FI Joint Venture Pty. Ltd.

Yogi Magnetite Project

Pipeline Corridor Flora and Fauna Assessment

April 2020

Executive summary

FI Joint Venture (FIJV) proposes to construct and operate a magnetite iron ore project (the Yogi Mine Project) located approximately 225 km east-northeast of Geraldton and 15 km northeast of Yalgoo in the Mid-West of Western Australia. The project will also require the construction of a magnetite slurry pipeline and water pipeline from the mine to Geraldton Port, and a gas supply pipeline from the Dampier to Bunbury Natural Gas Pipeline network.

GHD Pty Ltd (GHD) was commissioned by FIJV to undertake a reconnaissance flora and vegetation survey and a Level 1 fauna survey of a section of the pipeline corridor. The survey area assessed as part of this scope included approximately 80 km of the pipeline corridor, extending from the Yogi Mine Project to east of Mullewa, covering 4,654.86 hectares (ha).The purpose of the survey was to identify key flora, vegetation and fauna values. The outcome of the survey will be used to inform the environmental assessment and approvals process.

The survey area comprised approximately 316.07 ha of cleared areas, with the remaining vegetated land comprising 21 vegetation types ranging from Very Good (110.10 ha) to Excellent (4,228.79 ha) condition. The vegetation types included five woodland and 16 shrubland types. Areas rated as Very Good had signs of historical grazing with other disturbances including historical clearing for tracks and material gravel pits, and recent fire activity (only affecting Vegetation Type 19).

The field survey confirmed the presence of a Priority Ecological Community (PEC), the Eucalypt Woodlands of the WA Wheatbelt, listed as Priority 3 by Department of Biodiversity, Conservation and Attractions (DBCA). Vegetation Type (VT) 17 *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland represents the PEC based on the nomination advice (DEC 2011), which lists *Eucalyptus loxophleba* as one of the dominate species that forms the PEC in the Avon Wheatbelt IBRA bioregion. There is 69.95 ha of this PEC in Excellent condition within the survey area.

Ninety three flora species were identified during the survey with the most commonly recorded families including Fabaceae, Chenopodiaceae, Amaranthaceae and Myrtaceae. No Declared Pest plants or Weeds of National Significance were recorded during the survey.

No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or *Biodiversity Conservation Act 2016* (BC Act) listed flora were recorded within the survey area. Three DBCA Priority-listed flora species were recorded during the survey, *Philotheca nutans* (Priory 1), *Dicrastylis linearifolia* (Priority 3) and *Acacia speckii* (Priority 4). *Philotheca nutans* was not identified in the desktop searches, however it was identified in the field and confirmed by the WA Herbarium. This represents a range extension for the species of approximately 150 km. A further three species are considered likely or may possibly occur within the survey area based on a likelihood of occurrence assessment.

Eight broad fauna habitat types recorded during the field survey (excluding area considered cleared and degraded). The survey area habitats form part of a large continuous tract of habitat. The habitats have been impacted to some degree by tracks, grazing livestock and feral animals. Parts of the survey area were also impacted by historical gravel pits and a historical railway line. While the structural complexity of some habitat types show stress signs of grazing and reduced water availability, the majority of the site is uncleared and represents good, intact habitat.

Sixty eight fauna species were recorded from the survey area, including 53 birds, nine mammals and six reptiles. Of these, five were introduced mammal species. No conservation significant fauna were recorded during the survey. The only Malleefowl mounds found were very old, disused, that have not been used for nesting for many decades. A likelihood of occurrence

assessment was conducted post-field survey for all conservation significant fauna identified in the desktop assessment. The assessment identified the likely presence of the Malleefowl (*Leipoa ocellata*), listed as Vulnerable under the BC Act and EPBC Act), Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*), listed as Vulnerable under the BC Act, Western Spiny-tailed Skink (black form) (*Egernia stokesii* subsp. *badia)*, listed as Vulnerable under the BC Act and Endangered under the EPBC Act) and the Long-tailed Dunnart (*Sminthopsis longicaudata)*, listed as Priority 4 by DBCA, as the survey provides suitable habitat for these species.

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1. Introduction

1.1 Project background

FI Joint Venture (FIJV) proposes to construct and operate a magnetite iron ore project (the Yogi Mine Project) located approximately 225 kilometres (km) east-northeast of Geraldton and 15 km northeast of Yalgoo in the Mid-West, Western Australia (WA). The Project will also require the construction of a magnetite slurry pipeline and a water pipeline from the mine to Geraldton Port, and a gas supply pipeline from the Dampier to Bunbury Natural Gas (DBNG) Pipeline network.

1.2 Purpose of this report

GHD Pty Ltd (GHD) was commissioned by FIJV to undertake a reconnaissance flora and vegetation survey and a Level 1 fauna survey of a section of the pipeline corridor. The purpose of the survey was to identify key flora, vegetation and fauna values. The outcome of the survey will be used to inform the environmental assessment and approvals process.

To support environmental approvals for the Project, GHD has completed flora, vegetation and fauna assessments of the mine area (GHD 2019a, b). This report focuses on the pipeline corridor associated with the magnetite slurry pipeline and water pipeline.

1.3 Project location

1.3.1 Survey area

The pipeline corridor broadly follows the Mt Magnet Road extending from the Yogi Mine Project west to the Geraldton Port. The survey area assessed as part of this scope included approximately 80 km of the pipeline corridor, extending from the Yogi Mine Project to east of Mullewa. The survey area is approximately 500 meters (m) wide, covers 4,654.86 hectares (ha) and is shown in , Appendix A.

1.3.2 Study area

The study area was defined for the desktop based searches for the flora and fauna survey and includes a 40 km buffer of the survey area.

1.4 Scope of works

The scope of works was to undertake a reconnaissance flora and vegetation survey and a Level 1 fauna survey of the survey area. The scope of works included:

- A desktop review of publicly available information and databases, to determine the flora and fauna values of the survey area
- A reconnaissance flora and vegetation survey to identify:
  - Broad vegetation types present, including any Threatened or Priority Ecological Communities (TECs or PECs)
  - Vegetation condition
  - Dominant flora species present including introduced species
  - The presence or likelihood of any Threatened or Priority flora
- A Level 1 fauna survey to identify:
  - Broad fauna habitat types
  - Fauna species present including introduced species

  - The presence or likelihood of any Threatened or Priority fauna, including a targeted Malleefowl assessment
- Preparation of a technical report that documents the results of the desktop assessment and field survey, including mapping.

1.5 Relevant legislation, conservation codes and background information

In WA some ecological communities, flora and fauna are protected under both Federal and State Government legislation. In addition, regulatory authorities 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 survey is provided in Appendix B.

1.6 Report limitations and assumptions

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

GHD otherwise disclaims responsibility to any person other than FIJV 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 (including species listings). 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 FIJV 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 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 access tracks, operational works, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions 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 study 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 identity environmental information relevant to the study area and to assist in survey design. The search parameters used included a 40 km buffer of two search areas 116° 32' 37" East, 28° 23' 13" South and 116°04' 04" East, 28° 27' 21". This desktop assessment included a review of:

- The Department of the Environment and Energy (DEE) Protected Matters Search Tool (PMST) to identify species and communities 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 Community (TECs and PECs) database to determine the potential for TECs or PECs to be present within the study area (DBCA 2018a)
- The DBCA Threatened (Declared Rare) and Priority Flora and Fauna, and WA Herbarium (WAHERB) databases for Threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) and listed as Priority by the DBCA, previously recorded within the study area (DBCA 2018b and DBCA 2018c) (Appendix C)
- The DBCA NatureMap database for flora and fauna species previously recorded within the study area (DBCA 2007–) (Appendix C)

2.2 Field survey

2.2.1 Vegetation and flora

GHD Senior Ecologist Joel Collins (SL012542 and DRF 82-1819) completed a reconnaissance vegetation and flora assessment of the survey area from 26-30 November 2018. The field survey was undertaken to identify and describe the dominant vegetation types, assess vegetation condition, and identify and record vascular flora taxa present at the time of survey. Opportunistic searches for conservation significant or other significant ecological communities and flora taxa were also undertaken during the field survey.

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 survey methods involved a combination of relevé sampling and traversing the survey area by both vehicle and foot. Relevés and photo reference sites were conducted along the survey area to describe the vegetation and physical features. Thirty-five relevés were conducted throughout the survey area with the locations of each relevé presented in Figure 3. Field data at each relevé site was recorded on a pro-forma data sheet and included the parameters detailed in Table 1. Survey and relevé data are provided in Appendix D.

Table 1 Data collected during the field survey

Aspect	Measurement
Collection attributes	Site code, personnel/recorder, date, photograph of the site.
Physical features	Landform, slope, aspect, soil attributes, ground surface cover, leaf and wood litter.

Aspect	Measurement
Location	Coordinates recorded in GDA94 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition using the condition rating scale adapted by EPA (2016a) for the South-West and South-Western Interzone Botanical Provinces.
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 all species at relevé including stratum, average height and cover using National Vegetation Information System (NVIS).

A flora inventory was compiled from taxa listed in the relevés/photo reference sites and from opportunistic floristic records throughout the survey area.

Vegetation types

Vegetation types were identified and boundaries delineated using a combination of aerial photography, topographical features and field data/observations.

Vegetation types were described based on structure, dominant taxa and cover characteristics as defined by field observations. Vegetation type descriptions are consistent with NVIS Level V (Association). At Level V up to three taxa per stratum are used to describe the association (ESCAVI 2017).

Vegetation condition

The vegetation condition was assessed and mapped in accordance with the vegetation condition rating scale for the South West and South-Western 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 ecologist were identified in the field; all other species were collected and assigned a unique collection number to facilitate tracking. All specimens collected were identified using taxonomic literature, local and regional flora keys and by comparison with the named species held at the WA Herbarium.

The conservation status of all recorded flora was compared against the current lists available on FloraBase (WA Herbarium 1998–). Nomenclature used in this report follows that used by the WA Herbarium as reported on FloraBase (WA Herbarium 1998–).

Conservation significant flora

Prior to the field survey, information obtained from the desktop assessments (e.g. EPBC Act PMST, NatureMap and DBCA database search results) was reviewed to determine conservation significant flora taxa potentially present within the survey area and existing locations. Opportunistic searches for conservation significant flora (mostly at relevé and photo reference sites) were undertaken throughout the survey area. Where individuals were identified, the location and number of plants present were recorded using handheld GPS units and Samsung S2 tablets.

2.2.2 Fauna

GHD ecologist Steven Petts undertook a Level 1 fauna survey (reconnaissance survey) of the survey area in conjunction with the vegetation and flora assessment from 27-30 November 2018. The survey area was traversed by vehicle and on foot over the course of the survey to

identify and describe the dominant fauna habitat types present and their condition, assess habitat connectivity, and identify and record fauna species within the survey area. An assessment of the likelihood of conservation significant fauna and their habitats occurring within the survey area was also undertaken.

A targeted Malleefowl assessment was also undertaken from 20th to 31st January 2020 by GHD Senior Zoologist Robert Browne-Cooper and Brad Maryan (Zoologist) with field support provided by Grace Formentin and Will Purser.

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).

Malleefowl Mound searches

Target searching for Malleefowl mounds was undertaken from 20th to 31st January 2020 by Robert Browne-Cooper, Brad Maryan, Grace Formentin, and Will Purser. Based on vegetation community assessment and mapping carried out by GHD botanists during the flora and vegetation survey over the length of the survey area, specific habitat types were identified as potentially suitable for Malleefowl mounds based on a combination of vegetation type, density and soil characteristics. These habitats generally included relatively dense mixed shrublands or mallee woodlands on sandplains. Where these habitat areas intersected with the survey area, search areas were traversed on foot to detect Malleefowl Mounds.

It should be noted that the boundaries and spatial distribution of vegetation community and associated habitat type in a given area may not be static over time. This has relevance to the local and regional context of the survey area that has undergone significant historical (last 100 years) changes that have impacted on vegetation and habitat structure and distribution. These factors include but not limited to climate change, feral goats, fire, weeds, and ground disturbance. Consequently, the suitability of habitat in a given location for Malleefowl can change.

The search area included the location of the midline of the proposed pipeline with two field personnel spaced 20 to 30 metres and straddling the midline of the proposed pipeline. This gave a total search area width of approximately 60 metres searched for all potentially suitable

habitats of dense shrubland and mallee woodland. Figure 7 shows the target search transects along the pipeline alignment. The personnel spacing of transects was reduced to 15 to 20 metres in areas where vegetation density reduced ground visibility.

Target searching involved visual assessment of remnant areas identifying breeding evidence (presence/absence of Malleefowl mounds), foraging evidence (scratchings), droppings, current activity (via presence of prints) and any other signs of Malleefowl. For the purpose of this assessment, the NHT (2007) National manual for the Malleefowl monitoring system standards will be used to define mound size, use and age.

Information collected during the field survey included:

- Foraging Activity (scratching) – Identified by the disturbance of Malleefowl in litter while foraging. Often the disturbance is extensive and close to an existing mound. The location was recorded via GPS.
- Droppings – During the transect walks, visual inspection for Malleefowl dropping were conducted. These were assessed for age and images recorded. The location was recorded via GPS.
- Prints – During the transect walks, visual inspection for Malleefowl prints were conducted. These were assessed for age and images recorded. The location was recorded via GPS.
- Mounds – Malleefowl utilise a mound to incubate their eggs. The mounds are a good indication of habitat usage, reproductive output, distribution and occurrence. Mounds were assessed according to their current activity status or profile ranking according to NHT (2007). These profiles are shown and described below.

Malleefowl profile descriptions (NHT 2007)

Profile 1 – Typical crater with raised rims. This is a typical shape of an inactive mound. However the mound may also be active and open. (GHD regards Profile 1 mounds as being inactive).

Profile 2 – Mound fully dugout and active. The characteristic of this profile is that the crater slopes down steeply and at the base the sides drop vertically to form a box-like structure with sides usually 20 to 30 cm deep. Often litter will have been raked into windrows and may have started to enter the mound.

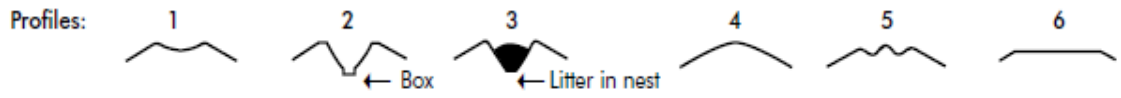
Profile 3 – Mound with litter and active. This is the next stage after Profile 2. Litter will have been raked into the mound by Malleefowl and thick layers of litter are evident on the surface. There may or may not be sand mixed with the litter at this stage.

Profile 4 – Active mound mounded up with debris but no crater. This is the typical profile of an active and worked mound but unopened Malleefowl mound.

Profile 5 – Mound forms a sandy crater with peak in centre. This is a typical profile of an active mound which is in the process of being closed by Malleefowl or being thermoregulated by the birds.

Profile 6 – Mound low and flat without distinct peak or crater. These mounds are long unused and often abandoned. The rim and crater are very eroded leaving a shallow depression or barely discernible as a low ring of slightly raised soil or remnant accumulated gravel. Often the depression or crater has established vegetation growing within the (if anything is left). The eroded nature of these mounds indicate the long period (many decades) of non-usage by Malleefowl.

Additionally mounds were measured for their size including total diameter, rim width, rim height (to outside ground level) and crater depth (to rim height). A picture was also taken of each mound and locations were recorded by GPS.



Opportunistic fauna searches

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
- 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.

Fauna species identification and nomenclature

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 by Principal and Senior Zoologists.

Nomenclature used in this report follows that used by the WA Museum and the DBCA NatureMap database (DBCA 2007–) with the exception of birds, where Christidis and Boles (2008) was used.

2.3 Limitations

2.3.1 Desktop limitations

Desktop investigations use a variety of online resources such as the DBCA searches, NatureMap database and the EPBC Act PMST. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

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 and NatureMap database provide more accurate information for the general area. However, some records of collections, sightings or trappings cannot be dated or have plain language locality descriptions and may misrepresent the current range of a species.

2.3.2 Survey limitations

The EPA technical guidance recommend 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. Based on this assessment, the present survey effort has not been subject to any constraints which affect the thoroughness of the assessment and the conclusions which have been formed.

Table 2 Field survey limitations

Aspect	Constraint	Comment
Sources of information and availability of contextual information.	Nil	Adequate information is available for the survey area, this includes: • Broad scale (1:1,000,000) mapping by Beard (1976) and digitised by Shepherd *et al.* (2002) • Regional biogeography (Desmond and Chant 2001, Beechman 2001). • Database searches (DBCA and NatureMap).
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 surveyed.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Minor	The reconnaissance vegetation and flora survey was undertaken in spring 2018 which is the recommended timing for flora surveys in the region. The flora recorded from the field survey is detailed in section 4.5.1 and a full flora list is presented in Appendix E. The timing is considered appropriated due to the high proportion of species able to be identified at the time of the survey. The reconnaissance fauna survey was also undertaken in spring 2018. The fauna assessment sampled those species that can be easily seen, heard or have 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 were identified to species level. The fauna assessment was aimed at identifying habitat types and terrestrial vertebrate fauna utilising the survey area. No sampling for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than vertebrate species.
Flora determination	Minor	Flora determination was undertaken by the survey ecologist in the field and at the WA Herbarium. Four taxa were only able to be identified to species level, the remaining 53 taxa were identified to species level. 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 Nature criteria.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	Access to the survey area was made by vehicle and on foot, with access along the survey area by the existing DBNG pipeline access track. There were some areas that had poor access by vehicle and foot. Information gained from the survey was extrapolated across those sections of the survey area not accessed on foot during the field survey to assist with determining the vegetation types and condition and fauna habitat types for the entire survey area

Aspect	Constraint	Comment
Mapping reliability	Minor	The vegetation was using high-resolution ESRI aerial imagery obtained from Landgate, topographical features, previous broad scale mapping (Beard 1976) and field data. 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 ±5 metres on average. Therefore the data points consisting of coordinates recorded from the GPS may contain minor inaccuracies. It should be noted that the boundaries and spatial distribution of vegetation communities and associated habitat types in a given area may not be static over time. This has relevance to the local and regional context of the survey that has undergone historical changes over the last 100 years that have impacted on vegetation and habitat structure. These factors include but not limited to climate change, feral goats, fire, weeds, and ground disturbance.
Timing/weather/ season/cycle	Minor	The field surveys were conducted during spring (26-30 November 2018), with follow-up target Malleefowl survey in January 2020. In the three months prior to the spring survey (August-October), the Mullewa weather recording station (No. 008095, Bureau of Meteorology (BoM) 2019) recorded a total of 64.4 mm of rainfall. This is marginally below the recorded long-term average for the same period (August-October; 76.7 mm) (BoM 2019). The weather conditions recorded during the survey were generally dry, hot and strong prevailing north-easterly winds. A summary of the climatic conditions are provided: • Daily maximum temperature ranging from 32.7 to 37.0 °C • Daily minimum temperature ranging from 12.2 to 14.4 °C • Daily rainfall 0 mm. The weather conditions recorded during the survey periods are considered unlikely to have impacted upon the vegetation and flora survey. However, the hot and windy conditions did influence the fauna survey. During hot and windy conditions there is generally less activity of fauna groups as many species seek shelter. During periods of windy conditions fauna signs, such as tracks, are reduced or covered up and are not as easily observed. The survey timing was considered appropriate for the flora and fauna field survey.
Disturbances (e.g. fire, flood, accidental human intervention)	Nil	One area along the survey area had been burnt approximately 2-3 years ago. This vegetation type is recovering with many species in juvenile growth form (*Acacia* sp., *Allocasuarina* sp., *Eucalyptus* sp.), however, the dominant species were still able to be identified.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey areas were sampled in accordance with EPA (2016a) and terrestrial fauna sampled in accordance to EPA (2016b). The survey area was sufficiently covered by the survey team during the survey.
Resources	Nil	Adequate resources were employed during the field survey. Ten person days were spent undertaking the survey using two qualified ecologists.

Aspect	Constraint	Comment
Access restrictions	Nil	No access problems were encountered during the survey.
Experience levels	Nil	The ecologists who executed the survey are practitioners suitably qualified and experienced in their respective fields. Senior Ecologist Joel Collins has over 15 years' experience in undertaking flora and vegetation surveys within the Mid West and Wheatbelt regions of WA. Ecologist Steven Petts has over seven years' experience undertaking fauna surveys within the Mid West of WA. The phase 2 fauna survey and targeted searches were executed by senior zoologists, Robert Browne-Cooper and Brad Maryan who each have over 15 years of fauna survey are assessment experience in Western Australia, including mid-west and Wheatbelt bioregions targeting the Malleefowl, Western Spiny-tailed Skink and other locally relevant species.

3. Desktop assessment

3.1 Climate

The climate of the study area is classified as desert to semi-desert warm Mediterranean with a bimodal (summer and winter) rainfall pattern (Beard 1976). Rainfall is moderately variable, with rainfall events being restricted to local areas rather than being widespread. The majority of all rainfall received occurs during winter months and is a result of low pressure system associated with the westerly wind system. Summer rainfall occurs as result of thunderstorms and heavy downpours associated with remnant tropical cyclones. The BoM Mullewa station (site number 008095) is the nearest weather station to the survey area with reliable long-term data. Climatic data from this site indicates:

- Mean maximum temperature ranges from 18.8 °C in July to 36.8 °C in January
- Mean minimum temperature ranges from 7.0 °C in July to 20.2 °C in February
- Mean annual rainfall of 333.7 mm with an average of 43.9 rain days per year (BoM 2019).

Climatic data from this site including the long-term average, and from 2018 is summarised in Plate 1.

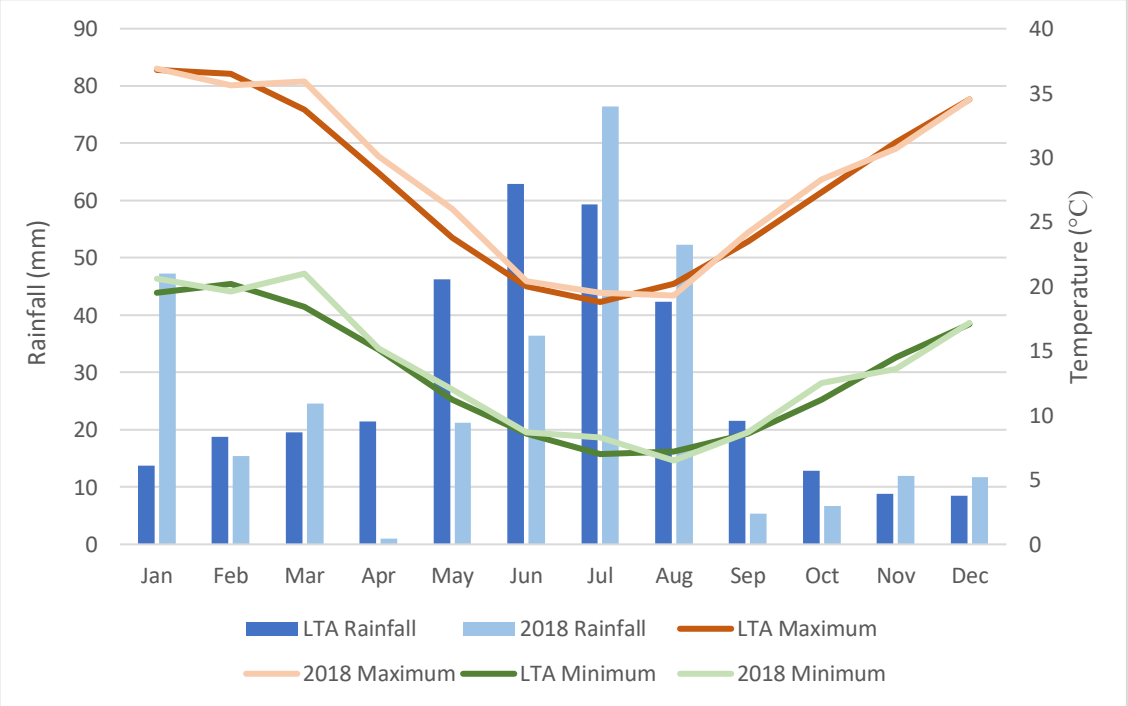


Plate 1 Climatic data for Mullewa (BoM 2019)

3.2 Landforms and soils

The survey area is located within the Murchison Province of the Yilgarn Craton. The survey area is intersects three soil landscape zones including:

- Irwin River Zone: characterised by dissected plateau (with shallow valleys, stony ridges and sandplain remnant) on deeply weathered mantle, colluvium and alluvium over granite and gneiss of the Yalgoo Craton. Yellow and Red deep sands with Red shallow sands with Red loamy earths and Red deep and some Red shallow loams. Bowgada-Jam shrublands and York gum woodland (with some acacia-casuarina thickets and halophytic shrublands (Tille 2006).

- Karrara Hills, Plains and Lakes Zone: characterised by hills and ranges, sandy plains, hardpan wash plains, stony plains and salt lakes (with some mesas and plains) on greenstone and granitic rocks of the Yilgarn Craton. Red shallow loams, Red loam earths, Red deep sands and Salt lake soils with some Red shallow sands, Stony soil and Red shallow sandy duplexes (Tille 2006).
- Yalgoo Plains Zone: characterised by hardpan wash plains (with some sandplains, stony plains, mesas and granite outcrops) on granitic rocks (with some greenstone) of the Yilgarn Craton (Murchison Domain). Red loamy earths and Red shallow loams (often with hardpans) with Red deep sands and Red shallow sands and some shallow sandy complexes (Tille 2006).

3.3 Land systems

The majority of the survey area is located within the Southern Rangelands Pastoral District. Land systems have been mapped by the Department of Agriculture and Food Western Australia (DAFWA) based on a survey completed by Hennig *et al.* (1994). Seven land systems intersect the survey area (Table 3).

The western portion of the survey area is situated in the agriculture zone of Western Australia. The Department of Primary Industries, Resources and Development (DPIRD) have previously mapped soil landscapes for the far western portion extent of the survey area. Five soil landscape systems intersect the western part of the survey area (Table 4).

Table 3 Land system description

Land system	Description	Land type	Location
Joseph Land system	Undulating yellow sandplain supporting dense mixed shrublands with patchy Mallees.	Sandplains with *Acacia*, Mallees and heath	Western and central portions
Pindar Land system	Stony plains with *Acacia* shrublands and halophytic shrublands	Washplains, Eucalypt woodland with non-halophytic understorey.	Western and central portions
Bandy Land system	Gritty-surfaced plains and low outcrops of granite with scattered acacia shrublands.	Gritty-surfaced plains and granite tors and domes; *Acacia* shrublands.	Western and central portions
Nerramyne Land system	Undulating plains of sandy-surfaced laterite and weathered granite with low remnant plateaux, breakaways and rises supporting *Acacia* shrublands	Stony plains with Acacia shrublands and halophytic shrublands	Eastern and central portion.
Kalli Land system	Elevated gently undulating red sandplains edged by stripped surfaces on laterite and granite, supporting acacia tall shrublands with wanderrie grass understoreys.	Sandplains and occasional dunes; Grassy acacia shrublands	Eastern and central portion.

Land system	Description	Land type	Location
Tindalarra Land system	Near level hardpan wash plains, narrow drainage lines and moderately saline drainage floors; supporting tall mixed acacia shrublands with wanderrie grasses, also minor saltbush/bluebush low shrublands.	Wash plains on hardpan; Mulga shrublands	Eastern portion
Challenge Land system	Gently undulating gritty and sandy surfaced plains, occasional granite hills, tors and low breakaways, supporting acacia shrublands and occasional halophytic shrublands.	Gritty-surfaced plains and granite tors and domes; Acacia shrublands	Eastern portion.

Table 4 Soil landscape systems

Soil landscapes	Description
Fegan system	Gently undulating low rises and hillcrests of broad mature valleys, in upper Irwin River catchment.
Pindar 1 subsystem	Gently undulating sandplain and gentle slopes; acid yellow deep sand and sandy earths with some loamy earths and hardpan soils
Pindar 2 subsystem	Gently undulating sandplain and long gentle slopes; acidic yellow and brown deep sands and sandy earths
Noolagabbi 1 subsystem	Level to very gently inclined valley flats; brown loamy duplexes and red shallow loams over hardpans
Noolagabbi Saline Drainage, Phase 2	Narrow drainage lines to broad level salt plains in broad mature valleys.

3.4 Hydrology

3.4.1 Watercourses

The survey area intersects the Greenough River and Tributaries Catchment Area which is a Proclaimed Surface Water Area under the *Rights in Water and Irrigation Act 1914* (RIWI Act) The survey area is intersected by the Irwin River North, Pindathuna Creek and tributaries of the Greenough River and Yarramonger River. All intersecting rivers and tributaries are seasonal. No permanent surface water bodies lie within the survey area. Underlying the survey area is the Proclaimed Gascoyne Groundwater Area (RIWI Act 1914) (GoWA 2019).

3.4.2 Wetlands

No Wetlands of National Significant or RAMSAR Wetlands intersect the survey area (GoWA 2019).

3.5 Regional biogeography

The survey area is located within the Interim Biogeographic Regionalisation of Australia (IBRA) bioregions of Yalgoo (YAL) and Avon Wheatbelt (AVW) and subregions Tallering and Merredin respectively (DEE 2018b).

The Tallering subregion is characterised by low woodlands to open woodlands of *Eucalyptus*, *Acacia* and *Callitris* on red sandy plains of the Western Yilgarn Craton and Southern Carnarvon

Basin. The Western Yilgarn Craton comprises mulga, *Callitris-E. salubris*, and Bowgada open woodlands and scrubs on earth to sandy-earth plains. The Southern Carnarvon Basin has a basement of Phanerozoic sediments. The subregion is particularly rich in ephemerals (Desmond and Chant 2001).

The Merredin subregion is characterised by drainage dissecting a tertiary plateau in Yilgarn Craton within a gently undulating landscape of low relief. Proteaceous heath scrub is rich with endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials flats. Within this subregion is the ancient peneplain with low relief, gently undulating landscape. There is no connected drainage; salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain. (Beechman 2001).

3.6 Vegetation and flora

3.6.1 Broad vegetation mapping and extent

Broad scale (1:1,000,000) pre-European vegetation mapping of the Yalgoo and Wheatbelt region was completed by Beard (1976) at an association level. The mapping indicates six vegetation associations intersect the survey area (Table 5).

Table 5 Broad scale vegetation associations intersecting the survey area (Beard 1976)

Vegetation association	Description	Location within survey area
18	Low woodland; mulga (*Acacia aneura*)	Eastern portion
125	Bare areas; salt lakes	Eastern portion
202	Shrublands; mulga & Acacia quadrimarginea scrub	Eastern portion
243	Shrublands; bowgada & minnieritchie scrub	Eastern portion
361	Shrublands; bowgada & minnieritchie scrub with scattered mulga	Entire survey area
364	Shrublands; bowgada scrub with scattered eucalypts & cypress pine	Central portion
404	Shrublands; bowgada & Acacia murrayana scrub	Central portion
419	Shrublands; bowgada, jam and *Melaleuca uncinata* thicket	Entire survey
420	Shrublands; bowgada & jam scrub	Entire survey area
676	Succulent steppe; samphire	Western portion
683	Succulent steppe with open scrub; scattered *Acacia sclerosperma* & snakewood over samphire	Eastern portion
686	Medium woodland; York gum & red mallee	Western portion

The pre-European vegetation mapping has been adapted and digitised by Shepherd *et al.* (2002). The extents of the vegetation associations have been determined by the State-wide vegetation remaining extent calculations maintained by the DBCA (current as of December 2018– Government of WA (GoWA) 2019). As shown in Table 6, the current extents remaining of all associations (with the exception of associations 125 and 676) are greater than 38% of their pre-European extents at all levels (e.g. State, IBRA bioregion, IBRA sub-region and Local Government Area (LGA)). The current extents remaining of association 125 is less than 29% at the LGA level and of association 676 is less than 27% at the LGA level and less than 25% at the IBRA bioregion and IBRA sub-region levels.

Table 6 Extents of vegetation association mapped within the survey area (Beard 1976, GoWA 2019)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	%current extent in all DBCA managed lands
18	State: WA	19,892,306.48	19,843,148.07	99.75	6.64
	IBRA: Yalgoo	101,331.17	101,232.93	99.90	19.45
	IBRA sub-region: Tallering	101,278.46	101,180.22	99.90	19.41
	LGA: Shire of Yalgoo	548,671.49	548,555.14	99.98	19.88
125	State: WA	3,485,785.49	3,146,487.22	90.27	8.45
	IBRA: Yalgoo	106,869.97	42,029.08	39.33	2.27
	IBRA sub-region: Tallering	106,869.97	42,029.08	39.33	5.02
	LGA: Shire of Yalgoo	77,136.66	21,603.94	28.01	7.59
202	State: WA	448,529.31	448,343.80	99.96	22.92
	IBRA: Yalgoo	45,096.14	45,011.91	99.81	40.16
	IBRA sub-region: Tallering	45,096.14	45,011.91	99.81	40.16
	LGA: Shire of Yalgoo	52,004.53	51,900.75	99.80	34.83
243	State: WA	148,432.56	148,426.20	100.00	4.0
	IBRA: Yalgoo	40,588.09	40,581.74	99.98	13.87
	IBRA sub-region: Tallering	40,177.72	40,171.36	99.98	14.01
	LGA: Shire of Yalgoo	40,065.26	40,058.91	99.98	14.05
361	State: WA	87,511.09	87,484.57	99.97	26.67
	IBRA: Yalgoo	76,479.74	76,453.22	99.97	27.31
	IBRA sub-region: Tallering	76,456.96	76,430.44	99.97	27.32
	LGA: Shire of Yalgoo	77,518.54	77,492.03	99.97	27.88
364	State: WA	510,984.96	506,124.99	99.05	46.17
	IBRA: Yalgoo	509,047.32	504,231.91	99.05	46.33
	IBRA sub-region: Tallering	122,194.01	119,461.81	97.76	44.87
	LGA: City of Greater Geraldton	20,148.16	19,866.51	98.60	3.26
404	State: WA	206,553.92	198,504.92	96.10	21.72
	IBRA: Yalgoo	151,772.33	143,906.80	94.82	13.77
	IBRA sub-region: Tallering	136,683.55	132,835.10	97.18	14.92

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	%current extent in all DBCA managed lands
	LGA: Shire of Yalgoo	59,928.02	59,928.02	100.00	34.86
419	State: WA	313,225.36	296,195.62	94.56	40.40
	IBRA: Yalgoo	302,707.71	289,825.55	95.74	40.15
	IBRA: Avon Wheatbelt	10,517.64	6,370.07	60.57	51.75
	IBRA sub-bioregion: Tallering	302,707.72	289.825.56	95.74	40.15
	IBRA sub-region: Merredin	10,517.64	6,370.07	60.57	51.75
	LGA: City of Greater Geraldton	94,775.26	91,002.31	96.02	13.20
	LGA: Shire of Yalgoo	90,566.53	89,276.96	98.58	18.08
420	State: WA	859,632.29	830,216.29	96.58	14.61
	IBRA: Avon Wheatbelt	44,968.05	17,161.76	38.16	10.55
	IBRA: Yalgoo	621,396.05	620,265.57	99.82	16.41
	IBRA sub-region: Tallering	615,816.17	614,685.69	99.82	16.56
	IBRA sub-region: Merredin	44,968.05	17,161.76	38.16	10.55
	LGA: City of Greater Geraldton	43,129.59	22,990.59	53.31	11.67
	LGA: Shire of Yalgoo	549,363.25	548,343.31	99.81	12.91
676	State: WA	2,063,413.95	1,963,881.55	95.18	15.44
	IBRA: Avon Wheatbelt	124,573.10	30,418.61	24.42	1.30
	IBRA sub-region: Merredin	124,377.02	30,380.38	24.43	1.31
	LGA: City of Greater Geraldton	101,326.01	21,122.27	26.77	1.35
683	State: WA	50,318.87	49,976.10	99.32	34.75
	IBRA: Yalgoo	50,075.10	49,732.32	99.32	34.92
	IBRA sub-region: Tallering	50,075.10	49,732.32	99.32	34.92
	LGA: Shire of Yalgoo	46,866.17	46,852.33	99.97	30.40
686	State: WA	13,135.07	8,436.97	64.23	17.43
	IBRA: Avon Wheatbelt	8,800.29	4,156.84	47.24	12.05
	IBRA: Yalgoo	4,334.78	4,280.12	98.74	22.66
	IBRA sub-region: Merredin	8,800.29	4,156.84	47.24	12.05
	IBRA sub-region: Tallering	4,334.78	4,280.12	98.74	22.66
	LGA: City of Greater Geraldton	7,475.62	4,567.52	61.10	10.97

3.6.2 Conservation significant ecological communities

A search of the EPBC Act PMST identified one EPBC Act-listed TEC potentially occurring within the study area. The DBCA data indicated there are three conservation significant ecological communities (and/or their buffers) that intersects the survey area. Identified TECs and PECs are displayed in Table 7 and , Appendix A.

Table 7 Conservation significant ecological communities

Community	Status	Location
Yalgoo (Gnows Nest/Wolla Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation)	DBCA: Priority 1 PEC	Eastern portion of survey area, buffer intersects the survey area
Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo and Moore palaeodrainage on Wagga Wagga and Bunnawarra Stations	DBCA: Priority 1 PEC	Eastern portion of survey area
Wheatbelt Woodlands Eucalypt woodlands of the Western Australian Wheatbelt	EPBC Act: Critically Endangered TEC DBCA: Priority 3 PEC	Western portion of survey area. Four individual patches intersect the survey area. These patches align with Beard (1976) broad vegetation association 686
Gullewa vegetation complexes (banded ironstone formation)	DBCA Priority 1 PEC	15 km south of the survey area

Eucalypt Woodlands of the WA Wheatbelt (TEC) (EPBC Act: Critically Endangered)

Defined as eucalypt woodlands occurring in the Merredin, Katanning and Western Mallee IBRA Sub-regions of WA. Small outlying patches may extend into adjacent areas. The Eucalypt Woodlands of the WA Wheatbelt TEC as defined by (Threatened Species Scientific Committee (TSSC) 2015) has a number of key diagnostic characteristics that are required to be met:

- The structure of the community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10 %
- The key species of the tree canopy are species of *Eucalyptus* that are typically single-trunked. One or more of the tree species as identified in Table 2a of the Approved Conservation Advice (TSSC 2015) are dominant or co-dominant. If other species are present in the tree canopy (e.g. species identified in Table 2b of TSSC (2015) or other taxa) then these collectively do not occur as dominants in the tree canopy
- A native understory is present, but is of variable composition, being a combination of grasses, other herbs and shrubs
- The minimum condition, mature tree density and patch size thresholds are met as outlined in Table 3 of TSSC (2015).

Eucalypt Woodlands of the WA Wheatbelt (PEC) (DBCA: Priority 3)

The Priority 3 PEC Eucalypt Woodlands of the WA Wheatbelt is defined as per the nomination form (DEC 2011) as eucalypt-dominated woodlands in the WA Wheatbelt region in the IBRA Avon Wheatbelt 1 (Merredin) and 2 (Katanning) and Mallee 2 (Western Mallee) Sub-regions with the specific exceptions of:

- Woodlands and forests dominated by Jarrah (*E. marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum (*E. loxophleba*) present

- Woodlands dominated or co-dominated by Wandoo (*E. wandoo*) where it occurs in Jarrah forest (but is included for Wheatbelt)
- Non-woodland communities dominated by eucalypts, specifically those dominated by eucalypts with a mallee growth form.

Both mallee and woodland forms of the key eucalypt species occur in association with either shrub or other understorey. However, this nomination focuses specifically on woodland eucalypt sub-communities. Although mallee eucalypts may be present, they are included only where they occur in the understorey. The community is also defined by its structure as a woodland, in which trees are widely spaced with canopy cover between 10-30 %, however, there are no minimum condition and patch size thresholds (DEC 2011).

3.6.3 Flora diversity

The *NatureMap* database identified 456 flora, representing 60 families and 182 genera previously recorded within the study area (Appendix C). This total comprised 440 native taxa and 16 naturalised (introduced) taxa. Dominant families recorded include Fabaceae (72 taxa), Asteraceae (58 taxa) and Poaceae (39 taxa).

3.6.4 Conservation significant flora

Desktop searches of the EPBC Act PMST, *NatureMap* database and DBCA TPFL and WAHERB databases identified the presence/potential presence of 33 conservation significant flora taxa within a 40 km buffer of the study area. The desktop searches recorded:

- Three taxa listed under the EPBC Act and/or as Threatened under the BC Act
- Six Priority 1 flora taxa
- One Priority 2 flora taxon
- 17 Priority 3 flora taxa
- Six Priority 4 flora taxa.

3.7 Fauna

3.7.1 Fauna diversity

The *NatureMap* database identified 190 vertebrate fauna species previously recorded within the study area (Appendix C). This total included eight amphibians, 124 birds, 10 mammals and 47 reptiles. One invertebrate species was also identified in the desktop assessment. Of these, 181 are native species and nine are introduced species.

3.7.2 Conservation significant fauna

The EPBC Act PMST, NatureMap and DBCA databases identified the presence/potential presence of 17 conservation significance fauna within the study area. Locations of previously recorded conservation significant fauna in proximity to the study area is presented in , Appendix A. The desktop searches recorded:

- Six species listed as Threatened under the EPBC Act and/or as Schedule 1-4 (Threatened) under the BC Act
- One species listed as Schedule 7 (Other specially protected fauna) under the BC Act
- Four species listed as migratory (Terrestrial and Wetland) under the EPBC Act and/or as Schedule 5 (Migratory birds protected under an international agreement) under the BC Act
- Six species listed as Priority by DBCA.

4. Field survey results

4.1 Vegetation and flora

4.1.1 Vegetation types

The varying soil types, geology and landforms of the study area have provided diverse growing conditions for vegetation. In total, the field survey identified 21 vegetation types (VT) covering the survey area. The three most dominant vegetation types are *Melaleuca eleuterostachya* open woodland (VT14) (1,000.61 ha), *Acacia rhodophloia* and *Acacia aptaneura* open woodland (VT01) (688.05 ha) and *Melaleuca lateriflora*, *Melaleuca hamata* and *Acacia tetragonophylla* shrubland (VT08) (652.95 ha). VT14 is found predominantly in the western portion of the survey area while VT01 and VT08 are located predominantly in the eastern portion of the survey area. Vegetation type 18, *Acacia tetragonophylla* sparse shrubland on seasonally wet clay pan, expressed the lowest coverage within the survey area with 1.36 ha. *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland (VT17) was recorded in the western portion of the survey area.

Approximately 316.72 ha (6.80%) of the survey area comprised cleared land, including areas used as gravel pits.

The VTs described within the survey area are presented in Table 8 and mapped in **Error! Reference source not found.** (Appendix A).

4.1.2 Vegetation condition

The vegetation condition within the survey area was rated from very good to excellent. Areas rated as very good had signs of historical grazing, which has reduced the native species cover in the understorey. In total, 110.10 ha (2.36%) of vegetation was considered to be in Very Good condition while 4,228.79 ha (90.85%) was considered to be in Excellent condition with the remaining 316.07 ha (6.79%) being cleared. Other disturbances include historical clearing for tracks and material gravel pits, which are located in the western half of the survey area. Vegetation type 19 has been recently burnt (2-3 years ago) with good recruitment of native species. Recent fires were not recorded for the other vegetation types.

4.1.3 Conservation significant ecological communities

Assessing the vegetation types described at a broad level, based on dominant species and condition, one conservation significant community was identified as occurring within the survey area, the Eucalypt Woodlands of the WA Wheatbelt Priority 3 PEC.

Eucalypt Woodlands of the WA Wheatbelt PEC

The field assessment confirmed the presence of the Eucalypt Woodlands of the WA Wheatbelt PEC, listed as Priority 3 by DBCA (DBCA 2018a). VT 17 *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland represents the PEC based on the nomination advice (DEC 2011), which lists *Eucalyptus loxophleba* subsp. *loxophleba* as one of the dominant species that forms the PEC in the Avon Wheatbelt IBRA bioregion. Other subspecies are also listed, such as *Eucalyptus loxophleba* subsp. *supralaevis*, with this subspecies recognised as being a combination sprouter (a tree but becoming a mallee with repetitive disturbance events (DEC 2011). This PEC differs from the TEC in that it includes a wider range of *Eucalyptus* species in the tree canopy and has no minimum condition and patch size thresholds. VT 17 vegetation condition was mapped as Excellent. The Eucalypt Woodlands of the WA Wheatbelt PEC was recorded from two relevés within the survey area with additional occurrences mapped to record a total of six separate patches. The Eucalypt Woodlands of the

WA Wheatbelt PEC only occurs in the Avon Wheatbelt IBRA bioregion; outside of this bioregion the PEC does not occur. There was one occurrence of the PEC that was previously mapped by DBCA (2018a) on the western edge of the survey area, however, this occurrence does not represent the PEC as the vegetation type was recorded as a shrubland (VT21) and not a Eucalypt woodland in this locality. The PEC covers 69.95 ha (5.96%) within the total survey area.

The spatial distribution of this PEC is shown on **Error! Reference source not found.**, Appendix A .

Eucalypt Woodlands of the WA Wheatbelt TEC

The field assessment confirmed the presence of VT 17 *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland, however, this VT does not align with the Eucalypt Woodlands of the WA Wheatbelt TEC, listed as Critically Endangered under the EPBC Act, as it does not meet all of the key diagnostic criteria (TSSC 2015). VT 17 is dominated by *Eucalyptus loxophleba* subsp. *supralaevis,* which is not listed as a key species identified in Table 2a (TSSC 2015), only the typical form *Eucalyptus loxophleba* subsp. *loxophleba* is listed. *Eucalyptus loxophleba* subsp. *supralaevis* is listed in Table 2b (TSSC 2015) as an associated canopy species, however, are excluded if they are dominant or co-dominate. VT 17 *Eucalyptus loxophleba* subsp. *supralaevis* is a dominant and does not occur with any other species listed in Table 2a, therefore, does not represent the TEC under the TSSC (2015).

Yalgoo (Gnows Nest/Wolla Wolla and Woolgah-Wadgingarra) vegetation complexes (banded ironstone formation) PEC

The survey area intersects the buffer of one occurrence of the Yalgoo complexes (banded ironstone formation) Priority 1 PEC. No VTs occurring on BIF ranges/ridges were recorded in the survey area, therefore this PEC was not present within the survey area.

Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo palaeodrainage PEC

The Wagga Wagga and Yalgoo calcrete groundwater assemblage type on Yalgoo palaeodrainage Priority 1 PEC intersects the eastern portion of the survey area. As this PEC is a subterranean fauna assemblage it was not assessed as part of this flora and fauna assessment.

Table 8 Vegetation types within the survey area

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT01 - *Acacia rhodophloia* and *Acacia aptaneura* open woodland	688.05	*Acacia rhodophloia* and *Acacia aptaneura* open woodland over *Acacia tetragonophylla*, *Eremophila galeata* and *Acacia ramulosa* var. *ramulosa* sparse shrubland over *Maireana tomentosa* sparse chenopod shrubland on plain. Other associated species include *Acacia fuscaneura*, *Atriplex semilunaris*, *Maireana pyramidata*, *Ptilotus obovatus*, *Enchylaena tomentosa*, *Hakea recurva* subsp. *recurva*, *Maireana georgei*, *Eremophila forrestii* subsp. *forrestii* and *Eremophila compacta* subsp. *compacta*	R01, R05, R08, R12, R19, R22	
VT02 - *Acacia eremaea* and *Acacia acuminata* (narrow phyllode variant) open woodland	36.49	*Acacia eremaea* and *Acacia acuminata* (narrow phyllode variant) open woodland over *Scaevola spinescens*, *Acacia burkittii* and *Rhagodia eremaea* sparse shrubland over *Ptilotus obovatus* and *Frankenia setosa* sparse shrubland over *Aristida contorta* sparse tussock grassland on clay plain. Other associated species include *Senna* sp. *Meekatharra* (E. Bailey 1-26), *Maireana pyramidata*, *Sclerolaena eriacantha*, *Ptilotus obovatus* and *Maireana georgei*	R02, R06	
VT03 - *Acacia aptaneura* open woodland over *Acacia tetragonophylla*, *Acacia victoriae* and *Acacia burkittii* sparse shrubland	51.46	*Acacia aptaneura* open woodland over *Acacia tetragonophylla*, *Acacia victoriae* and *Acacia burkittii* sparse shrubland over *Enchylaena tomentosa*, *Maireana tomentosa* and *Rhagodia eremaea* sparse chenopod shrubland over *Cymbopogon ambiguus* sparse tussock grassland on drainage line	R03	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT04 - *Acacia aptaneura* open woodland over *Eremophila galeata*, *Acacia tetragonophylla* and *Exocarpos aphyllus* sparse shrubland	178.11	*Acacia aptaneura* open woodland over *Eremophila galeata*, *Acacia tetragonophylla* and *Exocarpos aphyllus* sparse shrubland over *Maireana planifolia, Ptilotus obovatus* and *Solanum lasiophyllum* sparse shrubland on rocky plain	R04	
VT05 - *Acacia tetragonophylla, Acacia victoriae* and *Pittosporum angustifolium* open shrubland	3.06	*Acacia tetragonophylla*, *Acacia victoriae* and *Pittosporum angustifolium* open shrubland over *Ptilotus obovatus, Solanum lasiophyllum* and *Maireana tomentosa* sparse shrubland on floodplain. Other associated species include *Eremophila galeata* and *Abutilon cryptopetalum*	R07	
VT06 - *Acacia acuminata* (narrow phyllode variant), *Acacia victoriae* and *Acacia tetragonophylla* sparse shrubland	79.21	*Acacia acuminata* (narrow phyllode variant), *Acacia victoriae* and *Acacia tetragonophylla* sparse shrubland over *Senna glaucifolia, Melaleuca hamata* and *Eremophila longifolia* sparse shrubland over *Maireana tomentosa*, *Scaevola spinescens* and *Ptilotus obovatus* open shrubland over *Eragrostis dielsii* sparse tussock grassland on floodplain. Other associated species include *Melaleuca lateriflora* and *Hakea recurva* subsp. *recurva*	R09	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT07 - *Melaleuca lateriflora* open to sparse shrubland	163.72	*Melaleuca lateriflora* open to sparse shrubland over *Cratystylis subspinescens*, *Tecticornia ?halocnemoides* and *Maireana tomentosa* chenopod shrubland on drainage flats. Other associated species include *Frankenia setosa, Sclerolaena eriacantha, Atriplex codonocarpa* and *Maireana pyramidata*	R10, R11	
VT08 - *Melaleuca lateriflora*, *Melaleuca hamata* and *Acacia tetragonophylla* shrubland	652.95	*Melaleuca lateriflora, Melaleuca hamata* and *Acacia tetragonophylla* shrubland over *Cratystylis subspinescens* and *Atriplex semilunaris* sparse shrubland over *Scaevola spinescens, Maireana tomentosa* and *Frankenia setosa* sparse shrubland on drainage flats. This vegetation type contains small clay pan pockets dominated by *Acacia cuthbertsonii* subsp. *cuthbertsonii* and *Exocarpos aphyllus*. Other associated species include *Grevillea obliquistigma* subsp. *obliquistigma* and *Ptilotus divaricata.*	R13, R14, R15	
VT09 - *Casuarina obesa* woodland to open woodland	104.68	*Casuarina obesa* woodland to open woodland over *Melaleuca lateriflora* and *Acacia cuthbertsonii* subsp. *cuthbertsonii* sparse shrubland over *Tecticornia ?disarticulata* and *Frankenia pauciflora* shrubland. This vegetation type contains areas of Tecticornia chenopod shrubland with no overstorey as a mosaic.	R16, R17	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT10 - *Grevillea obliquistigma* subsp. *obliquistigma* sparse shrubland	57.32	*Grevillea obliquistigma* subsp. *obliquistigma* sparse shrubland over *Acacia burkittii*, *Pittosporum angustifolium* and *Acacia tetragonophylla* open shrubland over *Ptilotus nobilis, Atriplex semilunaris* and *Solanum lasiophyllum* open shrubland on plain	R18	
VT11 - *Acacia acuminata* (narrow phyllode variant), Acacia speckii (P4) and *Acacia cuthbertsonii* subsp. *cuthbertsonii* sparse shrubland	83.95	*Acacia acuminata* (narrow phyllode variant), *Acacia speckii* (P4) and *Acacia cuthbertsonii* subsp. *cuthbertsonii* sparse shrubland over *Grevillea extorris* sparse shrubland over *Ptilotus obovatus* and *Solanum lasiophyllum* open shrubland on granite outcropping. Other associated species include *Cymbopogon ambiguus, Aristida contorta* and *Borya sphaerocephala*.	R20	
VT12 - *Acacia ramulosa* var. *ramulosa, Acacia speckii* (P4) *and Acacia cuthbertsonii* subsp. *cuthbertsonii* sparse shrubland	374.16	*Acacia ramulosa* var. *ramulosa, Acacia speckii* (P4) and *Acacia cuthbertsonii* subsp. *cuthbertsonii* sparse shrubland over *Eremophila forrestii* subsp. *forrestii* and *Hakea recurva* subsp. *recurva* sparse shrubland over *Ptilotus obovatus* and *Solanum lasiophyllum* open shrubland on plain. Other associated species include *Acacia aptaneura, Cymbopogon ambiguus* and *Aristida contorta.*	R21	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT13 - *Acacia burkittii, Acacia aptaneura* and *Acacia tetragonophylla* open shrubland	84.76	*Acacia burkittii, Acacia aptaneura* and *Acacia tetragonophylla* open shrubland over *Acacia andrewsii* and *Eremophila punicea* sparse shrubland over *Rhagodia drummondii*, *Ptilotus divaricata* and *Frankenia setosa* open shrubland on plain. Other associated species include *Acacia speckii* (P4), *Acacia eremaea* and *Aristida contorta*	R22	
VT14 - *Melaleuca eleuterostachya* open woodland	1000.61	Melaleuca eleuterostachya open woodland over *Acacia acuminata* (narrow phyllode variant), *Acacia craspedocarpa* and *Acacia tetragonophylla* open shrubland over *Ptilotus obovatus, Maireana carnosa* and *Sclerolaena eriacantha* sparse shrubland on shallow soil over granite on plain. Other associated species include *Borya sphaerocephala*, *Aristida contorta*, *Acacia umbraculiformis* and *Acacia sclerosperma* subsp. *sclerosperma*.	R23, R24, R29, R33	
VT15 - *Acacia rhodophloia, Callitris columellaris* and *Grevillea obliquistigma* subsp. *obliquistigma* shrubland	327.44	*Acacia rhodophloia*, *Callitris columellaris* and *Grevillea obliquistigma* subsp. *obliquistigma* shrubland over *Aluta aspera* subsp. *hesperia* and *Eremophila forrestii* subsp. *forrestii* sparse shrubland. Other associated species include *Eucalyptus ?rigidula*, *Dianella revoluta* var. *divaricata, Eriachne* sp. and *Waitzia nitida* on sandplain	R25, R27	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT16 - *Acacia burkittii, Acacia rhodophloia* and *Acacia tetragonophylla* open shrubland	47.72	*Acacia burkittii, Acacia rhodophloia* and *Acacia tetragonophylla* open shrubland over *Aluta aspera* subsp. *hesperia, Senna* sp. *Austin* (A. Strid 20210) and *Solanum lasiophyllum* sparse shrubland over *Borya sphaerocephala* open forbland on granite/quartz outcropping. Other associated species include *Aristida contorta* and *Ptilotus obovatus*	R26	
VT17 - *Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland. Within the Avon Wheatbelt IBRA region VT17 represents the PEC Eucalypt Woodlands of the WA Wheatbelt	277.35	*Eucalyptus loxophleba* subsp. *supralaevis* open mallee woodland to woodland over *Melaleuca eleuterostachya*, *Acacia rhodophloia* and *Acacia andrewsii* open shrubland over *Rhagodia drummondii* and *Ptilotus obovatus* sparse shrubland on loam soil. Other associated species include *Acacia ramulosa* var. *linophylla, Senna filifolia* and *Waitzia nitida*	R28, R31	
VT18 - *Acacia tetragonophylla* sparse shrubland on seasonally wet clay pan	1.36	*Acacia tetragonophylla* sparse shrubland over *Frankenia pauciflora, Enchylaena tomentosa* and *Maireana carnosa* shrubland on seasonally wet clay pan	R30	

Vegetation type	Area (ha)	Vegetation description	Relevé	Representative photo
VT19 - *Acacia neurophylla* subsp. *erugata* and *Melaleuca hamata* open shrubland	58.36	*Acacia neurophylla* subsp. *erugata* and *Melaleuca hamata* open shrubland on laterite sandy gravel plain (burnt 2-3 years ago). Other associated species include *Acacia longispinea*, *Anthotroche pannosa* and *Mirbelia ramulosa*	R32	
VT20 - *Melaleuca hamata* and *Acacia acuminata* (narrow phyllode variant) shrubland on drainage flats	33.12	*Melaleuca hamata* and *Acacia acuminata* (narrow phyllode variant) shrubland over *Exocarpos aphyllus* sparse shrubland on clay drainage flats	R34	
VT21 - *Acacia burkittii, Acacia effusifolia* and *Senna filifolia* shrubland	34.28	*Acacia burkittii, Acacia effusifolia* and *Senna filifolia* shrubland over *Eremophila ?clarkei* sparse shrubland over *Borya sphaerocephala* open forbland on shallow soils over granite. Other associated species include *Philotheca nutans* (P1), *Acacia tetragonophylla, Hakea recurva* subsp. *recurva* and *Philotheca brucei* subsp. *brucei*	R35	

4.1.4 Flora diversity

A total of 93 flora taxa were identified during the survey from 23 families and 43 genera. The most commonly recorded families include Fabaceae, Chenopodiaceae, Amaranthaceae and Myrtaceae. A full list of species recorded during the field survey is presented in Appendix D.

4.1.5 Introduced flora

No Declared Pest plants (as listed under the *Biosecurity and Agricultural Management Act 2007*) or Weeds of National Significance were recorded during the survey.
**Mesembryanthemum nodiflorum* (Slender Iceplant) was recorded growing near a track south of Yalgoo town site. No other introduced species were recorded within the survey area with the majority of the vegetation types being in Very Good to Excellent condition with no presence of introduced species recorded.

4.1.6 Conservation significant flora

No EPBC Act or BC Act listed flora were recorded within the survey area, however, three DBCA Priority-listed flora species was recorded during the survey. These included:

- *Philotheca nutans* (P1): recorded at VT21 with 10 individuals (Plate 2)
- *Dicrastylis linearifolia* (P3): recorded at VT15 with over 100 individuals (Plate 3)
- *Acacia speckii* (P4): recorded from relevé sites 20, 21 and 22. This species was dominant in VT 11, 12 and 13 and occurred at <2% cover.

The locations of the conservation significant flora recorded during the survey are presented in **Error! Reference source not found.** & **Error! Reference source not found.**, Appendix A.

Plate 2 *Philotheca nutans* (P1)

Plate 3 *Dicrastylis linearifolia* (P3)

Likelihood of occurrence assessment

The likelihood of occurrence (LOO) assessment was conducted post-field survey for all 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.

Two of the flora species identified in the desktop searches were confirmed during the field survey; *Dicrastylis linearifolia* (P3) and *Acacia speckii* (P4). Both of these species have been previously recorded within the survey area (DBCA 2018b). In addition, *Chamelaucium* sp. Yalgoo (Y. Chadwich 1816) (P1) is considered likely to occur based on proximity of the records (DBCA 2018b) and suitable habitat. *Eremophila viscida (*Federally listed as Endangered, State listed as Threatened) and *Enekbatus dualis (*State listed as Priority 1) are considered possible to occur within the survey area due to close proximity of records (DBCA 2018b) and/or suitable habitat within the survey area. *Philotheca nutans* (P1) was not identified in the desktop searches, however it was identified in the field and confirmed by the WA Herbarium. This represents a range extension for the species of approximately 150 km.

4.2 Fauna

4.2.1 Fauna habitat types

Eight broad fauna habitat types recorded during the field survey (excluding area considered cleared and degraded). The spatial distribution of habitat types is based on current vegetation mapping. Habitat characteristics may change over time on local and regional scale due to many factors. These factors include but not limited to climate change, feral goats, fire, weeds, and ground disturbance. Consequently, habitat characteristic in a given location that may have historically been suitable for Malleefowl may presently be unsuitable or sub-optimal. The eight habitat types described in Table 9 closely align with the vegetation types described in section 4.1.1. The eight broad fauna habitat types include:

- Low outcrops (sometimes granite or quartz)
- Drainage line
- Mallee over mixed shrubland on sandplain
- Mixed shrubland on sandplain
- Open Mulga woodland/shrubland on Clayey Soils
- Claypan
- Stoney plain
- Acacia shrubland over shallow soils over granite

4.2.2 Fauna habitat linkages

The survey area habitats form part of a large continuous tract of habitat. The habitats have been impacted some degree by tracks, grazing livestock and feral animals such as feral goats. Parts of the survey area were also impacted by historical gravel pits and a historical railway line. While the structural complexity of some habitat types show stress signs of grazing and reduced water availability, the majority of the site is uncleared and represents good, intact habitat. The survey area intercepts pastoral stations and therefore, fences and dirt tracks creates an artificial barrier for fauna moving between habitats.

Table 9 Recorded fauna habitat types from the survey area

Description	Extent in survey area	Representative photograph
Low outcrops (sometime granite or quartz) This habitat incorporates vegetation types 11 and 16. Low Granite outcrops are limited to a small area in the central portion of the survey area. These granite outcrops form part of larger granite system that is located beyond the survey area. The granite formations are usually associated with low vegetation types due to the shallow soils and comprise *Acacia, Eremophila, Grevillia, Hakea,* and *Borya* and an abundance of grasses and herbs. The environment had areas of good ground covers, litter and debris but lacked logs due to vegetation present. However the outcropping with exfoliating rock, crevices and slabbing provides excellent cover for a range of fauna species. **Conservation significant fauna** No conservation significant species were recorded. This habitat type provides moderate to high conservation value for the Western Spiny-tailed Skink (*Egernia stokesii subsp. badia)* which has been recorded in similar habitat type within the local area. Opportunistic search of this habitat did not identify potential presence of this species. Furthermore the Long-tailed Dunnart (*Sminthopsis* longicaudata) and Gilled Slender Bluetongue (*Cyclodomorphus branchialis*) is also likely to utilise this habitat. The Peregrine Falcon (*Falco peregrinus*) may also utilise these areas for foraging.	131.67	

Description	Extent in survey area	Representative photograph
Drainage line This habitat incorporates vegetation types 3, 9 and 20. The drainage line habitat is typically located in the lower elevated areas of the survey area and often associated with the base of hills located south of the survey area. The drainage lines predominately flow east to west before meandering south of the survey area. These drainage lines intercept a number of chenopod clay pans before reforming into a new drainage line. The vegetation along these drainage lines include *Acacia* species, *Allocasuarina obesa, Hakea* spp., *Grevillea* spp. overlying low shrubs of chenopod species and native grasses. Much of the expose bare ground is either sandy soils or clay. A small section of the drainage line comprise granite scree. The habitat type would flow following heavy and persistent rainfall, as a result prolonging the life of native grasses. In areas where the shrubland is denser, this vegetation would provide suitable habitat for a variety of fauna species, in particular foraging opportunities, breeding habitat and refugia for bush birds and small mammals. **Conservation significant fauna** No conservation significant species were recorded. The areas where granitic scree provide moderate habitat value for the Long-tailed Dunnart.	189.25	

Description	Extent in survey area	Representative photograph
Mallee over mixed shrubland on Sandplain This habitat incorporates vegetation type 17. This habitat type is dominated by *Eucalyptus loxophleba* in the upperstorey, *Acacia* species in the midstorey with grasses and herbs in the understorey. Proportions of this habitat type had been previously grazed by cattle as much of the survey area were historically pastoral stations. In areas where the shrubland is denser, this vegetation would provide suitable habitat for a variety of fauna species, in particular foraging opportunities, breeding habitat and refugia for bush birds and small mammals. Where the shrubland was more open and on loamy soils, large termitaria were present. Termitaria provide habitat and food source for numerous small reptiles, mammals and invertebrates. **Conservation significant fauna** No conservation significant species were recorded. This habitat type provides moderate value to the conservation species; however, this is generally limited to the denser shrubs and where there is little evidence of disturbance. This habitat may provide both suitable breeding habitat and dispersal habitat for Malleefowl (*Leipoa ocellata*).	277.35	

Description	Extent in survey area	Representative photograph
Mixed Shrubland on Sandplain This habitat incorporates vegetation types 15, 19 and 20. The mixed shrubland on sandplain habitat type was recorded in the central and western portion of the survey area. This habitat forms part of a continuous track of vegetation that occurs beyond the survey area. The habitat is dominated by *Acacia* spp., *Grevillea* spp., *Hakea* spp., *Callitris* spp. in the overstorey and *Eremophila* spp. in the midstorey, and groundcover comprising clumps of native grasses and herbs. There is some leaf litter (15%) and wood litter (5%); where present the litter was usually thin layer around the base of the shrubs. There are some fallen logs (15%) and loose bark trees present. The loose bark trees provides habitat for reptile species such as Variegated Dtella (*Gehyra variegata).* Bare ground is 50% comprising deep brown sand with minor loam. In areas where the vegetation is denser, this vegetation would provide suitable habitat for a variety of fauna species, in particular foraging opportunities, breeding habitat and refuge for birds including Bushbirds and Honeyeaters. **Conservation significant fauna** No conservation significant species were recorded. Two very old/disused Malleefowl mounds were found within this habitat (Figure 7). This habitat type provides moderate value to the conservation species; however, this is generally limited to the denser shrubs and where there is little evidence of disturbance. This habitat may provide dispersal habitat for Malleefowl.	385.79	

Description	Extent in survey area	Representative photograph
Open Mulga woodland/shrubland on Clayey Soils This habitat incorporates vegetation types 1, 2, 5, 6, 7, 8, 10, 12, 13 and 14. *Acacia* shrublands are the most dominant habitat type within the survey area. The habitat type is dominated by *Acacia* spp. in the upperstorey, *Eremophila* spp. in the mid-storey and with groundcover comprising clumps of native grasses and herbs. A large proportion of the *Acacia* shrublands has been previously disturbed by cattle grazing, resulting in large areas with very limited understorey or groundcover vegetation. There are also areas with little evidence of disturbance, which retain some structural diversity. The environment had areas of good ground covers, litter, logs or debris. There was no evidence of fire in this habitat. In areas where the shrubland is denser, this vegetation would provide suitable habitat for a variety of fauna species, in particular foraging opportunities, breeding habitat and refugia for bush birds and small mammals. Where the shrubland was more open, and on loamy soils, large termitaria were present. Termitaria provide habitat and food source for numerous small reptiles, mammals and invertebrates. **Conservation significant fauna** This habitat is the most homogenise and widespread in the region. This habitat provides a moderate value for conservation significant fauna. Historically numerous species would have persisted but are now locally extinct. The Gilled Slender Bluetongue may utilise this habitat and the Peregrine Falcon would utilise these well vegetated corridors for hunting/foraging.	3140.32	

Description	Extent in survey area	Representative photograph
Chenopod Claypan This habitat incorporates vegetation type 18. The claypan habitat type occurs in relatively small patches throughout the survey area. These claypans would likely be seasonally inundated by water when the ephemeral drainage lines flow. The habitat type is *dominated* by *Frankenia pauciflora*, *Tecticornia* spp., Atriplex species and *Maireana* species overlying clayey sand mixture. One claypan identified in the survey area was bare. Bovine grazing (showing signs of heavy grazing, soil compaction and trampling) was evident, as this habitat would provide a water source for fauna. A low of fauna species were recorded from this habitat type possibly due to the lack of cover. **Conservation significant fauna** No conservation significant fauna species were recorded. The increased structural diversity and sandy substrate in this environment is likely to support a broader suit of fauna species than the surrounding habitat types. The Gilled Slender Bluetongue may utilise this habitat and the Peregrine Falcon would utilise these well vegetated corridors for hunting/foraging.	1.36	
Stony Plain This habitat incorporates vegetation type 4. The stony plan habitat type was recorded in the eastern portion of the survey area. This habitat type forms part of a BIF ridge located to the north of the survey area. The stony plan comprises low scattered *Acacia* shrubs overlying *Atriplex* spp. and *Sclerolaena* spp. The stony plain provided limited habitat value to fauna species due to lack of microhabitats. The habitat had obvious signs of impacts from historical grazing. The habitat is likely to provide a linkage to a more structurally diverse habitat type (BIF ridge) located north of the survey area. As such this habitat is likely to provide foraging opportunities for birds, reptiles and mammals, particularly those species with a large home range. **Conservation significant fauna** No conservation significant species were recorded. The habitat provides a low to moderate value for the Long-tailed Dunnart. As	178.11	

Description	Extent in survey area	Representative photograph
the habitat is part of a contiguous area of remnant vegetation extending through and beyond the survey area, it is unlikely for conservation species to exclusively use this habitat within the survey area.		
Acacia shrubland over shallow soils over granite This habitat incorporates vegetation type 21. The shallows soils over granite habitat type is located in the far western portion of the survey area. This habitat type is characterised by *Acacia* species over *Eremophila clarkei* over a forblands. Bare ground comprises shallows pale brown sandy loam with granite. This habitat type had been heavily disturbed with evidence of historical excavation activities and clearing being observed. There were some large boulders observed which may offer microhabitat for smaller animals such as reptiles. **Conservation significant fauna** No conservation significant species were recorded. The habitat provides low value for conservation significant species, due to the high level of disturbances, it is unlikely for conservation significant species to utilise this habitat type.	34.28	

4.2.3 Fauna diversity

A total of 68 fauna species were recorded from the survey area, including 53 birds, nine mammals and six reptiles. Of these five were introduced fauna species. The list of fauna species identified during the field survey is provided in Appendix E

4.2.4 Introduced fauna

Five introduced fauna species were recorded including Cattle (*Bos taurus*), Cat (*Felis catus*), European Rabbit (*Orcytolagus cuniculus*), Goat (*Capra aegagrus*) and Sheep (*Ovis aries*).

4.2.5 Conservation significant fauna

No conservation significant fauna were recorded from the survey area. The only evidence of conservation significant fauna was three very old disused (extinct) Malleefowl mounds. The mound profile of these mounds based on NHT (2007) was assessed as 6. Mound low and flat without peak or crater. All three mounds had no sign of recent activity with establishment of shrubs commonly occurring within the old mounds indicating there has been no nesting activity for many decades.

Likelihood of occurrence assessment fauna

A likelihood of occurrence assessment was conducted post-field survey for all conservation significant fauna identified in the desktop assessment (Appendix E). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat.

The assessment identified the likely presence of the Malleefowl (*Leipoa ocellata*), Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*), Western Spiny-tailed Skink (black rock inhabiting form) (*Egernia stokesii* subsp. *badia)* and the Long-tailed Dunnart (*Sminthopsis longicaudata)* as the survey area provides suitable habitat for these species. Table 9 provides habitat details for each of these conservation listed species that are considered likely to occur in the survey area.

The likelihood of occurrence assessment identified that other fauna species of conservation significance could occasionally occur within the habitats of the survey area (e.g. species deemed unlikely). However, it is considered unlikely the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of these species and that these other species may occasional use the habitats of the survey area for temporary refuge and dispersal between other areas of habitat (i.e. Peregrine Falcon).

The presence of three very old Malleefowl mounds within the survey area indicate that historically active mounds occurred in this area. Historical habitat changes increased threatening processes for Malleefowl may account for current Malleefowl paucity. These may include feral predators, fire regimes changes, feral herbivore pressure (goats, rabbits), and local and regional climate change.

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