuca sheathiana</i> (Boree, Buri)			
81.	19699 <i>Thryptomene australis</i> subsp. <i>brachyandra</i>			
<b>Pittosporaceae</b>				
82.	19744 <i>Pittosporum angustifolium</i>			
<b>Plantaginaceae</b>				
83.	7300 <i>Plantago drummondii</i> (Sago Weed)			
<b>Poaceae</b>				
84.	521 <i>Paspalidium gracile</i> (Slender Panic)			
<b>Polygonaceae</b>				
85.	11052 <i>Persicaria prostrata</i>			
<b>Pottiaceae</b>				
86.	32341 <i>Crossidium davidai</i>			
<b>Primulaceae</b>				
87.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
<b>Proteaceae</b>				
88.	1949 <i>Grevillea acuaria</i>			
89.	19541 <i>Grevillea nematophylla</i> subsp. <i>nematophylla</i>			
90.	15981 <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i>			
91.	2055 <i>Grevillea oncogyne</i>			
92.	13458 <i>Grevillea sarissa</i> subsp. <i>sarissa</i>			
<b>Resedaceae</b>				
93.	3085 <i>Reseda luteola</i> (Wild Mingnonette)	Y		
<b>Sapindaceae</b>				
94.	11730 <i>Alectryon oleifolius</i> subsp. <i>canescens</i>			
95.	4769 <i>Dodonaea lobulata</i> (Bead Hopbush)			
96.	4770 <i>Dodonaea microzyga</i>			
<b>Scrophulariaceae</b>				
97.	11769 <i>Eremophila arachnoides</i> subsp. <i>tenera</i>		P1	
98.	7211 <i>Eremophila georgei</i>			
99.	14340 <i>Eremophila glabra</i> subsp. <i>glabra</i>			
100.	7219 <i>Eremophila granitica</i> (Thin-leaved Poverty Bush)			
101.	15112 <i>Eremophila interstans</i> subsp. <i>interstans</i>			
102.	15111 <i>Eremophila interstans</i> subsp. <i>virgata</i>			
103.	7226 <i>Eremophila ionantha</i> (Violet-flowered Eremophila)			
104.	15003 <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>			
105.	14594 <i>Eremophila parvifolia</i> subsp. <i>auricampa</i>			
106.	7259 <i>Eremophila pustulata</i> (Warted Eremophila)			
107.	18259 <i>Myoporum platycarpum</i> subsp. <i>platycarpum</i>			
<b>Solanaceae</b>				
108.	7030 <i>Solanum plicatile</i>			
<b>Zygophyllaceae</b>				
109.	4394 <i>Zygophyllum ovatum</i> (Dwarf Twinleaf)			

**Conservation Codes**  
T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
---------	--------------	-------------	-------------------	------------------------------------

4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# NatureMap Species Report

Created By Guest user on 22/02/2018

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 121° 43' 59" E, 31° 00' 16" S  
**Buffer** 20km  
**Group By** Species Group

Species Group	Species	Records
Bird	74	245
Invertebrate	2	2
Reptile	14	23
<b>TOTAL</b>	<b>90</b>	<b>270</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Bird</b>				
1.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
2.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
3.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
4.	24264 <i>Acanthiza robustirostris</i> (Slaty-backed Thornbill)			
5.	24265 <i>Acanthiza uropygialis</i> (Chestnut-rumped Thornbill)			
6.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
7.	24312 <i>Anas gracilis</i> (Grey Teal)			
8.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
9.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
10.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
11.	25528 <i>Aphelocephala leucopsis</i> (Southern Whiteface)			
12.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
13.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
14.	<i>Barnardius zonarius</i>			
15.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
16.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
17.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
18.	24361 <i>Coracina maxima</i> (Ground Cuckoo-shrike)			
19.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
20.	24416 <i>Corvus bennetti</i> (Little Crow)			
21.	25592 <i>Corvus coronoides</i> (Australian Raven)			
22.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
23.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
24.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
25.	24322 <i>Cygnus atratus</i> (Black Swan)			
26.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
27.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
28.	24470 <i>Dromaius novaehollandiae</i> (Emu)			
29.	<i>Egretta novaehollandiae</i>			
30.	47937 <i>Euseyornis melanops</i> (Black-fronted Dotterel)			
31.	<i>Eolophus roseicapillus</i>			
32.	24651 <i>Eopsaltria australis</i> subsp. <i>griseogularis</i> (Western Yellow Robin)			
33.	24567 <i>Epthianura albifrons</i> (White-fronted Chat)			
34.	24368 <i>Eurostopodus argus</i> (Spotted Nightjar)			
35.	25621 <i>Falco berigora</i> (Brown Falcon)			
36.	25727 <i>Fulica atra</i> (Eurasian Coot)			
37.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
38.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
39.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
40.	24557 <i>Leipoa ocellata</i> (Malleefowl)			T
41.	25659 <i>Lichenostomus leucotis</i> (White-eared Honeyeater)			
42.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
43.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
44.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
45.	24551 <i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
46.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
47.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
48.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
49.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
50.	<i>Microcarbo melanoleucos</i>			
51.	25693 <i>Microeca fascinans</i> (Jacky Winter)			
52.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
53.	24618 <i>Oreoica gutturalis</i> (Crested Bellbird)			
54.	24619 <i>Pachycephala inornata</i> (Gilbert's Whistler)			
55.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
56.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
57.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
58.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i> (Striated Pardalote)			
59.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			
60.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
61.	24748 <i>Platycercus varius</i> (Mulga Parrot)			
62.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
63.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
64.	24681 <i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
65.	24683 <i>Pomatostomus superciliosus</i> (White-browed Babbler)			
66.	42344 <i>Pumella albifrons</i> (White-fronted Honeyeater)			
67.	24278 <i>Pyrrholaemus brunneus</i> (Redthroat)			
68.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
69.	30948 <i>Smicromis brevirostris</i> (Weebill)			
70.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
71.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
72.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
73.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
74.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

#### Invertebrate

75.	<i>Hoggicosa storri</i>			
76.	<i>Isometroides vescus</i>			

#### Reptile

77.	24871 <i>Ctenophorus cristatus</i> (Bicycle Dragon)			
78.	25251 <i>Echiopsis curta</i> (Bardick)			
79.	25115 <i>Hemiergis initialis</i> subsp. <i>initialis</i>			
80.	25162 <i>Lerista picturata</i>			
81.	30938 <i>Lucasium damaeum</i>			
82.	30935 <i>Lucasium maini</i>			
83.	24904 <i>Moloch horridus</i> (Thorny Devil)			
84.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
85.	24966 <i>Nephruerus laevisimus</i>			
86.	25259 <i>Pseudonaja affinis</i> subsp. <i>affinis</i> (Dugite)			
87.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
88.	25263 <i>Pseudonaja modesta</i> (Ringed Brown Snake)			
89.	25269 <i>Suta fasciata</i> (Rosen's Snake)			
90.	30814 <i>Tympanocryptis cephalus</i> (Pebble Dragon)			

#### Conservation Codes

T - Rare or likely to become extinct  
X - Presumed extinct  
IA - Protected under international agreement  
S - Other specially protected fauna  
1 - Priority 1  
2 - Priority 2  
3 - Priority 3  
4 - Priority 4  
5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

# **Appendix D** – Flora data

Flora species list

Flora likelihood of occurrence assessment guidelines

Flora likelihood of occurrence assessment

## Flora taxa list

Row Labels	Taxon	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Amaranthaceae	<i>Ptilotus helichrysoides</i>				X			X	
Amaranthaceae	<i>Ptilotus nobilis</i>		X		X			X	
Amaranthaceae	<i>Ptilotus obovatus</i>			X	X	X		X	
Apocynaceae	<i>Alyxia buxifolia</i>				X		X		
Asteraceae	<i>Asteraceae</i> sp.		X		X	X			
Asteraceae	<i>Cratystylis microphylla</i>			X					
Asteraceae	<i>Olearia muelleri</i>		X	X	X			X	
Asteraceae	<i>Xanthium spinosum</i>	*DP							X
Casuarinaceae	<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>		X	X	X				
Casuarinaceae	<i>Allocasuarina eriochlamys</i> subsp. <i>eriochlamys</i>						X		
Chenopodiaceae	<i>Atriplex nummularia</i> subsp. <i>spathulata</i>		X	X	X	X		X	
Chenopodiaceae	<i>Atriplex vesicaria</i>		X		X				
Chenopodiaceae	<i>Enchylaena tomentosa</i>				X				
Chenopodiaceae	<i>Maireana brevifolia</i>				X				
Chenopodiaceae	<i>Maireana sedifolia</i>		X	X	X			X	
Chenopodiaceae	<i>Maireana triptera</i>		X	X	X	X			
Chenopodiaceae	<i>Maireana villosa</i>		X	X	X			X	
Chenopodiaceae	<i>Rhagodia drummondii</i>				X	X			
Chenopodiaceae	<i>Rhagodia spinescens</i>					X			
Chenopodiaceae	<i>Sclerolaena brevifolia</i>		X	X	X				
Chenopodiaceae	<i>Sclerolaena diacantha</i>		X		X				
Chenopodiaceae	<i>Sclerolaena drummondii</i>				X				
Chenopodiaceae	<i>Sclerolaena fusiformis</i>				X				
Chenopodiaceae	<i>Tecticornia halocnemoides</i>				X			X	
Euphorbiaceae	<i>Euphorbia drummondii</i>					X			
Fabaceae	<i>Acacia acuminata</i>						X		
Fabaceae	<i>Acacia colletioides</i>			X	X		X	X	

Row Labels	Taxon	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Fabaceae	<i>Acacia erinacea</i>			X	X			X	
Fabaceae	<i>Acacia jennerae</i>			X		X			
Fabaceae	<i>Acacia masliniana</i>				X				
Fabaceae	<i>Acacia prainii</i>		X						
Fabaceae	<i>Acacia</i> sp.				X				
Fabaceae	<i>Acacia tetragonophylla</i>				X	X	X		
Fabaceae	<i>Senna artemisioides</i>		X	X	X	X	X	X	
Fabaceae	<i>Swainsona canescens</i>								X
Frankeniaceae	<i>Frankenia interioris</i> var. <i>interioris</i>				X		X	X	
Goodeniaceae	<i>Scaevola spinescens</i>		X	X	X		X	X	
Lamiaceae	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>						X		
Lamiaceae	<i>Salvia verbenaca</i>	*				X			
Lamiaceae	<i>Westringia cephalantha</i> var. <i>cephalantha</i>				X				
Loranthaceae	<i>Amyema</i> sp.				X	X	X		
Malvaceae	<i>Malvaceae</i> sp.					X			
Myrtaceae	<i>Eucalyptus celastroides</i> subsp. <i>celastroides</i>							X	
Myrtaceae	<i>Eucalyptus griffithsii</i>				X	X	X		
Myrtaceae	<i>Eucalyptus lesouefii</i>			X	X				
Myrtaceae	<i>Eucalyptus moderata</i>				X				
Myrtaceae	<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>			X			X		
Myrtaceae	<i>Eucalyptus ravida</i>				X				
Myrtaceae	<i>Eucalyptus salmonophloia</i>		X	X	X	X		X	
Myrtaceae	<i>Eucalyptus stricklandii</i>				X			X	
Myrtaceae	<i>Eucalyptus torquata</i>			X	X				
Myrtaceae	<i>Eucalyptus transcontinentalis</i>		X		X				
Myrtaceae	<i>Melaleuca sheathiana</i>				X				
Pittosporaceae	<i>Pittosporum angustifolium</i>		X		X	X			
Poaceae	<i>Austrostipa</i> sp.		X			X			

Row Labels	Taxon	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Poaceae	<i>Enneapogon caeruleus</i>		X			X			
Poaceae	<i>Paspalidium constrictum</i>		X		X	X			
Poaceae	<i>Triodia</i> sp.						X		
Proteaceae	<i>Grevillea acuaria</i>				X			X	
Proteaceae	<i>Grevillea stenobotrya</i>				X		X		
Santalaceae	<i>Exocarpos aphyllus</i>		X	X	X	X			
Santalaceae	<i>Santalum acuminatum</i>				X	X			
Santalaceae	<i>Santalum spicatum</i>				X	X			
Sapindaceae	<i>Dodonaea lobulata</i>				X	X		X	
Sapindaceae	<i>Dodonaea microzyga</i> var. <i>acrolobata</i>				X		X		
Scrophulariaceae	<i>Eremophila ?caperata</i>				X			X	
Scrophulariaceae	<i>Eremophila ?granitica</i>						X		
Scrophulariaceae	<i>Eremophila alternifolia</i>					X			
Scrophulariaceae	<i>Eremophila clavata</i>				X				
Scrophulariaceae	<i>Eremophila decipiens</i> subsp. <i>decipiens</i>					X			
Scrophulariaceae	<i>Eremophila dempsteri</i>				X				
Scrophulariaceae	<i>Eremophila glabra</i> subsp. <i>glabra</i>		X	X	X	X			
Scrophulariaceae	<i>Eremophila interstans</i> subsp. <i>interstans</i>				X				
Scrophulariaceae	<i>Eremophila interstans</i> subsp. <i>virgata</i>		X	X	X	X		X	
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>		X		X				
Scrophulariaceae	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>		X		X			X	
Scrophulariaceae	<i>Eremophila parvifolia</i> subsp. <i>auricampa</i>		X	X	X			X	
Scrophulariaceae	<i>Eremophila pustulata</i>				X		X		
Scrophulariaceae	<i>Eremophila scoparia</i>		X	X	X	X		X	
Scrophulariaceae	<i>Myoporum platycarpum</i> subsp. <i>platycarpum</i>				X				
Solanaceae	<i>Lycium australe</i>		X		X	X			
Solanaceae	<i>Nicotiana glauca</i>	*							X
Solanaceae	<i>Solanum lasiophyllum</i>		X						

Row Labels	Taxon	Status	VT01	VT02	VT03	VT04	VT05	VT06	VT07
Solanaceae	<i>Solanum nummularia</i> subsp. <i>spathulata</i>		X	X	X				
<b>Total</b>	<b>84</b>		<b>30</b>	<b>24</b>	<b>62</b>	<b>29</b>	<b>17</b>	<b>23</b>	<b>3</b>

### Flora likelihood of occurrence assessment guidelines

Likelihood of occurrence	Guideline
Known	Species recorded within the survey area from field survey results.
Likely	Species previously recorded within the study area and large areas of suitable habitat occur in the survey area.
Possible	Species previously recorded within the study area and areas of suitable habitat occur/may occur in the survey area.
Unlikely	Species previously recorded within the study area, but suitable habitat does not occur in the survey area.
Highly unlikely	Species not previously recorded within the study area, suitable habitat does not occur in the survey area and/or the survey area is outside the natural distribution of the species.
Other considerations	Intensity of survey, availability of access, growth form type, recorded flowering times, cryptic nature of species

#### Source information - desktop searches

PMST – DEE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area

DBCA – DBCA (2007–) records of threatened flora, database search within the study area (accessed February 2018)

NM – DBCA NatureMap (accessed February 2018)

### Flora likelihood of occurrence assessment for conservation significant flora

Family	Taxon	Status		Description (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WCAct	EPBC Act			
Fabaceae	<i>Gastrolobium graniticum</i>	T	En	Erect, open shrub, to 2.5 m high. Flower is yellow and orange and red, Aug to Sep. Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	Unlikely: species previously recorded > 20 km from the survey area	PMST
Montiaceae	<i>Calandrinia</i> sp. Widgiemooltha (F. Obbens & E. Reid FO 9/05)	P1		Herb to 30 cm tall, 10 - 20 cm wide. Flowers purple. Commonly found growing in amongst <i>Tecticornia</i> shrubs	Possible: Species previously recorded < 20 km from the survey area and some suitable habitat exists	DBCA
Myrtaceae	<i>Cyathostemon divaricatus</i>	P1		Erect straggly shrub to 80 cm high, 80cm wide, white to pale pink flowers.	Possible: Species previously recorded < 20 km from the survey area and some suitable habitat exists	DBCA

Family	Taxon	Status		Description (WA Herbarium 1998–, DEE 2018)	Likelihood of Occurrence	Source
		WCAct	EPBC Act			
Scrophulariaceae	<i>Eremophila arachnoides</i> subsp. <i>tenera</i>	P1		Broom-like shrub, to 3 m high, branches with tubercles often elongated & coalescing. Fl. white/blue-purple.	Likely: Species previously recorded < 20 km from the survey area and large areas of suitable habitat exists	NatureMap DBCA
Scrophulariaceae	<i>Eremophila praecox</i>	P1		Broom-like shrub, 1.5-3 m high. Fl. purple, Oct or Dec. Red/brown sandy loam. Undulating plains.	Unlikely: species previously recorded > 20 km from the survey area	DBCA
Euphorbiaceae	<i>Ricinocarpos</i> sp. <i>Eastern Goldfields</i> (A. Williams 3)	P1		Erect shrub to 2 m high x 2 m wide. Fl. Yellow, Mar. Rocky hillslope. Dry red-brown sandy loam over felsic and mafic volcanics	Unlikely: species previously recorded > 20 km from the survey area	DBCA
Chenopodiaceae	<i>Tecticornia flabelliformis</i>	P1	Vu	Erect shrub, to 0.2 m high. Clay. Lake foreshore of saline flats	Unlikely: species previously recorded > 20 km from the survey area	PMST DBCA

# **Appendix E – Fauna data**

Fauna species list

Fauna likelihood of occurrence assessment guideline and definitions

Fauna likelihood of occurrence assessment

## Fauna species list

Family	Scientific Name	Common Name	Conservation Listing
<b>Birds</b>			
Acanthizidae	<i>Acanthiza apicalis</i>	Inland Thornbill	
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	
Acanthizidae	<i>Smicrornis brevirostris</i>	Weebill	
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie	
Artamidae	<i>Strepera versicolor</i>	Grey Currawong	
Dromaiidae	<i>Dromaius novaehollandiae</i>	Emu	
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren	
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	
Meliphagidae	<i>Anthochaera carunculata</i>	Red Wattlebird	
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater	
Meliphagidae	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	
Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner	
Meliphagidae	<i>Purnella albifrons</i>	White-fronted Honeyeater	
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird	
Pachycephalidae	<i>Pachycephala inornata</i>	Gilbert's Whistler	
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler	
Psittaculidae	<i>Barnardius zonarius</i>	Australian Ringneck	
Psittaculidae	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	
Psittaculidae	<i>Psephotus varius</i>	Mulga Parrot	
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	
Strigidae	<i>Ninox boobook</i>	Southern Boobook	
<b>Reptiles</b>			
Agamidae	<i>Ctenophorus cristatus</i>	Crested Dragon	
Scincidae	<i>Menetia greyii</i>	Common Dwarf Skink	
Scincidae	<i>Tiliqua rugosa</i>	Shingleback	
Varanidae	<i>Varanus gouldii</i>	Sand Goanna	
<b>Mammal</b>			
Bovidae	<i>Bos taurus</i>	Cow	Int
Bovidae	<i>Capra hircus</i>	Feral Goat	Int
Canidae	<i>Canis lupus dingo</i>	Dingo	
Felidae	<i>Felis catus</i>	Feral Cat	Int
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit	Int
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo	
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	

## Fauna likelihood of occurrence assessment guidelines

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within or close proximity to the survey area.
Likely	Species are <b>likely</b> to occur in the survey area where there is suitable habitat within the survey area and there are recent records of occurrence of the species in close proximity to the survey area. OR Species known distribution overlaps with the survey area and there is suitable habitat within the survey area.
Unlikely	Species assessed as <b>unlikely</b> include those species previously recorded within 10 km of the survey area however: <ul style="list-style-type: none"> <li>• There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area.</li> <li>• The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area. OR</li> </ul> Those species that have a known distribution overlapping with the survey area however: <ul style="list-style-type: none"> <li>• There is limited habitat in the survey area (i.e. the type, quality and quantity of the habitat is generally poor or restricted).</li> <li>• The suitable habitat within the survey area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the survey area.</li> </ul>
Highly unlikely	Species that are considered <b>highly unlikely</b> to occur in the survey area include: <ul style="list-style-type: none"> <li>• Those species that have no suitable habitat within the survey area.</li> <li>• Those species that have become locally extinct, or are not known to have ever been present in the region of the survey area.</li> </ul>

### Source information - desktop searches

NM – DBCA *NatureMap* (accessed February 2018)

DBCA – SWA – DBCA (2007–) records of threatened fauna, database search within the SWA study area (accessed February 2018)

PMST – DEE Protected Matters Search Tool (PMST) to identify fauna listed under the EPBC Act potentially occurring within the study area (accessed February 2018)

### Definitions

Term	Description
study area	a 20 km buffer around the survey area
survey area	the area subject to the current survey
region	the area within an approximate 20 km radius of the survey area
Cr	Critically endangered
En	Endangered
Vu	Vulnerable
IA	International agreement
Mi	Migratory
Ma	Marine
CD	Conservation dependent
OS	Other specially protected fauna
P1 – P4	Priority 1 – Priority 4

### Fauna likelihood of occurrence assessment

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	<i>NatureMap</i>	EPBC PMST		
<b>Birds</b>							
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu	X	X	The Malleefowl generally occurs in semi-arid areas of Western Australia, from Carnarvon to south east of the Eyre Bird Observatory (southeast Western Australia). It occupies shrublands and low woodlands that are dominated by mallee vegetation, as well as native pine <i>Callitris</i> woodlands, <i>Acacia</i> shrublands, Broombush <i>Melaleuca uncinata</i> vegetation or coastal heathlands. The nest is a large mound of sand or soil and organic matter (Jones and Goth 2008; Morcombe, 2004). They prefer vegetation with a dense understorey of shrubs and their breeding habitat is characterized by light soil and an abundant leaf litter, which is used in the construction of nesting mounds. Density of the canopy cover is an important feature associated with high breeding densities, with grazed areas generally have much lower densities. In the WA Wheatbelt, Malleefowl distribution is associated with landscapes with lower rainfall, greater amounts of mallee and shrubland that occur as large remnants, and lighter soil surface textures.	<b>Likely</b> Species known from the region. Suitable habitat present.
<i>Merops ornatus</i>	Rainbow Bee-eater	IA	Ma	X		The Rainbow Bee-eater is found throughout the state except in desert regions, particularly in open forests and woodlands, with sandy, loamy soil, but also sandridges, sandpits, riverbanks, mangroves, rainforest shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. They also inhabit sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe 2004; Pizzey and Knight	<b>Likely</b> Species known from the region. Suitable habitat present.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	NatureMap	EPBC PMST		
						2012). They dig out nests in open areas where there is relatively soft but firm sands, either on flat ground or in the side of a sandy bank (Nevill 2013).	
<i>Calidris ferruginea</i>	Curlew Sandpiper	Vu	CR, Mi		X	Curlew Sandpipers mainly occur in areas with soft mud conditions, including intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around nontidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are found inland less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. In WA, they are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division, but are more sparsely distributed between Carnarvon and Dampier Archipelago (DEE 2018). They are common on the Swan Coastal Plain, particularly near large drying lakes like Thompson and Forrestdale, and Peel Inlet. They are less common along the southern coast to Esperance (Nevill 2013).	<b>Unlikely</b> Although the species has been recorded approximately 46 km to the north, the species has not been recorded within the survey area and there is no suitable habitat.
<i>Pezoporus occidentalis</i>	Night Parrot	CR	En		X	The Night Parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. The night parrot was thought to be extinct but in 2013 it was rediscovered in Queensland (Pullen Pullen Reserve). Subsequently, the species has been found in Goneaway National Park and Diamantina National Park in Queensland and near Broome in Western Australia (DotEE 2017). The Night Parrot's habitat consists of stony rises, scattered trees and shrubs, Mulga woodland, sandy lowlands, salt lakes, clay plans, and bare gibber, with shrubby glasswort, chenopod, seeding	<b>Highly unlikely</b> The species has not been recorded in the region.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	<i>NatureMap</i>	EPBC PMST		
						spinifex, <i>Astrelba</i> , shrubby samphire, saltbush, bluebush, and <i>bassia</i> associations (Pizzey and Knight 2012, TSSC 2016). They are likely to occur anywhere from inland WA west to the Pilbara and the west coast (Pizzey and Knight 2012).	
<i>Apus pacificus</i>	Fork-tailed Swift	IA	Mi		X	The Fork-tailed Swift is common in coastal and sub coastal areas between Carnarvon and Augusta including near and offshore islands. There are scattered records along south coast from Denmark east to Cocklebidy on the Great Australian Bight, and sparsely scattered records inland. They are found across a range of habitats, from inland open plains to wooded areas. They are most often observed over inland plains in Australia, but sometimes recorded over coastal cliffs and beaches as well as urban areas. They have been recorded well out to sea as well as from offshore islands especially when on passage from Indonesia. This species is almost exclusively aerial (DotE 2015).	<b>Unlikely</b> Although the species has been recorded approximately 130 km to the north-west, they have not been recorded within the survey area.
<i>Motacilla cinerea</i>	Grey Wagtail	IA	Mi		X	The Grey Wagtail is an opportunistic migrant to Australia. The species typically migrates to Indonesia occasionally landing in Australia. Most records for the species are from Northern Australia and South Australia (Morcombe 2004). The non-breeding habitat only of the Grey Wagtail has a strong association with water, particularly rocky substrates along water courses but also lakes and marshes (DEE 2018). It can be found mainly in banks and rocks in fast-running freshwater habitats: rivers, creeks, streams, and around waterfalls, both in forest and open country; but occurs almost anywhere during migration (Johnstone and Storr 2004).	<b>Highly unlikely</b> The species is not known from the region.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	NatureMap	EPBC PMST		
<i>Actitis hypoleucos</i>	Common Sandpiper	IA	Mi		X	The Common Sandpiper is found along all coastlines of Australia and uses a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around often narrow and steep muddy margins or rocky shores. The species has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, mangroves, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. It is often found near mangroves, and sometimes in areas of mud littered with rocks or snags (DEE 2018). They are somewhat uncommon in the south west, but can be found on Rottnest and Penguin Islands, and along the south coast all the way to the Esperance region, including the inland lakes like Lake Warden (Nevill 2013). This species is widespread and scattered, common on the north and west coasts and uncommon in the south-east and interior (Morcombe 2004).	<b>Unlikely</b> Although the species has been recorded approximately 104 km to the north-west, the species has not been recorded within the survey area. No suitable habitat present within survey area.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	IA	Mi		X	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. Sometimes they occur on rocky shores (DEE 2018). They are found throughout many wetlands on the Swan Coastal	<b>Unlikely</b> Although the species has been recorded approximately 46 km north-west, the species has not been recorded within the survey area. No suitable habitat present within survey area.

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	NatureMap	EPBC PMST		
						Plain, in Perth lakes with wet grassed margins and receding waters, Vasse and Harvey Estuaries, and the Busselton wetlands, but are less common on the south coast until the Esperance region (Nevill 2013).	
<i>Calidris melanotos</i>	Pectoral Sandpiper	IA	Mi		X	In Australia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum (DEE 2018). The bird can be seen on the Swan Coastal Plain but is rare to scarce on Lake Thompson, and as well on any freshwater wetland in the southwest with shallow, well-grassed margins. They are seen at Lake Warden, Esperance, and at Lake McLarty (Nevill 2013).	<b>Highly unlikely</b> Species not known from the region.
<b>Mammals</b>							
<i>Dasyurus geoffroii</i>	Western Quoll / Chuditch	Vu	Vu		X	The Chuditch inhabits eucalypt forest (especially Jarrah, <i>Eucalyptus marginata</i> ), dry woodland and mallee shrublands. In Jarrah forest, Chuditch populations occur in both moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest. Most diurnal resting sites in sclerophyll forest consist of hollow logs or earth burrows (Van Dyke and Strahan, 2008). The species can travel large distances, has a large home range and is sparsely populated through a large portion of its range.	<b>Unlikely</b> Suitable habitat present, however the species was last recorded in the region in 1974, approximately 23 km to the south, near Lake Lefroy. However, the

Specie name	Common name	Status		Source		Description and habitat requirements	Likelihood of occurrence
		State	Federal	NatureMap	EPBC PMST		
							species is a wide ranging species, capable of travelling long distances.

## References

Department of the Environment and Energy (DEE) 2018, Species Profile and Threats Database (SPRAT), retrieved February 2018 from <http://www.environment.gov.au/cgibin/sprat/public/sprat.pl>.

- *Actitis hypoleucos* — Common Sandpiper, [http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon\\_id=59309](http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=59309)
- *Calidris acuminata* — Sharp-tailed Sandpiper, [http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon\\_id=874](http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=874)
- *Calidris ferruginea* — Curlew Sandpiper, [http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon\\_id=856](http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=856)
- *Calidris melanotos* — Pectoral Sandpiper, [http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon\\_id=858](http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=858)
- *Motacilla cinerea* — Grey Wagtail, [http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon\\_id=642](http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=642)

Department of the Environment (DotE) (2015). Referral guideline for 14 birds listed as migratory species under the EPBC Act. Commonwealth of Australia.

Johnstone, RE and Storr, GM 1998, Handbook of Western Australian Birds, Volume 1: Nonpasserines (Emu to Dollarbird), Perth, Australia, Western Australian Museum.

Jones, D and Goth, A (2008), Mound-builders. CSIRO Publishing, Collingwood, Victoria.

Morcombe, M 2004, Field Guide to Australian Birds, Queensland, Australia, Steve Parish Publishing Archer Field.

Nevill, SJ 2013, Birds of Western Australia. Simon Nevill Publications, Perth, Western Australia.

Pizzey, G and Knight, F (2012). The Field Guide to the Birds of Australia. Harper Collins Publishers, Sydney, Australia.

Threatened Species Scientific Committee (TSSC) (2016). Approved Conservation Advice for *Pezoporus occidentalis* (Night Parrot). Department of the Environment, Canberra.

Van Dyke, S and Strahan, R 2008, The Mammals of Australia, Third Edition, Sydney Australia, New Holland Publishing

## **Appendix F** – Ten clearing principals assessment

Principle	Assessment	Outcome	Data sources
<p>a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.</p>	<p>The survey area is situated in the Eremaean Botanical Province of Western Australia (Beard 1990), within the Coolgardie bioregion and the Eastern Goldfields subregion. The flora of the Eastern Goldfields subregion is diverse with 1613 recorded native vascular species.</p> <p>Desktop searches identified 109 native plant taxa within 20 km of the survey area. The field survey recorded 84 native flora taxa; the survey area is considered to have a moderate-high level of flora biodiversity.</p> <p>Desktop searches identified the presence/potential presence of seven conservation significant flora taxa within 20 km of the survey area. No EPBC Act or WC Act-listed flora taxa were recorded within the survey area during the field survey. No DBCA-listed Priority Flora taxa were identified within the survey area during the GHD survey. However, a likelihood of occurrence assessment concluded one taxon is likely to occur within the survey area <i>Eremophila arachnoides</i> subsp. <i>tenera</i> (P1).</p> <p>Broad scale vegetation mapping of the area undertaken by Beard (1972) identified two vegetation associations within the survey area:</p> <ul style="list-style-type: none"> <li>• Medium Woodland; coral gum and goldfields blackbutt (association 9)</li> <li>• Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468)</li> </ul> <p>Both vegetation associations are considered well represented at local and regional scales (i.e. state, IBRA bioregion, IBRA subregion and LGA) with greater than 96 % of the pre-European extents remaining.</p> <p>Seven vegetation types and additional areas that described modifications in the landscape were described within the survey area, these were:</p> <ul style="list-style-type: none"> <li>• <i>Eucalyptus salmonophloia</i>, <i>E. lesouefii</i> and <i>E. transcontinentalis</i> open woodland over Chenopod open shrubland (VT01)</li> <li>• Occasional <i>Eucalyptus salmonophloia</i> with <i>E. lesouefii</i> <i>E. oleosa</i> subsp. <i>oleosa</i> and <i>E. torquata</i> woodland over <i>Eremophila</i> spp. shrubland (VT02)</li> <li>• Mosaic <i>Eucalyptus</i> spp. woodland (VT03)</li> <li>• <i>Eucalyptus salmonophloia</i> and <i>E. griffithsii</i> open woodland over a tall sparse shrubland (VT04)</li> <li>• <i>Eucalyptus oleosa</i> subsp. <i>oleosa</i> and <i>E. griffithsii</i> woodland over <i>Triodia</i> sp. open hummock grassland (VT05)</li> <li>• <i>Eucalyptus salmonophloia</i>, <i>E. stricklandii</i> and <i>E. celastroides</i> subsp. <i>celastroides</i> over variable open shrubland (VT06)</li> <li>• Variable shrubland/ herbland (VT07)</li> <li>• Water source</li> <li>• Cleared/ track/ road</li> </ul>	<p>Not likely to be at variance to this Principle</p>	<p>Beard (1990)  DBCA (2007–)  DBCA TEC and PEC databases  DBCA TPFL and WAHERB  WA Herbarium (1998–)</p>

Principle	Assessment	Outcome	Data sources
	<p>Vegetation condition within the survey area was rated from Excellent to Good. Drainage lines represented by VT04 was rated as Very good and the vegetation surrounding the man-made water sources was in Good condition. with the exception of</p> <p>No Commonwealth or State listed TECs or PECs were identified in the desktop searches or within the survey area.</p> <p>No reserves, conservation areas or other DBCA-managed estates are located within the survey area. The closest conservation areas are; Kambalda Nature Reserve located approximately 14 km south west, Lakeside Timber Reserve, approximately 14.5 km north west and Majestic Timber Reserve approximately 12.6 km north east of the survey area.</p> <p>Desktop assessments identified 86 native fauna taxa within 20 km of the survey area. A survey of the survey area recorded 37 fauna taxa, including 26 birds, 7 mammals and 4 reptiles. The species recorded in the survey area have been previously been recorded in the Coolgardie IBRA bioregion and are not considered to be dependent on the resources in the survey area.</p> <p>The survey area does not contain vegetation in better condition than that in the surrounding region. Nor is the survey area considered to comprise a high level of biological diversity.</p>		
<p>b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA</p>	<p>The desktop assessment indicated that 10 conservation significant fauna taxa may use the survey area. These results exclude marine species as no marine habitat is present within the survey area.</p> <p>No significant fauna were recorded within the survey area during the field survey. However two conservation significant fauna species are considered likely to occur; Malleefowl, listed as Vulnerable under the EPBC Act and the Rainbow Bee-eater listed as International Agreement under the WC Act.</p> <p>Malleefowl were recorded within Location 53 West, located approximately 26 km west of the survey area. Suitable similar habitat is present within this survey area so it is considered likely that the Malleefowl also occurs within this survey area.</p> <p>The Rainbow Bee-eater is also considered likely to occur within the survey area. However, the timing of the field survey coincided with bee-eater migration to northern Australia (between February and April), this may be the reason why this species was not recorded during the field survey.</p> <p>The Malleefowl is the only threatened fauna species listed under the EPBC Act and WC Act that is considered 'likely to occur' in the survey area. The survey area contains suitable habitat for foraging and breeding (Mixed Eucalyptus woodland over mixed shrubs and Mixed <i>Eucalyptus</i> woodland over spinifex). These habitats are common in the local and regional area; they are not exclusive to the survey area. No individuals or breeding mounds were recorded in the survey area during the field survey.</p>	<p>Not likely to be at variance to this Principle</p>	<p>DEE (2018) DBCA (2007–)</p>

Principle	Assessment	Outcome	Data sources
	<p>The Rainbow Bee-eater may opportunistically use; Mixed <i>Eucalyptus</i> woodland over chenopods, Mixed <i>Eucalyptus</i> woodland over mixed shrubs, Mixed <i>Eucalyptus</i> woodland over spinifex, Mixed <i>Eucalyptus</i> woodland over rocky hillslopes and <i>Eucalypt</i>-lined creek line habitats for foraging. These habitats are common in the local and regional area; they are not exclusive to the survey area.</p> <p>Habitats recorded in the survey area are also found in the local area in similar or better condition. The proposed project footprint will not significantly diminish the extent of the recorded habitats on a regional or local scale.</p> <p>The habitat types within the survey area is well connected and part of a largely contiguous landscape. Existing minor barriers within the survey area that may restrict movement of fauna is the haul road, tracks and fence lines.</p>		
<p>(c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.</p>	<p>Desktop searches identified the presence/potential presence of two EPBC Act listed flora taxa within 20 km of the survey area; <i>Gastrolobium graniticum</i> and <i>Tecticornia flabelliformis</i>. <i>Gastrolobium graniticum</i> is also listed under the WC Act as Threatened, whilst <i>Tecticornia flabelliformis</i> is listed as Priority 1 by DBCA</p> <p>A likelihood of occurrence assessment, which takes into account the habitats present, known taxa distribution and previous records, was completed for both EPBC Act listed flora taxa identified in the desktop assessment. This assessment concluded that neither taxa were likely to occur within the survey area. Searches for conservation significant flora were undertaken during the GHD field survey. No Threatened flora taxa were recorded during the survey.</p>	<p>Not likely to be at variance to this Principle.</p>	<p>DEE (2018)            DBCA (2007–)            DBCA TPFL and WAHERB            WA Herbarium (1998–)</p>
<p>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.</p>	<p>Desktop searches identified no TECs within 20 km of the survey area. No Commonwealth or State listed TECs were identified within the survey area during the field survey.</p>	<p>Not likely to be at variance to this Principle.</p>	<p>DEE (2018)            DBCA TEC and PEC databases</p>
<p>(e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an</p>	<p>The survey area is located within the Coolgardie IBRA bioregion. This IBRA bioregion has approximately 96% of its pre-European extent remaining Broad scale vegetation mapping of the area undertaken by Beard (1972) identified two vegetation associations within the survey area:</p> <ul style="list-style-type: none"> <li>• Medium Woodland; coral gum and goldfields blackbutt (association 9)</li> </ul>	<p>Not likely to be at variance to this Principle.</p>	<p>Beard (1972)            GoWA (2017)</p>

Principle	Assessment	Outcome	Data sources
area that has been extensively cleared	<ul style="list-style-type: none"> <li>• Medium woodland; Salmon Gum and Goldfields Blackbutt (association 468)</li> </ul> <p>These associations are considered well-represented at all levels (state, IBRA bioregion, IBRA sub-region and LGA) with greater than 96 per cent of their pre-European extents remaining. The survey area is surrounded by intact native vegetation and is well connected to the surrounding vegetation</p>		
(f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	<p>There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. However, there are several minor ephemeral drainage lines within the survey area. The larger of these drainage lines flow north to south, eventually draining into Lake Lefroy, located approximately 8 km south.</p> <p>Two ephemeral drainage lines are represented by VT04 <i>Eucalyptus salmonophloia</i> and <i>E. griffithsii</i> open woodland over a tall sparse shrubland. The flora taxa recorded within VT04 are not considered wetland or dampland species. The drainage line supported <i>Eucalyptus</i> spp. over a suite of shrubs, herbs and grasses commonly found within the larger survey area. These flora taxa most likely opportunistically dispersed and established along the drainage line during the wetter months. The vegetation recorded within VT04 is not considered riparian vegetation.</p>	Not likely to be at variance to this Principle.	GoWA (2018)
(g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The Australian Soil Resource Information System (ASRIS) indicates that the survey area has ‘No Known Occurrence’ of Acid Sulphate Soils (ASS).</p> <p>Any clearing of native vegetation within the survey area has the potential to cause soil and wind erosion. However, as the area will be managed as a mining area the potential degradation is likely to be minimised and managed through mitigation measures including staged clearing, revegetation of temporarily disturbed areas and the implementation of drains and bunds where necessary.</p>	Not likely to be at variance to this Principle.	ASRIS (2013) (
(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.	<p>No reserves, conservation areas or other DBCA-managed estates are located within the survey area. Three conservation areas occur within 20 km the vicinity of the survey area, including:</p> <ul style="list-style-type: none"> <li>• Kambalda Nature Reserve approximately 14 km south west,</li> <li>• Lakeside Timber Reserve, approximately 14.5 km north west</li> <li>• Majestic Timber Reserve approximately 12.6 km north east</li> </ul> <p>The survey area is largely surrounded by remnant native vegetation and if cleared would not be considered a significant barrier to fauna movement or to impact upon the ability of the surrounding vegetation to provide a habitat linkage. Clearing of the survey area is unlikely to impact on the environmental values of any adjacent or nearby conservation areas.</p>	Not likely to be at variance to this Principle.	DBCA Estate spatial dataset

Principle	Assessment	Outcome	Data sources
<p>(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.</p>	<p>The survey area is located in the RIWI Act listed Goldfields Groundwater Area and the Salt Lake Basin Surface Water Management Area and Sub-area. No rivers or surface water bodies listed under the RIWI Act were identified within the survey area. There are two main ephemeral drainage lines located within the survey area. These drainage lines travel in a north to south direction and flow into Lake Lefroy, located approximately 8 km south. No lakes or wetlands or natural water bodies were recorded in the survey area; two man-made dams were identified at the north and near the middle of the survey area.</p> <p>Average rainfall for the area is 267 mm and relatively evenly distributed throughout the year. However, rainfall can also be highly erratic year to year. During heavy localised rainfall events erosion may occur in cleared areas leading to temporary soil erosion and/or sedimentation, particularly in the vicinity of these ephemeral drainage lines.</p> <p>Clearing of the survey area is unlikely to cause appreciable deterioration in the quality of surface or underground water.</p>	<p>Not likely to be at variance to this Principle.</p>	<p>BOM (2018) GoWA (2018)</p>
<p>(j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding</p>	<p>The climate of the region is described as semi-arid with an average annual rainfall of 267 mm. Rainfall is relatively evenly spread throughout the year, but can occur in heavy localised falls. Based on an average annual evaporation rate of 144 millimetres, any surface water resulting from rainfall events is likely to be relatively short lived. In addition the survey area is surrounded by remnant native vegetation and it is likely that a large proportion of runoff will be absorbed by this natural environment.</p> <p>There are no permanent drainage channels or wetlands within or in the vicinity of the survey area. There are two ephemeral drainage lines within the survey area, these are only likely to flow following heavy rain.</p> <p>The survey area is characterised by predominantly flat to gently undulating plains with silty clay soils with a number of low rocky rises scattered throughout the survey area. Any surface flow is expected to be minimal, and it is unlikely that any clearing in the survey area will lead to an appreciable increase in run off that will cause, or exacerbate, the incidence of flooding.</p>	<p>Not likely to be at variance to this Principle.</p>	<p>BOM (2018)</p>

GHD

Level 10

999 Hay Street

T: 61 8 6222 8222 F: 61 8 6222 8555 E: permail@ghd.com

© GHD 2018

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

6136816-

57667/[https://projects.ghd.com/oc/WesternAustralia/westgoldfloraandfaun/Delivery/Documents/6136816-REP-Flora and fauna survey Location 45.docx](https://projects.ghd.com/oc/WesternAustralia/westgoldfloraandfaun/Delivery/Documents/6136816-REP-Flora%20and%20fauna%20survey%20Location%2045.docx)

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Benkovic M Jensen	J Tindiglia G. Gaikhorst	 	J Tindiglia		17/05/2018

[www.ghd.com](http://www.ghd.com)

