Main Roads Western Australia

Coongan Gorge Road Realignment

Biological Assessment

June 2016

Executive summary

Introduction

The Coongan Gorge Realignment project is located on the Marble Bar Road from Straight Line Kilometre (SLK) 323-328 in the Shire of East Pilbara. The four kilometre (km) section of road through Coongan Gorge is a narrow winding section of road with steep descents and restricted sight distances that are safety hazards.

The proposed project will include:

- The realignment and reconstruction of approximately five km of Marble Bar Road between SLK 318 and 323
- The upgraded road shall have an 8.0 metre (m) wide seal on a 10.0 m wide formation
- Associated drainage works include minor floodways, culverts and off-road drainage
- Possibility of a side track to divert traffic during stages of construction.

Clearing extents of the project are currently unknown and will depend on the requirement of the side track to be established. Material pits will be determined when funding for the project is confirmed and assessed in due course.

GHD Pty Ltd was commissioned by Main Roads to undertake a biological assessment of the survey area.

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.

Key results

- Nine vegetation associations were identified and described from the survey area. A review of the aerial photography illustrates there is representation of this vegetation outside the survey area. The vegetation is also consistent with vegetation associations identified in the vegetation mapping for the area (Beard 1979; Payne and Schoknecht 2011).
- The survey area is in a largely disturbed condition with signs of obvious disturbance, including fire, flood, grazing and road maintenance activities.
- No EPBC Act, WC Act or Priority listed flora taxa were recorded within the survey area during the survey. The Likelihood of Occurrence assessment post-field survey concluded that two consdervation significant flora taxa are considered likely and four conservation significant flora taxa may possibly occur within the survey area.
- Ten introduced taxa were recorded within the survey area during the field survey. No introduced species listed as a Declared Pest under Section 22 of the BAM Act or a WoNS (DotE 2016) were recorded within the survey area.
- The EPBC Act listed Northern Quoll (*Dasyurus hallucatus*), Ghost Bat (*Macroderma gigus*), Greater Bilby (*Macrotis lagotis*), Rainbow Bee-eater (*Merops ornatus*), Great Egret (*Ardea modesta*) and Priority 4 listed Western Pebble-mound Mouse (*Pseudomys chapmani*) were recorded during the survey
- The Likelihood of Occurrence assessment post-field survey concluded that nine additional conservation significant fauna taxa may likely occur within the survey area.

Potential project constraints – biological aspects

GHD has provided preliminary environmental approvals and referrals advice based on the biological constraints identified within the survey area. As the project is in concept design there may be opportunities to avoid and minimise the impacts on these biological constraints through design refinement. Furthermore, if the biological constraints can be avoided or impacts to these minimised it may negate the need for referral to Federal/State environmental agencies.

Key biological constraints within survey area

Biological aspect	Survey area
Flora of conservation significance	No flora taxa of conservation significance were recorded during the field assessment. The likelihood of occurrence assessment indicates that six taxa are considered likely to be present within the survey area.
Fauna of conservation significance	Presence of six fauna species: • Northern Quoll (*Dasyurus hallucatus*) – One specimen recorded active, at least two specimens on camera trap, four latrine sites and prints obsertved. The range with rocky habitats, riverine and woodlands are all core habitat for the species. The remainder is potential foraging habitat and supportive only • Ghost Bat (*Macroderma gigas*) – One specimen recorded active at night in the survey area. No caves present in the survey area. The survey area is foraging habitat for the species • Greater Bilby (*Macrotis lagotis*) – three sets of print identified as potential Bilby and one old burrow system. Habitat is present, the species is known from the region • Rainbow Bee-eater (*Merops ornatus*) – 17 individuals recorded, foraging and potential breeding habitat • Western Pebble-mound Mouse (*Psudomys chapmani*) – recent evidence of seven active mounds was recorded within the survey area including 12 inactive mounds • Greater Egret (*Ardea modesta*) - Two specimens recorded in and close to the survey area. Water Body and woodlands are foraging and roosting habitat Potential presence of nine species and their habitats within the survey area are: • Grey Falcon (*Falco hypoleucos*) – Records within the survey area and the species is a potential resident with breeding and hunting habitat present • Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) – Records in the region and foraging habitat present in riverine, woodland and ranges. Foraging habitat available for the species throughout the survey area. • Pilbara Olive Python *(Liasis olivaceus barroni*) - Records in the region and habitat present in riverine (water body), woodland and ranges, all considered core habitat. • Peregrine Falcon (*Falco peregrinus*) – Records in the region and habitat present in riverine, woodland, and ranges, hunting (foraging) habitat available for the species throughout the survey area • Long-tailed Dunnart (*Sminthopsis longicaudata*) – Records in the region and habitat available for the species. • Glossy Ibis *(Plegadis falcinellus)* – Records in the region and habitat available for the species. • Wood Sandpiper *(Tringa glareola)* – Records in the region and habitat available for the species. • Sharp-tailed Sandpiper *(Calidris acuminata)* – Records in the region

Biological aspect	Survey area
	and habitat available for the species. • Common Sandpiper *(Actitis hypoleucos)* - Records in the region and habitat available for the species.

Matters of National Environmental Significance

It was considered that the Northern Quoll, Greater Bilby and Pilbara Olive Python would require referral based on the presence of the species, records in the region and core habitat critical to the survival of the species present within the survey area.

It was also considered that the Ghost Bat, Pilbara Leaf-nosed Bat, Rainbow Bee-eater, Greater Egret, Glossy Ibis, Wood Sandpiper, Sharp-tailed Sandpiper and Common Sandpiper are unlikely to rely on the habitats present within the survey area and clearing of habitat for the project is unlikely to significantly impact a population of this species. It is considered unlikely that the project would require referral to the DotE for impacts on this species.

Environmental Protection Authority

The potential impacts from the loss of native vegetation and loss of fauna habitat can be effectively assessed through the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Therefore, with consideration of the biological values discussed in this report, it is considered unlikely that the project would require referral to the EPA under Section 38 of the *Environmental Protection Act 1986*.

Department of Environment and Regulation

No EPBC Act, WC Act or Priority listed flora taxa were recorded within the survey area during the survey. The Likelihood of Occurrence assessment post-field survey concluded that two conservation significant flora taxa are considered likely and four conservation significant flora taxa may possibly occur within the survey area.

Fifteen fauna of conservation significance are considered to occur or likely to occur in survey area. As such, any clearing permit application should assess the significance of any potential impacts of the proposed clearing area on these species.

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1. Introduction

1.1 Background

The Coongan Gorge Realignment project is located on the Marble Bar Road from Straight Line Kilometre (SLK) 323-328 in the Shire of East Pilbara. The four kilometre (km) section of road through Coongan Gorge is a narrow winding section of road with steep descents and restricted sight distances that are safety hazards.

The proposed project will include:

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Clearing extents of the project are currently unknown and will depend on the requirement of the side track to be established. Material pits will be determined when funding for the project is confirmed and assessed in due course.

1.2 Purpose of this report

GHD Pty Ltd (GHD) was commissioned by Main Roads Western Australia (Main Roads) to undertake a biological assessment of the survey area. The purpose of the assessment was to delineate key flora, vegetation, fauna, soil, groundwater and surface water values within the survey area and the potential impact to areas of sensitivity. The outcomes of the assessment will be used in the environmental assessment and approvals process.

1.3 Location

1.3.1 Study area

A study area[1] was defined for the desktop based searches of the biological assessment and includes a 40 km buffer of the survey area.

1.3.2 Biological survey area

The survey area is located on the Marble Bar Road from SLK 323-328, approximately 40 km north of Marble Bar in the Pilbara Region of Western Australia (WA).

The survey area is 146.39 hectares (ha) in size and is located in the Shire of East Pilbara. The location of the survey area is mapped in Figure 1, Appendix A.

1.4 Scope of works

The scope of works, as detailed in the Main Roads Consultants' Brief was to undertake a desktop assessment and biological survey for the Coongan Gorge Realignment project located on Marble Bar Road SLK 323-328. Upon completion of the biological survey the consultant was required to supply to Main Roads with a constraints assessment highlighting areas of significance (e.g. locations of Priority Flora, Threatened fauna, etc.).

[1] The 40 km radius boundary of the study area has been updated from that indicated by the Main Roads brief for the project due to the fact that 40 km is the maximum *NatureMap* buffer size applicable to any one search.

The following actions were completed to fulfil the scope:

- Complete a desktop assessment of the study area prior to the field survey work to identify all biological features and constraints, which may be in, or nearby the survey area
- Identify and review any existing and relevant environmental reports
- Identify significant flora, vegetation/ecological communities, fauna, soil, groundwater and surface water values and potential sensitivity to impact
- Identify pre-European vegetation type(s) using Beard mapping
- Conduct a field survey (to be done by an environmental specialist in accordance with regulatory expectation for years of experience in the relevant bioregion) to verify / ground truth the desktop assessment findings
- Undertake vegetation condition mapping using Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) (2015)
- Undertake ecological community mapping and describe according to National Vegetation Information System (NVIS) structural and floristics
- Undertake relevant environmental constraints mapping using GIS mapping software (e.g. ArcMap)
- Assess the survey areas plant species diversity, density, composition, structure and weed cover, recording the percentage of each in nominated quadrats
- Undertake a targeted flora and fauna survey, to a level deemed necessary according to results of *NatureMap* (DPaW 2007–) database searches
- Assess all biological aspects likely to require referral of the project to the EPA
- Assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are likely to require referral of the project to the Federal Department of the Environment (DotE). Provide justification of decision as to whether referral to the DotE is likely to be required. Ensure to reference relevant Commonwealth significant impact guidelines
- Determine the legislative context of environmental aspects required for the assessment
- Provide a concise report on the findings of the biological survey
- Provide raw survey data at project completion in electronic form including but not limited to flora/fauna records, ecological community and condition mapping. The data is to be provided in a format that satisfies Main Roads data standards
- Submit a WA Herbarium and a DPaW Threatened/Priority Flora Report Form for any conservation significant flora recorded during the survey.

Method as per GHD Section 2 response

The biological assessment will be undertaken in accordance with Part B of the Scope of Works provided by Main Roads. The biological assessment includes a Level 1 vegetation and flora assessment and targeted single seasonal flora of conservation significance survey. The Level 1 flora and vegetation survey will be undertaken with regard to the EPA Guidance Statement No. 51 (EPA 2004b) and the subsequent Flora and Vegetation Technical Guide (EPA and DPaW 2015). In addition to this, the biological assessment includes a Level 1 fauna assessment including a targeted habitat assessment for fauna species of conservation significance and camera trap surveys. The Level 1 fauna assessment will be undertaken with regard to the EPA

Guidance Statement No. 56 (EPA 2004a) and the subsequent Technical Guide (EPA and DEC 2010).

1.5 Relevant legislation, conservation codes and background information

In WA some ecological communities, flora and fauna are protected under both Australian Government 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 Main Roads and may only be used and relied on by Main Roads for the purpose agreed between GHD and the Main Roads as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Main Roads 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 Main Roads 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 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 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 identity relevant environmental information pertaining to the area and to assist in survey design. The search parameters used were a 40 km radius from a point on the Marble Bar Road 119° 48' 23" East, 20° 54' 58" South. This included a review of:

- The DotE Protected Matters Search Tool (PMST) to identify communities and species listed under the EPBC Act potentially occurring within the study area (DotE 2016a) (Appendix C)
- The DPaW Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) database to determine the potential for TECs or PECs to be present within the study area
- The *NatureMap* database for flora and fauna species previously recorded within the study area (DPaW 2007–) (Appendix C)
- The DPaW Threatened (Declared Rare) and Priority Flora (TPFL) database, the DPaW Threatened and Priority Fauna database, and the WA Herbarium database for flora taxa listed under the *Wildlife Conservation Act 1950* (WC Act) and listed as Priority by the DPaW, previously recorded within the study area
- Existing datasets including previous vegetation mapping of the survey area (Beard 1975), 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 potential to contain TECs, PECs, and Threatened and Priority listed flora and fauna species.

2.2 Field survey

2.2.1 Vegetation and flora

As part of the biological survey a Level 1 single season vegetation and flora assessment of the survey area was conducted by botanist Joshua Foster (SL011812) from the 26 May to 30 May 2016. The field survey was undertaken to verify the results of the desktop assessment, identify and describe the dominant vegetation units, assess vegetation condition and identify and record vascular flora taxa present at the time of survey. Searches for conservation significant ecological communities and flora taxa were also undertaken.

The survey methodology employed for the survey was undertaken with reference to the EPA and the DPaW *Technical Guide – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA and DPaW 2015) and EPA (2004b).

Data collection

Field survey methods involved a combination of sampling quadrats located in identified vegetation units and traversing the survey area by foot. Twenty-three non-permanent quadrats were described throughout the survey area. To sample all the apparent vegetation units across the survey area, the location of quadrats was made primarily on the basis of aerial photographic maps. Additional sites were selected *in situ*, based on observations of vegetation units during the field assessment.

Quadrats (measuring 50 m x 50 m) were located within each identified vegetation unit, where possible. In situations where vegetation community size or shape (e.g. drainage channels)

precluded establishing sites of the standard dimension, an area of equivalent size (i.e. 2,00 m^2) was assessed, where possible. Field data at each quadrat was recorded on a pro-forma data sheet and included the parameters detailed in Table 1. Quadrat data is provided to Main Roads in Excel format.

Table 1 Data collected during the flora and vegetation field survey

Aspect	Measurement
Collection attributes	Personnel/recorder; date, quadrat dimensions, photograph of the quadrat.
Physical features	Aspect, soil attributes, ground surface cover, leaf and wood litter.
Location	Coordinates recorded in WGS84 datum using a hand-held Global Positioning System (GPS) tool to accuracy approximately ± 5 m.
Vegetation condition	Vegetation condition was assessed using the condition rating scale as adopted by the EPA and the DPaW (2015).
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 within the quadrat including average height and cover (using a modified Braun-Blanquet scale).

A flora inventory was compiled from taxa listed in described quadrats and from opportunistic floristic records throughout the survey area.

Vegetation units

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

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

Vegetation mapping has been undertaken at a scale suitable for this project.

Vegetation condition

The vegetation condition of the survey area was assessed and mapped in accordance with the vegetation condition rating scale for the Eremaean and Northern Botanical Provinces (EPA and DPaW 2015). The scale recognises the intactness of vegetation and consists of six rating levels as 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. All plant specimens collected during the field assessment were dried and processed in accordance with the requirements of the WA Herbarium. Plant species were identified by the use of taxonomic literature, electronic keys and online electronic databases. Where necessary, plant taxonomists considered to be authorities on particular plant groups were consulted.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (WA Herbarium 1998–) and the EPBC Act List of Threatened Flora (DotE 2016b).

Nomenclature used in this report follows that used by the WA Herbarium as reported on *FloraBase* (WA Herbarium 1998–).

Surveys for conservation significant flora

Prior to the field survey, information from the desktop assessments (e.g. aerial photography, geology, soils and topography data, EPBC Act PMST, TPFL and *NatureMap*) was reviewed to determine conservation significant flora taxa potentially present within the survey area. Additionally, ecological information (e.g. habitat, associated flora taxa and phenology) was sourced from *FloraBase* (WA Herbarium 1998–) and other relevant publications where available, to provide further details.

Potential habitats were searched for the presence of conservation significant flora. Locations within the survey area with differing hydrology, fire or disturbance history to the surrounding areas were also searched where identified.

When any known or potential Threatened, Priority or significant flora was located, the following data was collected: GPS location, height, number of plants and corresponding area of population, reproductive state and plant condition.

2.2.2 Fauna

As part of the biological survey, zoologist (Glen Gaikhorst) undertook a single season Level 1 fauna survey (reconnaissance survey) of the survey area from the 26 May to 30 May 2016. The fauna survey was undertaken concurrently with the vegetation and flora assessment and with reference to the EPA Guidance Statement No. 56 T*errestrial Fauna Survey for Environmental Impact Assessment in Western Australia* (EPA 2004a). The purpose of the reconnaissance survey was to verify the accuracy of the desktop study, and delineate and characterise the fauna assemblages present in the survey area.

The majority of the survey area was traversed on foot and by vehicle over the course of five days to identify and describe the dominant fauna habitat types and their condition, assess habitat connectivity, identify and record fauna species within the survey area. A Likelihood of Occurrence assessment for conservation significant fauna and their habitats occurring within the survey area was also undertaken.

Habitat assessment

A field data checklist was used to document the type, condition and extent of habitats within the survey area. The following information was collected for six (20 m x 20 m) habitat assessment quadrats located within the survey area:

- Habitat structure (e.g. vegetation type, presence/absence of structural layers such as ground cover and mid storey)
- Presence/absence of refuge including: density of ground covers, fallen timber, hollow-bearing trees and stags and rocks/boulder piles, and the type and extent of each refuge
- Presence/absence of waterways including type, extent and habitat quality within waterways
- 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
- Current land use and disturbance history
- 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 and observations)
- A representative photograph of each habitat type.

In addition to the habitat assessments, rapid habitat assessments were undertaken at six locations within the survey area to assist with documenting the extent and quality of the different habitat types. Habitat assessment locations are displayed in Figure 5, Appendix A.

Opportunistic fauna searches

Opportunistic fauna searches were also conducted across the survey area. The majority of opportunistic searches were undertaken at habitat assessment locations and focussed on the following:

- Searching the survey area for tracks, scats, bones, diggings and feeding areas for both native and feral fauna. For each scat found, the location, date, brief habitat description and GPS coordinate was recorded
- Searching through microhabitats including turning over rocks and ground debris (e.g. leaf litter) and examining tree hollows and hollow logs for reptile and other small vertebrate fauna
- Visual and aural surveys. This accounted for many bird species potentially utilising the survey area
- A visual assessment of the water bodies to identify any fish species observed
- Recording GPS locations of any conservation significant fauna species.

Camera trap survey

Motion sensor cameras (Reconyx-Hyperfire) were deployed for a period of at least 33 nights each at 8 locations within or bordering the survey area. Cameras were positioned in areas where Northern Quoll (*Dasyurus hallucatus*) habitat or other potential significant species maybe recorded. Cameras were baited with sardines to attract fauna species, particularly carnivorous marsupials (e.g. Dasyuridae) within the survey area. For each camera location the time and date deployed and recovered, a GPS coordinate, and brief habitat description were recorded (as seen below in Table 2). Camera locations are displayed in Figure 5, Appendix A.

Data from the cameras was downloaded to a computer and analysed for the presence of animals following the field survey.

Table 2 Camera trap locations and effort during the survey

Sites	Easting	Northing	Deployed	Collected	Total Nights	Comments
Cam 11	792921	7683820	24-May	27-Jun	34	on rocky scree slope
Cam 20	792461	7684020	24-May	27-Jun	34	at a low cave entrance on rocky ridgeline
Cam 15	791691	7684234	24-May	27-Jun	34	rocky ridge line on Snappy Gum
Cam 27	791130	7684652	24-May	27-Jun	34	rocky ridge line on Snappy Gum
Cam 21	790519	7685986	24-May	27-Jun	34	amongst large *Triodia* hummocks on plain
Cam 24	792213	7685765	24-May	27-Jun	34	amongst large *Triodia* hummocks on plain
Cam 18	793620	7684911	25-May	27-Jun	33	above water body on rocky ridge line
Cam ghd	793705	7685001	25-May	27-Jun	33	on water body on *Melaleuca* at waters edge

Bat survey

A Songmeter SM2BAT+ recorder (Wildlife Acoustics Inc., USA) was deployed at one location for one night to record ultrasonic echolocation calls emitted by microchiropteran bats. The detector location for the survey area is displayed in Figure 5, Appendix A.

Data from the detector was downloaded to a computer and analysed for the presence of bat calls by Craig Grabham of GHD following the field survey (see Appendix E).

Fauna Species Identification

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

Nomenclature follows that used by the WA Museum (as shown on *NatureMap)*, as it is deemed to contain the most up-to-date species information for WA, with the exception of birds, where Christidis and Boles (2008) was used.

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 DPaW searches of Threatened flora and fauna provide more accurate information for the general area. However, some collection, sighting or trapping records cannot be dated and often misrepresent the current range of threatened species.

Updated Wildlife Conservation (Rare Flora) and Wildlife Conservation (Specially Protected Fauna) Notices were gazetted on 3 November 2015. The format of these Notices has been changed to align with the EPBC Act threatened species lists. To date information contained in publically available databases such as *NatureMap* does not reflect the most recent gazetted Notices. This report has been updated to reflect the conservation status of flora and fauna listed in these Notices. However, the outputs of database searches contained in this report

such as *NatureMap*, may not reflect the conservation status of flora and fauna listed in these Notices.

2.3.2 Field survey limitations

The EPA and the DPaW (2015) Technical Guide and Guidance Statement No. 51 and 56 (EPA 2004b, a) states 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 3.

Table 3 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) vegetation mapping by Beard (1975) and digitised by Shepherd *et al*. (2002) • Regional biogeography (Kendrick and McKenzie 2001) • Regional vegetation (1:3,000,000) mapping by Beard *et al.* (2013) • Land system mapping (van Vreeswyk *et al.* 2004).
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 this survey, although opportunistic records were taken of invertebrate and aquatic fauna.
Proportion of flora collected and identified (based on sampling, timing and intensity) Proportion of fauna identified, recorded and/or collected	Moderate	The vegetation and flora survey was a single season survey only and was undertaken in late May 2016. The optimal time to undertake flora and vegetation surveys in the Pilbara region is 6-8 weeks post-wet season from March to June (EPA and DPaW 2015). Most of the conservation significant flora identified in the desktop assessment flower from April to June. The flora recorded from the field survey is detailed in Section 4.4 and a full flora species list is provided in Appendix D. The portion of flora collected and identified was considered low to moderate; with few annual flora present due very low rainfall received in the survey area prior to the field assessment, and that half of the Coongan Gorge had been very recently burnt. The fauna survey was undertaken in late May 2016 and was a reconnaissance survey only. The fauna assessment sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings, etc. Camera traps were deployed for approximately 1 month in key habitat areas that may support conservation significant species. Many cryptic (e.g. invertebrate species) and nocturnal 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. 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 (except for visual inspection and identification of observed fish species). Where terrestrial invertebrate fauna were recorded opportunistically, these findings were 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 of invertebrates is generally less extensive than that of vertebrate species.

Aspect	Constraint	Comment
Flora determination	Moderate	Flora determination was undertaken by Joshua Foster in the field and utilising specimens confirmed at the WA Herbarium. Four flora taxa could only be identified to genus due to lack of flowering and fruiting material required for identification. These taxa showed no resemblance to any conservation significant flora identified in the desktop assessment. Additionally, some species, particularly grasses and sedges, may have been overlooked due to lack of material. This may have affected the results of the survey as there are conservation significant flora known from the desktop assessment that are annual taxa and/or sedges. The taxonomy and conservation status of WA flora is dynamic. This report was prepared with reliance on taxonomy and conservation status current at the time of 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.
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed)	Minor	The survey area follows an existing road alignment corridor and was easily accessed by vehicle and on foot over the course of the field survey. 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 and habitat types for the entire survey area.
Mapping reliability	Nil	High resolution Environmental Systems Research Institute aerial imagery was available. Data was recorded in the field using hand-held GPS tools (e.g. Nomad Juno 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 m on average. Therefore, the data points consisting of coordinates recorded from the GPS may contain inaccuracies.
Timing/weather/ season/cycle	Major	The field survey was conducted in late May. In the four months prior to the survey (January to April), Marble Bar weather station (No. 004106, Bureau of Meteorology (BoM) 2016) recorded a total of 2.4 millimetres (mm) of rainfall. This rainfall is well below the long term average (LTA) for the same period (January to April; 272.2 mm) (BoM 2016). An assessment of the flowering times of conservation significant flora taxa shows that April to June is the optimum time to capture a majority of the conservation significant flora in flower Appendix D.
Disturbances (e.g. fire, flood, accidental human intervention)	Major	The majority of the survey area has been impacted to some degree by past disturbances including minor roads, communication line establishment, historical rail corridor, weed infestation, cattle grazing, flood and fire. Minor tracks used for access to pastoralism, fence lines, tourism, and access to material pits occur at various locations along the length of the survey area. Cattle grazing is evident throughout the survey area, in particular along drainage lines and creeks. Cattle (and native fauna) have been responsible for the majority of weed spread along watercourses and to shelter sites higher in the landscape. Flood events have scoured drainage lines and shifted debris in the larger creeks and rivers. Fire has significantly altered the vegetation of the survey area with repeat fires noted. The entirety of the southern side of the Coongan Gorge has been burnt within the last 12 months and was mostly devoid of vegetation.
Intensity (in retrospect, was the intensity adequate)	Nil	The vascular flora of the survey area was sampled with reference to the EPA and the DPaW (2015) Technical Guide and terrestrial fauna sampled in accordance to EPA (2004a) as required by the scope of works. The survey area was sufficiently covered by two ecologists during the survey.

Aspect	Constraint	Comment
Resources	Nil	Adequate resources were employed during the field survey. Twelve person days were spent undertaking the survey using one dedicated botanist and one zoologist.
Access restrictions	Minor	No access problems were encountered during the survey. The survey area was easily accessed by vehicle and on foot. Due to safety concerns some of the steeper slopes within the Coongan Gorge were not climbed.
Experience levels	Nil	The ecologists who executed the survey were practitioners suitably qualified in their respective fields. Glen Gaikhorst (zoologist) is a Senior Ecologist with over 20 years' experience in undertaking ecological surveys, most of which is undertaking surveys in WA, including projects in the Pilbara and Kimberley. Joshua Foster is an Ecologist (botanist and zoologist) with over 18 years' experience in undertaking ecological surveys in WA, including over 12 years in the Pilbara and Kimberley.

3. Desktop assessment

3.1 Climate

The survey area is located in the Pilbara Region of WA and experiences an arid tropical climate with summer rain, with an annual precipitation of 250-300 mm (Beard, 1990). Beard (1990) noted the local influence of topography on the rainfall recordings with higher rainfall averages occurring on the more elevated areas. The other major climatic influence on the flora and vegetation in the Pilbara Region is the heavy rains that occur during and immediately following cyclonic events. Cyclones develop off the northwest coast and often cross the coastline between Karratha and Port Hedland, resulting in cyclonic rainfall events inland.

The BoM Marble Bar station (site number: 004106) is the nearest, active weather station to the study area with continuous long-term data (approximately 40 km south from the study area). Climatic data from this site indicates the mean maximum temperature of the area ranges from 26.8 degrees Celsius (°C) in July to 41.8 °C in December, and the mean minimum temperature of the area ranges from 12.0 °C in July to 26.6 °C in January. The mean annual rainfall is 362.4 millimetres (mm), with an average of 27.4 rain days per year (BoM 2016).

Rainfall and temperature data for Marble Bar in the 12 months preceding the survey are summarised in Plate 1 (BoM, 2016). In the four months prior to the survey (January to April), Marble Bar weather station recorded a total of 2.4 mm of rainfall. This rainfall total is well below the LTA for the same period (January to April; 272.2 mm) (BoM, 2016).

The weather conditions recorded during the field survey included (BoM, 2016):

- Maximum temperature range: 31.4 °C – 34.4 °C
- Minimum temperature range: 17.5 °C – 21.0 °C
- Rainfall 0.0 mm.

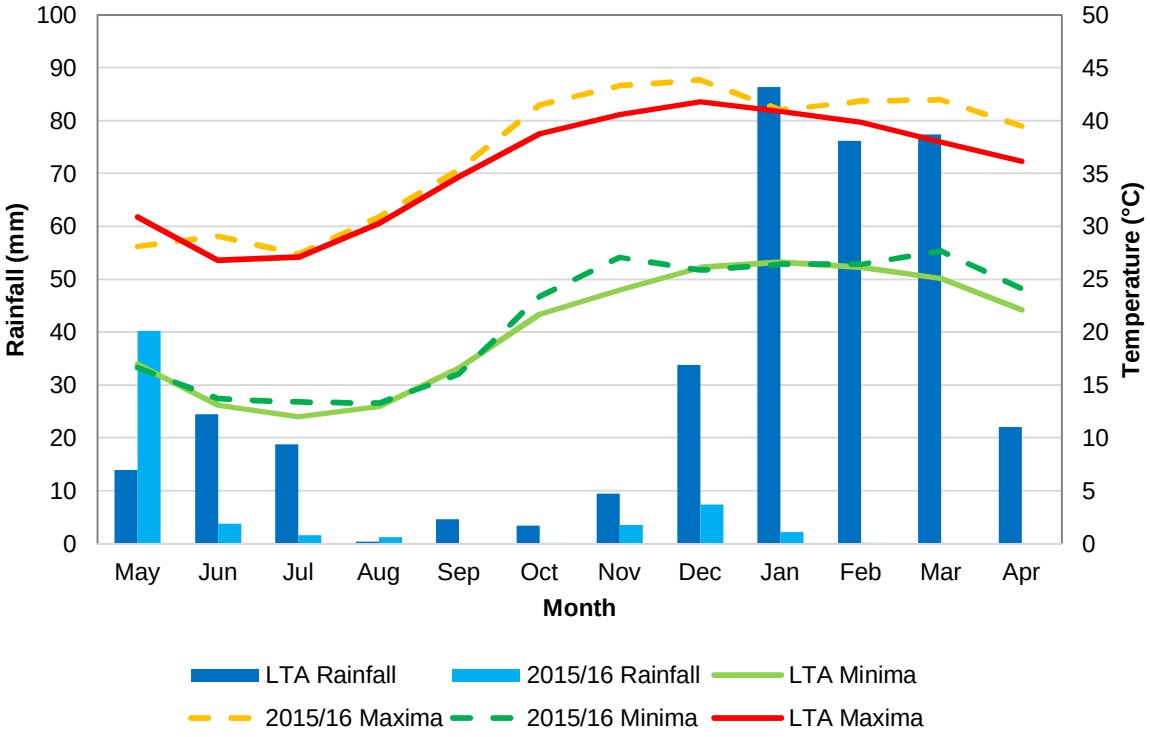

Plate 1 Rainfall and temperature data for Marble Bar (BoM 2016)

3.2 Landforms and soils

The survey area is located within the Chichester Ranges Zone of the Fortescue Soil-landscape Province. This zone is characterised by hills and dissected plateaux (with some stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Stony soils with some red shallow loams and hard cracking clays, supporting spinifex grasslands with kanji and snappy gum (and some tussock grasslands) (Tille 2006).

3.3 Land systems

Land system mapping of the Pilbara has been prepared by the Department of Agriculture and Food Western Australia (DAFWA) (van Vreeswyk *et al.,* 2004). The purpose of the rangelands survey was to provide a comprehensive description and map of the biophysical resources of the region, together with an evaluation of the condition of the soils and vegetation throughout. Lands within the Pilbara area have been described and mapped into 20 broad land types comprised of 102 land systems according to a combination of landforms, soils, vegetation and drainage patterns (van Vreeswyk *et al.,* 2004).

The mapping by van Vreeswyk *et al.* (2004) indicates that two land systems are present within the survey area:

- River Land System – Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands
- Talga Land System – Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.

3.4 Hydrology

A summary of the Department of Water (DoW) Geographic Data Atlas (DoW 2016) queries for the survey area is provided in Table 4. The survey area is located within the Pilbara Groundwater Area and the Pilbara Surface Water Area as listed under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

3.4.1 Wetlands

No wetlands occur within the survey area.

3.4.2 Watercourses

Two major river systems and associated tributaries intersect the survey area (Figure 2; Appendix A). Talga River intersects the eastern portion of the survey area and Coongan River intersects the western portion of the survey area.

3.4.3 Groundwater Dependent Ecosystems

There are two groundwater dependent ecosystems (GDEs) occur within the survey area: the Talga River and the Coongan River (BoM 2016a).

Table 4 Department of Water geographic atlas queries for the survey area

Aspect	Details	Result
Groundwater areas	Groundwater areas proclaimed under the RIWI Act.	Pilbara
Surface water areas	Surface water areas proclaimed under the RIWI Act.	Pilbara
Irrigation district	Irrigation Districts proclaimed under the RIWI Act.	None present
Rivers	Rivers proclaimed under the RIWI Act.	None present
Public Drinking Water Source Areas (PDWSA)	PDWSAs is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Area Water Supply Act 1947*.	None present
Waterway Management Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	None present

3.5 Land use

The survey area occurs within Eginbah Pastoral Station.

3.5.1 Conservation reserves and estate

No DPaW managed conservation areas are located within the study area. The closest DPaW managed conservation area is located approximately 40 km to the east of the survey area, associated with Meentheena Pastoral Station excised for conservation.

3.5.2 Environmentally Sensitive Areas

One Environmentally Sensitive Area (ESA) is located within the study area. The nationally important wetland is associated with the Fortescue Marsh located approximately 170 km south of the survey area. No ESAs are located within the survey area.

3.6 Regional biogeography

The survey area is situated in the Eremaean Botanical Province (Beard 1990), within the Pilbara Bioregion and Chichester Sub-region as described by the Interim Biogeographic Regionalisation of Australia (IBRA) (DotE, 2016c).

The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Kendrick and McKenzie, 2001).

The Chichester Sub-region comprises the northern section of the Yilgarn Craton. It is characterised by undulating Archaean granite and basalt plains that include significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. Drainage occurs to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock) (Kendrick and McKenzie, 2001).

3.7 Conservation significant ecological communities

A search of the EPBC Act PMST database did not identify any Australian Government-listed TECs within the study area. Similarly, a search of the DPaW TEC database did not identify any State-listed TECs within the study area.

No DPaW-listed PECs were identified within the study area. The nearest PEC is located over 85 km to the south of the survey area.

3.8 Vegetation

3.8.1 Pre-European vegetation associations and extent

Broad scale (1:1,000,000) pre-European vegetation mapping of the Pilbara area was completed by Beard (1975) at an association level. The mapping indicates that three vegetation associations are present within the survey area:

- Association 93: Hummock grasslands, shrub steppe; kanji over soft spinifex
- Association 171: Hummock grasslands, low tree steppe; snappy gum over soft spinifex & *Triodia brizioides*
- Association 619: Medium woodland; river gum (*Eucalyptus camaldulensis*).

The pre-European mapping has been adapted and digitised by Shepherd *et al.* (2002). The extents of the vegetation association have been determined by the state-wide vegetation remaining extent calculations maintained by the DPaW (Current as of June 2015 – Government of Western Australia (GoWA) 2015). The current extents of vegetation associations remaining are greater than 99 per cent of the pre-European extent at all scales (e.g. State, IBRA Bioregion, IBRA Sub-region and Local Government Area (LGA), and are therefore above the 30 per cent threshold level[2] (Table 5).

Table 5 Pre-European vegetation extents (Beard 1975, GoWA 2015)

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DPaW managed lands
93	State: Western Australia	3,044,309.54	3,040,641.00	99.88	1.96
	IBRA Bioregion: Pilbara	3,042,114.29	3,038,471.70	99.88	1.96
	IBRA Sub-region: Chichester	2,940,348.06	2,936,731.56	99.88	2.03
	LGA: Shire of East Pilbara	1,709,522.26	1,706,780.59	99.84	2.70
171	State: Western Australia	331,951.73	330,643.10	99.61	10.92
	IBRA Bioregion: Pilbara	331,307.42	330,026.24	99.61	10.94
	IBRA Sub-region: Chichester	331,307.42	330,026.24	99.61	10.94
	LGA: Shire of East Pilbara	331,951.73	330,643.10	99.61	10.92
619	State: Western Australia	119,373.78	118,205.02	99.02	0.20
	IBRA Bioregion: Pilbara	118,920.31	118,116.79	99.32	0.20

[2] The 30 per cent threshold level is the level below which species loss appears to accelerate exponentially at an ecosystem level (EPA 2000).

Vegetation association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	% Current extent in all DPaW managed lands
	IBRA Sub-region: Chichester	85,543.15	85,520.95	99.97	0.28
	LGA: Shire of East Pilbara	52,765.30	52,763.69	100.00	0.0

3.9 Flora

3.9.1 Flora diversity

A search of the *NatureMap* database identified 416 plant taxa, representing 56 families, which have previously been recorded within the study area. This total comprises 399 native flora taxa and 17 naturalised (non-native) flora taxa. Dominant families include:

- Fabaceae (88 taxa)
- Poaceae (70 taxa)
- Amaranthaceae (28 taxa)
- Malvaceae (28 taxa).

The *NatureMap* database search is provided in Appendix C.

3.9.2 Conservation significant flora

Desktop searches of the EPBC Act PMST database, *NatureMap* database, and the DPaW TPFL and WAHERB databases identified the presence/potential presence of nine conservation significant flora taxa within the study area.

The desktop searches recorded:

- No taxa listed under the EPBC Act
- No taxa listed as Threatened Flora under the WC Act
- Two Priority 1 taxa
- Two Priority 2 taxa
- Four Priority 3 taxa
- Two Priority 4 taxa.

The locations of conservation significant flora registered on the DPaW databases are provided in Figure 2, Appendix A. A Likelihood of Occurrence assessment for the conservation significant flora is provided in Appendix D.

3.9.3 Introduced flora

A search of the *NatureMap* database identified 17 introduced flora taxa previously recorded within the study area. One is listed as a Declared Pest (s22) under the *Biosecurity and Management Act 2007* (BAM Act) (**Datura leichhardtii*) but does not require any management in the Shire of East Pilbara. No plants identified as a Weed of National Significance (WoNS) (DotE 2016c).

3.10 Fauna

3.10.1 Fauna diversity

A search of *NatureMap* identified 209 vertebrate native fauna taxa previously recorded within 40 km of the survey area. This total included 26 mammals (two introduced species), three amphibians, 122 birds and 58 reptiles. The EPBC Act PMST indicated the potential presence of nine additional fauna taxa within 50 km of the survey area.

3.10.2 Conservation significant fauna

Searches of the EPBC Act PMST, DPaW Threatened and Priority Fauna database and *NatureMap* database identified the presence/potential presence of 26 conservation significant fauna species (Appendix E). Species identified by the PMST as marine and migratory marine were excluded from this assessment as no marine habitats were present within or nearby the survey area however species identified by the PMST as migratory terrestrial/wetland were considered as part of this assessment.

In addition to the 26 species identified by the database searches, four additional species were also considered for this assessment as a result of a review of the species listed under Schedules 1-3 and 5-7 of the WC Act (revised 20 November 2015) to occur within the DPaW Pilbara region (DPaW 2015).

4. Field results

4.1 Soils

The soils within the survey area are considered to be similar to that as identified in the desktop assessment. The majority are rocky soils, with sandier soils associated with areas of water flow (sheetwash, rivers and creeks).

4.2 Hydrology

4.2.1 Wetlands

There are no wetlands within the survey area. Semi-permanent pools occur on the Talga River and Coongan River, immediately abutting the survey area.

4.2.2 Watercourses

The watercourses identified as part of the desktop assessment occur within the survey area: the Talga River to the east and the Coongan River to the west.

4.3 Vegetation

4.3.1 Vegetation types

Nine vegetation types (VT) were identified and described from the survey area (Table 6 and Figure 3, Appendix A). The survey area is dominated by VT04 and VT05, with VT09 occupying the smallest area. Soil types are primarily stony sandy loams with sandier soils associated with areas of water flow. The vegetation types are closely allied with the landform feature in which they occur.

The vegetation types identified within the survey area are considered to be well represented outside the survey area. A review of the aerial photography indicates that there is representation of the defined vegetation types outside the survey area. The vegetation is also consistent with vegetation associations identified in the vegetation mapping for the area (Beard, 1979; Payne and Schoknecht, 2011).

4.3.2 Conservation significant ecological communities

No Australian Government or State-listed TECs or DPaW-listed PECs were identified within the survey area during the field survey.

4.3.3 Other significant vegetation

No areas considered to support 'other significant vegetation' were identified.

Table 6 Vegetation types recorded during the field survey

Vegetation types	Description	Landform and substrate	Extent (ha)	Representative photograph
VT01 Cleared/Degraded	Areas mostly devoid of native vegetation – covering roads, access tracks and material pits. Flora taxa present include representation from adjacent vegetation types and also include disturbance response taxa.	Various – roads, tracks etc.	4.79	
VT02 Riparian Woodland	Woodland to Low Woodland of *Eucalyptus camaldulensis, Melaleuca argentea* with *Sesbania formosa, E. victrix, Atalaya hemiglauca* over Tall Shrubland to Open Shrubland of *Acacia ampliceps, *Calotropis procera, A. trachycarpa* with **Vachellia farnesiana*, *Petalostylis labicheoides* over Low Open Shrubland of *Corchorus parviflorus*, *Pluchea tetranthera*, over Very Open Sedgeland of *Cyperus vaginatus* with Open Tussock Grassland of **Cenchrus ciliaris* with mixed Herbs.	Major creeklines and rivers, often with sandy soils.	6.79	
VT03 Floodplain Low Open Woodland	Low Open Woodland of *Corymbia hamersleyana* over Tall Open Shrubland to Scattered Shrub of *Acacia inaequilatera* with *A. trachycarpa* over Tussock Grassland of **Cenchrus ciliaris* with Hummock Grassland of *Triodia longiceps, T. epactia.*	Floodplains adjacent to major rivers. With red-orange (brown) loamy sands.	10.54	

Vegetation types	Description	Landform and substrate	Extent (ha)	Representative photograph
VT04 Spinifex Steppe on Calcareous Stony Lower Slopes	Hummock Grassland of *Triodia epactia* with *T. schinzii, T. longiceps* with emergent Scattered Trees of *Corymbia hamersleyana*, Scattered Shrubs to Tall Shrubland of *Acacia inaequilatera, Grevillea wickhamii, A. tumida* var. *Pilbarensis* Scattered Low Shrubs to Low Shrubland of *Corchorus parviflorus, A. spondylophylla, A. ptychophylla*, with Scattered Herbs	Lower Slopes with stony calcareous soils.	31.96	
VT05 Spinifex Steppe with Emergent Scrub on Sandy Lower Slopes	Hummock Grassland of *Triodia epactia* with *T. schinzii, T. longiceps* with **Cenchrus ciliaris*, with emergent Scattered Trees of *Corymbia hamersleyana*, Open Shrubland to Tall Shrubland of *Acacia tumida*, *Grevillea wickhamii, G. pyramidalis, A. inaequilatera, Petalostylis labicheoides,* Scattered Low Shrubs to Low Shrubland of *Corchorus parviflorus, A. spondylophylla, A. ptychophylla*, with Mixed Herbs of *Cleome* spp., *Heliotropium* spp.	Lower Slopes to broad drainage lines or areas of sheetwash with stony sandy soils.	32.89	
VT06 Spinifex Steppe on Stony Mid Slopes	Hummock Grassland of *Triodia epactia* with emergent Scattered Trees of *Corymbia hamersleyana*, Scattered Shrubs to Tall Shrubland of *Acacia inaequilatera, Grevillea wickhamii, Hakea lorea* with Scattered Low Shrubs to Low Shrubland of *Corchorus parviflorus, A. spondylophylla, A. ptychophylla*, with Scattered Herbs	Mid Slopes with stony soils.	18.03	

Vegetation types	Description	Landform and substrate	Extent (ha)	Representative photograph
VT7 Spinifex Steppe on Stony Upper Slopes with Emergents	Hummock Grassland of *Triodia epactia* with Very Open Tussock Grassland of *Eriachne mucronata, Cymbopogon ambiguus, *Cenchrus ciliaris* with emergent Scattered Trees of *Corymbia hamersleyana*, *Atalaya hemiglauca* with Scattered Shrubs to Tall Shrubland of *Acacia inaequilatera, Grevillea wickhamii, Hakea lorea* with Scattered Low Shrubs to Low Shrubland of *Corchorus parviflorus, A. spondylophylla, A. ptychophylla*, *Indigofera monophylla, Triumfetta chaetocarpa* with Scattered Herbs	Upper Slopes in Coongan Gorge with Outcropping rock and steep slopes.	38.49	
VT8 *Terminalia – Atalaya* Low Woodland on Steep Slopes	Low Open Forest to Low Open Woodland of *Terminalia circumalata, Atalaya hemiglauca* over Tall Shrubland to Shrubland of *Ehretia saligna, Acacia inaequilatera*, *Flueggea virosa*, over Low Shrubland of *Corchorus parviflorus, A. spondylophylla, A. ptychophylla*, *Indigofera monophylla, Triumfetta chaetocarpa* over Hummock Grassland of *Triodia epactia* with Open Tussock Grassland of *Eriachne mucronata, E. lindleyanus, Cymbopogon ambiguus, *Cenchrus ciliaris* with Scattered Herbs	Upper (south facing) Slopes in Coongan Gorge on sheltered stony gullies and very steep slopes.	0.96	
VT9 *Atalaya-Flueggea* Shrublands on Large Stony Scree	Open Shrubland to Tall Open Shrubland of *Atalaya hemiglauca*, *Flueggea virosa*, *Clerodendrum floribundum* with *Ehretia saligna* over Shrubland to Low Open Shrubland of *Gossypium australe, Senna glutinosa* subsp. *glutinosa, Corchorus parviflorus* over Very Open Hummock Grassland of *Triodia epactia, T. wiseana* with Very Open Tussock Grassland of *Cenchrus ciliaris, Eriachne mucronata, Cymbopogon ambiguus* with Scattered Herbs of *Cucumis variabilis* and *Boerhavia coccinea*	Upper slopes in Coongan Gorge on massive boulder field / large stony scree.	1.92	

4.3.4 Vegetation condition

The vegetation within the survey area was rated as between condition 3 and 7. The majority of vegetation throughout the survey area was rated as condition 6; in these areas the vegetation had been recently burnt. Rivers within the survey area were also rated as condition 6 due to the high weed infestation and disturbance by grazing cattle. A similarly large area of condition 5 was recorded indicating a recovery from extensive moderate to recent fires.

The areas mapped as condition 7 are due to the presence of historical material extraction and the Marble Bar Road. The better condition vegetation (condition 3) is associated with unburnt areas along the south facing slopes and gullies of the Coongan Gorge.

The extents of the vegetation condition ratings mapped within the survey area are provided in Table 7 with the vegetation condition of the survey area mapped in Figure 4, Appendix A.

Table 7 Extent of vegetation condition ratings within the survey area

Condition rating	Extent (ha)
3	4.94
4	14.46
5	53.70
6	67.12
7	6.17

4.4 Flora

4.4.1 Flora diversity

The survey recorded 120 flora taxa (including subspecies and varieties) representing 39 families. This total comprised 110 native species and ten introduced (exotic) species. Due to the absence of adequate flowering parts and/or fruiting bodies required for identification, four taxa could only identified to genera, however none of these taxa are considered to be introduced or conservation significant taxa.

Dominant families recorded from the survey area are:

- Fabaceae (26 taxa)
- Poaceae (19 taxa)
- Malvaceae (6 taxa)
- Asteraceae (5 taxa)
- Boraginaceae (5 taxa)
- Amaranthaceae (5 taxa).

The average species richness for the 23 quadrats was 14.26 ± 4.72 (standard deviation of the mean), with a range of eight to 27 species per quadrat.

A flora taxa list for the survey area is provided in Appendix D.

4.4.2 Conservation significant flora

No EPBC Act, WC Act or DPaW Priority listed flora taxa were recorded within the survey area during the 2016 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 that two taxa are considered likely to occur, based on known location and preferred habitat, four taxa may possibly occur and the remaining four taxa are unlikely to occur within the survey area. The recent burn over almost half of the survey area cannot preclude the presence of the six taxa being present. Four of the taxa considered are annual species and may not have been present due to the low rainfall. One taxon (*Nicotiana umbratica*) that may possibly occur has been recorded within 10 km of the survey area and some suitable habitat occurs within the survey area. A summary of the outcomes of species considered as known, likely or possible to occur is provided below (Table 8).

Table 8 Summary of Likelihood of Occurrence Assessment

Species	DPaW listing	Likelihood of Occurrence
Acacia cyperophylla var. *omearana*	P1	Possible
Euphorbia clementii	P2	Likely
Gomphrena leptophylla	P3	Possible
Nicotiana umbratica	P3	Likely
Bulbostylis burbidgeae	P4	Possible
Ptilotus mollis	P4	Possible

4.4.1 Other significant flora

No other significant flora as defined by the EPA and DPaW (2015) was identified within the survey area during the field survey.

4.4.2 Introduced flora

The survey area has had extensive disturbance from flood, fire, fauna grazing, weed infestation and road maintenance with weed species widespread across the survey area. Most weed species were associated with drainage lines or the main riverine channels, however, **Cenchrus ciliaris* was often recorded high in the landscape due to transportation by fauna. Ten introduced taxa were recorded within the survey area during the field survey (Appendix D). The most commonly recorded weed species were **Cenchrus ciliaris, *Aerva javanicar* and **Calotropis procera*.

Weeds of National Significance and Declared Pests

No introduced species listed as a Declared Pest under Section 22 of the BAM Act or a WoNS (DotE 2016d), was recorded within the survey area.

4.5 Fauna

4.5.1 Fauna habitat

Five main fauna habitat types were recorded during the field survey, which broadly aligned with the vegetation associations described in section 4.3 and mapped in Figure 3, Appendix A and include:

- *Triodia* hummock grassland on plain or undulating plain
- Minor drainage lines with small dense patches of trees/shrubs and scattered trees
- *Eucalyptus camaldulensis and Melaleuca argentia* along Talga and Coongan Rivers
- Rocky ridgelines /rocky ranges (with scree) with hummock grasslands and scattered trees and shrubs
- Water bodies and riverine habitats along the Talga River.

Disturbed areas also formed portions of the survey area and although not alsways considered as fauna habitat the minor roads in the survey area in areas comprise wheel ruts which still have the ability to be utilise by fauna. Disturbed areas have been included in Table 9.

The topography of survey area varied from riverine and flat plain to undulating plain with rocky ranges including Coongan Gorge. There are two major rivers (Talga and Coongan River) within the survey area, both low points in the environment with water bodies present. Minor drainage lines drain from the hills/ranges surrounding the survey area into these rivers. Soils were predominantly red or red-brown stony-sandy loams with surface gravels on the plain, some exfoliating rock was present in subtle rises. The rocky hills and ranges comprise mostly of rocky substrates with breakaways or exposed conglomerate rock. Most peaks or high points on the range had exposed rocky areas with scree slopes and breakaways in areas.

The habitat types for the survey area are described in Table 9.

Habitat connectivity

The fauna habitats of the survey area are part of a contiguous largely intact area of remnant vegetation within leased land primarily used for cattle grazing.

The fauna habitats of the survey area are part of a much larger area of similar habitats within the local area and greater study area. The positionof the Marble Bar Road is mostly on a plain with large flat to undulating expanses of hummock grassland with open woodland. The Marble Bar Road (at the survey area) winds within the Coongan Gorge and its associated ranges (and drainage lines) which consists mostly rocky hills/ranges.

The ephemeral drainage lines within the survey area drain into both the Coongan and Talga Rivers which are major watercourses in the region, ultimately draining into the much larger system of the De Grey River in the north.

The Marble Bar Road provides the only artificial barrier to fauna moving north-south through the landscape including the survey area. A natural barrier to movement of fauna is the large expanse of open sandy river bed of the Coongan and Talga river where at some point were one kilometre across with little cover. Apart from the Marble Bar Road (and other minor access tracks) fauna movement is largely unrestricted. Overall, the habitats within the survey area are largely contiguous through the local area and mostly well connected with habitats through the greater study area.

Disturbance

Some of the habitats within the survey area have been impacted to some degree by past disturbances including roads and minor roads, communication line establishment, historical rail and infrastructure, parking areas and cattle grazing. Roads make up a very small area of impact and are either maintained by pastoralism, tourism (access to rivers) or access to old rail areas. Portions of the survey area had been historically impacted by the establishment of underground services (telecommunications) lines. This corridor in some areas was approximately 6 m wide and ripped. Rehabilitation appeared to have naturally occurred in these areas. Cattle's grazing/use was evident throughout the survey area with heavy use age along drainage lines and river habitats. However use of cattle was evident in all areas.

The entire southern side of Marble Bar Road had recently been impacted by fire (including Coongan Gorge and associated plain) with the majority of the survey area being unburnt (< 5 years).

Habitat value

The survey area primarily consisting of Coongan Gorge and associated ranges and the riverine environments provides a high level of habitat diversity and significance for many native fauna species including species of conservation significance.

The hummock grassland plain would be moderate to high significance because of it connectivity and use by fauna moving between environments (ranges to water bodies and riverine) within the survey area. If these areas are further impacted or fragmented fauna movement maybe restricted and populations affected.

The habitats within the survey area are mostly intact, variable in composition and well connected with habitats within the local area and greater study area, with the exception of the Marble Bar Road.

A natural barrier to fauna exists via large expanses of open river bed which does provide existing barriers to the movement of some fauna. However this is a natural barrier and species may have adapted to the environment.

The overall value of the habitat was considered to be high, because of the diversity and quality of habitat types (e.g. good to excellent structural diversity within each habitat type), good connectivity and for supporting known and potential habitat values for conservation significant ffauna species (see Table 9). In particular, the Marble Bar Road winds between and bisects Coongan Range that have large amounts rocky habitat available. These habitat areas a known to support conservation species and likely to move over the landscape to utilise other areas and resources.

Following a review of aerial photography and corresponding native vegetation associations, and review of habitat types whilst driving along the Marble Bar Road the habitats of the survey area are considered to be well represented within the local area and are probably well represented within the greater study area. However, it is difficult to determine the value (e.g. habitat quality) of the habitats for conservation significant fauna in the greater study area (e.g. does the surrounding vegetation contain the necessary structure and microhabitats for breeding?). eIt is considered unlikely that the habitat within the survey area provides the habitat requirements for all fauna species of conservation significance discussed in section 4.5.3.

Table 9 Fauna habitat types within survey area

Description	Indicative photograph
***Triodia* hummock grassland on plain or undulating plain** Vegetation association: VA03, VA04 This habitat type occurs across the majority of the survey area on the plain or with slight undulation where there is association to low hills. This habitat type is mostly dominated by a *Triodia* hummock grassland (10-60 % cover depending on fire scaring) with heavy loam stony soils. The native grassland area appeared a mosaic of burn scars from 1 year to long unburnt (> 5 years) given the density and size of the grass hummocks recorded. However some areas were open due to over grazing rather than burn scar. The grassland provides good foraging and breeding opportunities for small native ground mammals and reptiles. Small skinks and dragons were observed active during the survey. Animal tracks, digs and occasional small burrows were recorded in this habitat type, most of which were varanid digs/burrows. The undulating areas (closest to the ranges) had presence of Western Pebble-mound mouse (*Pseudomys chapmani*). The overstorey consist of open woodland of scattered trees and small clumps of trees including *Corymbia* and *Eucalyptus* species (<10%). These trees were often small (to 6-8 meters) and provided few hollows. The shrub/midstorey layer was sparse but sometimes moderate to dense in small patches and consisted of *Acacia, Hakea and Grevillea* species (<10 %). Fallen branches were sparse in this habitat type-which is probably an artefact of the fire history and the open scattered over storey. Leaf-litter and other forms of non-vascular (ground cover of dead plant material) was localised beneath small clumps of trees but was uncommon. *Habitat value for fauna species of conservation significance* Moderate to high value Part of a larger area of contiguous remnant vegetation extending beyond the survey area. This habitat provides for the Western Pebble-mound mouse and potential hunting and foraging opportunities for the Peregrine Falcon (*Falco peregrinus*) and Grey Falcon (*Falco hypoleucos*). The Rainbow Bee-eater (*Merops ornatus)* was recorded within this habitat type during the survey. One Northern Quoll (*Dasyurus hallucatus*) was observed leaving the ranges onto the plain towards the Talga River during a night survey. It appears that the plain is used as a crossing for Quoll to water and resources. The Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*) would utilise the aerial environment for foraging.	 

Description	Indicative photograph
Minor drainage lines with small dense patches of trees/shrubs and scattered trees Vegetation association: VA05, VA08 This habitat type occurs across the survey area in the flatter areas with minor catchments and primarily consists of a small corridor of denser vegetation over a rocky substrate. Some of these drainage lines appeared artefacts of the road construction or run off provided by the road. Most of the drainage lines flowed into larger systems in the area eventually getting to either the Talga or Coogan Rivers. This habitat type is mostly dominated by a dense coverage of Acacia to 30 % which thins as you move away from the bed. Incursion by *Triodia* hummock grassland also occurs at some drainage lines up to 30 %, with Buffel Grass (*Cenchrus spp*.) also invaded into some lines forming up to 10 % coverage. These areas appeared a mosaic of burn scars from 1 year to long unburnt (> 5 years) given the density and size of the grass hummocks recorded. However some areas were open due to over grazing rather than burn scar. The drainage lines provide good foraging opportunities for small native ground mammals and reptiles as well as small birds such as honey eaters, wrens and whistlers. Some small skinks (*Carlia munda, Menetia greyi, Morethia ruficauda* and *Ctenotus saxatalis*) and dragons (*Amphibolurus logirostris*) were often observed moving amongst the dense grassland during the survey. Several Spinifex Pigeon (*Geophaps plumifera*) were flushed in this habitat. Few animal signs were recorded in this habitat type, due to the mostly stony substrates. However one old Rainbow bee-eater (*Merops ornatus*) burrow was recorded in a sandier section. Cattle and Kangaroo browsing and resting evidence was recorded. The overstorey consists of an open woodland (<10 %) of scattered trees including *Corymbia* and *Eucalyptus* species to 8 meters and provided few hollows, however the composition of trees varied if the drainage line was within the range or on the plain. Fallen timber, hollow bearing logs were very occasionally recorded in this habitat type-which is probably an artefact of the fire and the scattered overstorey. Leaf-litter and other forms of non-vascular (ground cover of dead plant material) were scarce. *Habitat value for fauna species of conservation significance* Moderate to high value Patchy in the landscape but part of a larger area of contiguous remnant vegetation extending beyond the survey area. This habitat provides potential hunting and foraging opportunities for the Peregrine Falcon (*Falco peregrinus*) and Grey Falcon (*Falco hypoleucos*). The Rainbow Bee-eater was recorded within this habitat type during the survey and an old breeding burrow recorded. Northern Quoll (*Dasyurus hallucatus*) has also been historically recorded in drainage lines however this is due to movement between areas rather than use within a core area. The Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*) and Ghost Bat (*Macroderma gigas*) would utilise the aerial environment for foraging. The Pilbara Olive Python (*Liasis olivaceus barroni*) may utilise this habitat to move between the range and the Riverine environments.	 

Description	Indicative photograph
***Eucalyptus camaldulensis and Melaleuca argentea* Woodland within Rivers** Vegetation association: VA02 This habitat type occurs in the Talga and Coongan River in (and close to) the survey area that comprise large Eucalyptus species primarily *Eucalyptus camaldulensis and Melaleuca argentea* in low points in the environment. This habitat type occurs in only small portions of the survey area and is associated to low lying areas where water bodies are present. This habitat type is mostly dominated by a moderate to sometimes dense coverage of *Melaleuca argentea* only with scattered *Eucalyptus camaldulensis* and scattered other tall shrubs and trees (60 %) to 15 meters tall, with the occasional very tall ~20 m present. The shrub/midstorey layer was sparse but sometimes moderate to dense in small patches and consisted of a mixed shrub species or young Eucalyptus and Melaleuca species (10 to 30 %). Portions of the river beds were open with occasional logs and debris present. This habitat appeared long unburnt given the size and lack of fire evidence present. Cattle use was evident throughout this habitat area. The tree and tall shrub coverage provided in the environment are excellent for a range of bush birds including an array of Honey eaters, Rufous Whistlers (*Pachycephala rufiventris*), Grey Shrike Thrush (*Colluricincla harmonica*) and Yellow Throated Miner (*Manorina flavigula*). Additionally, numerous water birds were utilising this habitat for roosting including Straw-necked Ibis (*Threskiornis spinicollis*), Australasian Darter (*Anhinga novaehollandiae*), Little Pied Cormorant (*Microcarbo melanoleucos*) and Little Black Cormorant (*Phalacrocorax sulcirostris*). Diameter at breast height (DBH) ranges from of 30-80 cm with the majority of trees probably between 40-60 cm. Small and medium (5–15 cm diameter) aerial hollows including some dead spouts are common within most larger trees, whereas large hollows (> 15 cm) were present but less common (but were in approximately 1 in 30 trees). Aerial hollows provide potential roosting and breeding habitat for native fauna (i.e. many nocturnal and diurnal birds, reptiles and microchiropteran bats). Animal tracks were prominent and easily identified in the soft sands in this habitat type, most of which were dog, cattle, cat, potential Bilby (*Macrotis lagotis*) and Northern Quoll (*Dasyurus hallucatus*). However large monitors, bustard and stone curlew were also recorded. Fallen timber, hollow bearing logs were very occasionally recorded in this habitat type-however where present were often a part of or tangled within root buttress of large trees forming dense entangled areas of woody debris. Leaf-litter and other forms of non-vascular (ground cover of dead plant material) was present but not built up due to water flow. *Habitat value for fauna species of conservation significance* High value A small area of habitat (in the survey area) that joins to or is a part of a larger area of continuous remnant vegetation extending beyond the survey area. This habitat provides potential hunting and foraging	 

Description	Indicative photograph
opportunities for the Peregrine Falcon (*Falco peregrinus*) and Grey Falcon (*Falco hypoleucos*). The Rainbow Bee-eater (*Merops ornatus*) was recorded in this environment. Northern Quoll and Bilby prints were recorded in the soft sands. A single Ghost Bat (*Macroderma gigas*) was recorded flying around (foraging) and likely that the Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*) would utilise the aerial environment for the same purpose. The dense buttress areas of debris would also provide excellent hide areas for Quoll and Pilbara Olive Python (*Liasis olivaceus barroni*). Roosting by migratory species Great Egret (*Ardea modesta*), Glossy Ibis (*Plegadis falcinellus*), Wood Sandpiper (*Tringa glareola*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Common Sandpiper (*Actitis hypoleucos*) could also occur in tall trees.	
Rocky Ridgelines / hills with hummock grasslands and scattered trees and shrubs (breakaway and scree were present in some areas) Vegetation association: VA06, VA07, VA09 This habitat type occurs across the survey area, where the road intersects (and portions of the loop road) the ranges and association to low hills. This habitat type is mostly dominated by Triodia hummock grassland (0 to 80% cover), depending on burn scars and scree presence. Substrate composition was rocky ranging from pebble rocks amongst Triodia, to breakaways and scree slope areas. Large areas of conglomerate rock were also present. The majority of the native grassland area appeared both long unburnt (> 5 years) and recently burnt in some areas (<1 year) given the density and size of the grass hummocks recorded. However some areas were a mosaic of burn ages. The grassland provides good foraging and breeding opportunities for small native ground mammals and reptiles. Small skinks and dragons were observed active during the survey. Animal tracks were recorded in this habitat type, most of which were kangaroo and wallaby. The rocky habitats on the ranges and hills also provide habitat to a different array of species (Dasyurus, dunnart, Pseudoantechinus and reptiles) as well as provide cave structures to bats. No large caves were recorded in the survey area to support Ghost Bat (*Macroderma gigas*) or Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*). No overstorey or mid storey was present or very scattered and the understorey shrub layer was sparse but sometimes moderate to <10 % and primarily consisted of a low acacia, gravillia or hakea species. Fallen branches were very sparse in this habitat type-which is probably an artefact of the fire history and the open scattered over and mid storey. Leaf-litter and other forms of non-vascular (ground cover of dead plant material) was localised and uncommon. *Habitat value for fauna species of conservation significance* High value A large area of habitat that joins to or is apart of a contiguous remnant environment extending beyond the	 

survey area. This habitat provides resources for the Western Pebble-mound mouse (*Pseudomys chapmani*) and Long-tailed Dunnart (*Sminthopsis longicaudata*) and potential hunting and foraging opportunities for the Peregrine Falcon (*Falco peregrinus*) Grey Falcon (*Falco hypoleucos*) and Rainbow Bee-eater (*Merops ornatus*). No large cliffs were present in the survey area for Peregrine Falcon to utilise for breeding however looked to be present in the greater study area. Northern Quoll (*Dasyurus hallucatus*) scats and feeding evidence was recorded in this environment and one individual was recorded traversing from the range onto the plain towards the river. This habitat is regarded as core habitat for this species. Ghost Bat (*Macroderma gigas*) and Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*) would utilise the aerial environment for foraging purposes. They would also utilise large caves for roosting and breeding however none were recorded in the survey area but maybe present within the greater study area. This environment is also core habitat for the Pilbara Olive Python (*Liasis olivaceus barroni*) which would utilise the rocky habitat areas as reuge moving to water bodies as required.

Riverine and water bodies along the Coongan and Talga River

Vegetation association: VA02

This habitat type occurs in a very small portion of the survey area where the survey area intersects the riverine environment. This environment is associated to and merges with *Eucalyptus camaldulensis* and *Melaleuca argentea* Woodland in the river beds. This habitat is mostly dominated by water bodies surrounded by either woodland or mud flats. The water body has water plants, fish and potentially the Plate-shelled Turtle (*Chelodina steindachneri*) present suggesting permanent (or semi permanent) in nature. Due to the presence of water and shade from the woodland high use was recorded by introduced grazers such as cattle, horse and camel and had severely impacted the area with extensive bank trampling and over grazing. Additionally, high use was also recorded by native species includeing water birds, bush birds, kangaroos and NortherN Quoll (*Dasyurus hallucatus*). The bat detector was placed over the water body on a rocky ridge and eight species of microchripteran bat were recotrded suggesting high use of the water resource to bat species.

Fallen timber, hollow bearing logs were very occasionally recorded in this habitat type-however where present were often a part of or tangled within root buttress of large trees forming dense entangled areas of woody debris. Leaf-litter and other forms of non-vascular (ground cover of dead plant material) was present but not built up due to water flow.

Habitat value for fauna species of conservation significance

High value

A small area of habitat (in the survey area) that joins to or is a part of scattered and isolated water bodies in the greater study area. This habitat provides potential hunting and foraging opportunities for the Peregrine Falcon (*Falco peregrinus*) and Grey Falcon (*Falco hypoleucos*). The Rainbow Bee-eater (*Merops ornatus*) was recorded in this environment. Northern Quoll prints were recorded near by and

likely utilise the water source. A single Ghost Bat (*Macroderma gigas*) was recorded flying around (foraging) nearby and likely that the Pilbara Leaf-nose Bat (*Rhinonicteris aurantia*) would utilise the aerial environment for the same purpose. The dense buttress areas of debris would also provide excellent hide areas for Quoll and Pilbara Olive Python (*Liasis olivaceus barroni*). Additionally, the python would utilise the water body as an ambush hunting location and is considered core habitat for the species. Foraging habitat on the banks and mud flat would be utilised by migratory species Great Egret (*Ardea modesta*), Glossy Ibis (*Plegadis falcinellus*), Wood Sandpiper (*Tringa glareola*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Common Sandpiper (*Actitis hypoleucos*) could also occur in tall trees.

Disturbed area

Vegetation association: VA01

This environment occurs across small cleared areas or comprise of corridors within the survey area. These include minor and major roads, old railway line corridor and supportive infrastructure. Most of the disturbed area have very little fauna significance except the old railwat corridor and infrastructure which is comprised of a formed raised corridor of placed rocks. These areas now breaking down is some areas provided crevices and ruge locations for geckos, snakes and liards.

Animal tracks were recorded in this habitat type, most of which were cattle and Kangaroo moving between the ranges to the water bodies.

Vegetation in these areas varied depending on the location of the disturbance.

Habitat value for fauna species of conservation significance

Low to Moderate value

Disurbed areas are mostly formed corridors in the landscape extending beyond the survey area. This habitat provides limited opportunites to conservation significant fauna. However a Northern Quoll latrine site was found along side the old Railway corridor (near to the water body) amongst boulders. Additionally where these corridors are positioned within the environment (to wind around the range) would force animals to cross from the ranges to the water bodies.

4.5.2 Fauna diversity

One hundred and thirteen fauna species were recorded within or in close proximity to the survey area during the survey, these included:

- 66 native birds
- 17 native mammals and six introduced mammals
- 20 native reptiles
- Four native fish.

The camera traps recorded a number of common species known from the area however the Northern Quoll and Rothchild's RockWallaby were identified and confirmed within the survey area.

NatureMap records indicate 209 vertebrate fauna taxa within the study area, many of which occur in the same and similar habitats that occur within and adjoining the survey area. The species diversity recorded during the current survey is considered to be moderate and it is likely with additional survey effort a higher number of native vertebrate fauna would be recorded within the survey area.

Of the 113 species recorded during this survey all have been previously recorded within the locality of the east Pilbara area (Atlas of Living Australia (ALA) 2016; DPaW 2007–).

A full list of fauna recorded during the field survey is presented in Appendix E.

Introduced fauna

During the survey, evidence for six introduced fauna species was recorded in the survey area and adjoining areas:

- Cat (*Felis catus*) – cat tracks were recorded at one location along a drainage line
- Dingo/dog (*Canis lupus dingo*) – scats and tracks were recorded
- Cow (*Bos taurus*) – scats and tracks everywhere
- Camel (*Camelus dromedarius*) - scats and tracks were recorded
- Horse (*Equus caballus*) - scats and tracks were recorded
- Rabbit (*Oryctolagus cuniculus*) - potential tracks (could also be Greater Bilby) but no other evidence recorded.

4.5.3 Conservation significant fauna

Five fauna species of conservation significance were recorded during the field surveys within the survey area. The Greater Bilby may also be present. Possible prints were recorded in the bed of the Talga River, however no other evidence was recorded. This species is also discussed below.

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll (*Dasyurus hallucatus*) is listed as Endangered under the EPBC Act and under the WC Act.

The Northern Quoll once occurred across the majority of northern Australia but its range has significantly contracted. It occurs in the Pilbara region but in disjunct populations. The Northern Quoll inhabits a range of vegetation associations but is especially abundant on dissected rocky escarpment and eucalypt woodland within 200 km of the coast. It is known to den in rock

crevices and rock piles and favours rocky areas. They are predominantly nocturnal but are occasionally active during the day, particularly during the mating season and are known to have a large home range (Van Dyck and Strahan 2008).

The Northern Quoll was recorded active in the survey area during nocturnal searchs. One individual (a female – due to visible neck fat rolls) was observed moving from the ranges onto the plain moving directly towards the Talga River. It is likely that this species is routinely moving between the range and rivers (water bodies) for resources. The species was also captured at twice on camera trap (Plate 2) (at least one male other unknown individual). Further evidence of this was the presence of numerous sets of prints located in the soft sands of the river beds. Three latrine sites were identified on the range and near to the water body (but still on rocky habitat) all of which were fresh sites. Plate 3 and Plate 4 show these observations. This data is mapped in Figure 5.

Plate 2 Northern Quoll from within the survey area

Plate 3 Northern Quoll Scats under a large boulder

Plate 4 Northern Quoll prints in the Talka River bed.

Ghost Bat *(Macroderma gigas)*

The Ghost Bat (*Macroderma gigas*) is listed as Vulnerable under the EPBC Act and under the WC Act.

The Ghost Bat occurs in a wide range of habitats (foraging), and requires an undisturbed cave, deep fissure or disused mine shaft in which to roost (roosting and breeding). It is patchily distributed across Australia with an isolated population persisting in the Pilbara region, and is sensitive to disturbance (Van Dyck and Strahan 2008).

The Ghost Bat was recorded on the edge of the survey area during spot lighting surveys. One individual was visually recorded flying within the *Melaleuca* Woodland presumably hunting. This location is mapped in Figure 5.

No caves suitable for Ghost Bat were recorded in the survey area and broader searches in the study area failed to yield any large caves. However this search was not exhaustive and additional surveys may identify cave systems. The complex and steep rocky slopes of habitat in the study area may contain caves that are suitable roosting and feeding habitat and may include maternity caves. The species has been recorded on numerous occations within 40 km of the survey area east and south (DPaW 2007–).

Greater Bilby (*Macrotis lagotis*)

The Greater Bilby (*Macrotis lagotis*) is listed as Vulnerable under the EPBC Act and under the WC Act.

The Greater Bilby distribution in Western Australia is restricted to the north, including the Pilbara, Sandy and Gibson Deserts. Extant population of the Greater Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. Populations are known to move long distances when current habitat ranges become unsuitable and resources depleated. Bilbies are largely solitary, widely dispersed and found in low numbers.

During the survey three sets of potential Bilby tracks were recorded in the bed of the Talga River (see Plate 5 and Plate 6). Unfortunately Bilby and Rabbit tracks are very similar in look and difficult to tell apart. Broader searches were undertaken within the study area (but only up to 1km from the survey area boundary) to locate any additional information from either the Bilby or Rabbit's presence. A old burrow system was located on the far side of the Talga River but due to the age and eroded nature of the system, no conclusive decision could be determined if it was Bilby or Rabbit. No other evidence was found from either species to make an informed disicion on which species (if not both) are present in the survey and study area. The survey area is within the northern most limit of the Rabbits distribution with only one record in the study area. However Bilby are known from the area with a recent population of bilby identified approximately 20 km north of the survey area (Martin Dziminski pers comm, DPaW 19/06/2016) and an additional population recorded 20 km south (DPaW 2007–).

Plate 5 A set of Bilby or Rabbit prints in the Talga River.

Plate 6 Second set of Bilby or Rabbit prints in the Talga River.

Rainbow Bee eater *(Merops ornatus)*

The Rainbow Bee-eater (*Merops ornatus*) is listed as Migratory Terrestrial under the EPBC Act and Schedule 5 (listed under international agreements) under the WC Act.

The Rainbow Bee-eater occurs in open forests and woodlands, shrublands, and in various open, cleared or semi-cleared habitats, including farmland and areas of human habitation.

The Rainbow Bee-eater was recorded on nine occasions (with 17 birds) in the survey area including one old burrow in the banks of a drainage line (see Plate 7 and Plate 8). It is likely the

species would breed in most areas on the plain of the survey area where opportunity presents. The Rainbow Bee-eater is a common and wide spread species in most parts of Australia and has been recorded regularly within 20 km of the survey area (DPaW 2007–). The locations where the species was recorded within the survey area are shown on Figure 5.

Plate 7 A pair of Rainbow Bee-eater from the survey area.

Plate 8 An old Rainbow Bee eater burrow.

Western Pebble-mound Mouse *(Pseudomys chapmani)*

The Western Pebble-mound Mouse is listed Priority 4 under DPaW Priority fauna listing.

The Western Pebble-mound Mouse is restricted to the Pilbara region where it is recognised as an endemic species. Habitat for the species can be found on stony hillsides with hummock grasslands. It constructs large mounds of pebbles on stony slopes which cover an area of 0.5-9.0 square metres. 'Active' mounds are characterized by volcano-like cones capped by 'craters' that mark occluded entrances to subterranean burrow systems in which the mice live, often gregariously (Van Dyck and Strahan, 2008).

Evidence of the species was recorded in 19 locations within the survey area (as shown in Figure 5, Appendix A). In total seven active and 12 inactive mounds were recorded on the range, low stony hills or undulating plains. Plate 9 shows one of the active mounds recorded. *NatureMap* records (DPaW, 2007–) indicate that this species is wide spread in the eastern Pilbara region. However this species is known to be sensitive to external impacts and populations are known to decline in areas where disturbance has occurred.

Plate 9 An active mound amongst Triodia.

Great Egret (*Ardea modesta*)

The Great Egret (*Ardea modesta*) is listed as Migratory Wetland species under the EPBC Act and Schedule 5 (listed under international agreements) under the WC Act.

The Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs.

During the survey two observations of the Great Egret were recorded one at Dorlena Gorge (within 1 km of the survey area) and the other from the water body in the survey area. The

species is regarded as common and wide spread and regularly recorded in water bodies and systems in the Pilbara.

Likelihood of Occurrence

Searches of the EPBC Act PMST and *NatureMap* database identified the presence/potential presence of 30 conservation significant fauna species. An assessment on the Likelihood of Occurrence for conservation significant fauna species in the survey area was conducted (Appendix E). This assessment was based on species biology, habitat requirements, the quality and availability of suitable habitat and records of the species in the survey area and the surrounding area (e.g. DPaW 2007–).

The assessment identified the likely presence of an additional nine other species of conservation significance (see Table 10). The Likelihood of Occurrence assessment revealed that other fauna species of conservation significance could occasionally occur within the habitats of the survey area (those species deemed 'unlikely' to occur). However, it is considered unlikely that the survey area provides important habitat (e.g. breeding habitat or key foraging habitat) for any of these 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 10 Summary of fauna species of conservation significance recorded during survey and determined likely to occur within the survey area

Species and status (EPBC, WC Act)	Justification for Likelihood of Occurrence
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Pilbara form) Vu, S3, Vu	**Likely – species is known from the study area and habitat present** No Caves were recorded in the survey area nor any identified during regional walks in study area. However the survey area is likely foraging habitat only used as required. There are no historical records within survey area with numerous records within 40 km of the survey area.
Pilbara Olive Python *Liasis olivaceus barroni* Vu, S3, Vu	**Likely – resident/regular visitor, opportunistic use in/to the survey area** The survey area provides suitable habitat for the species. The rocky ranges, rivers and associated habitats including the water bodies would be regarded as core habitat for the species. The remainder of the habitat in the survey area is supportive only. There are no historical records within survey area, numerous records within 80 km (one within 40 km).
Peregrine Falcon *Falco peregrinus* OS, S7	**Likely – regular visitor or resident to survey area** The survey area provides suitable hunting and roosting habitat. The survey area is probably part of the species broader home range, limited breeding habitat occurs within the survey area (breeding potential could occur in the large *E. camaldulensis* and *Melaleuca argentea* Woodland in the river). Core breeding habitat (e.g. steep cliffs) may be found in nearby ranges outside the survey area but within the study area. There are no historical records within survey area and three records within the study area.
Grey Falcon *Falco hypoleucos* Vu, S3	**Likely – regular visitor or resident to survey area** The survey area provides suitable hunting, roosting and breeding habitat for the species. The survey area is probably part of the species broader home range, limited breeding habitat occurs within the survey area (breeding potentially could occur in *E. camaldulensis* and *Melaleuca*

Species and status (EPBC, WC Act)	Justification for Likelihood of Occurrence
	argentea Woodland in the rivers). There are records within survey area and numerous records within the study area.
Long-tailed dunnart *Sminthopsis longicaudata* P4	**Likely –resident to survey area, restricted to the rocky ranges** The survey area provides suitable habitat for the species particularly in rocky ranges and associated rocky habitats. The species has been recorded within the study area and the species likely present. There is no historical records within survey area and numerous records are within 20 km.
Glossy Ibis *Plegadis falcinellus* Miw, S5, IA	**Likely – resident/regular visitor, opportunistic use in/to the survey area** This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. This species is knowbn tro persist in the Pilbara. The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).
Wood Sandpiper *Tringa glareola* Miw, S5, IA	**Likely –seasonal visitor, opportunistic use in/to the survey area** This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. This species is knowbn tro persist in the Pilbara. The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).
Sharp-tailed Sandpiper *Calidris acuminata* Miw, S5, IA	**Likely –seasonal visitor, opportunistic use in/to the survey area** This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. This species is knowbn tro persist in the Pilbara. The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).
Common Sandpiper *Actitis hypoleucos* Miw, S5, IA	**Likely –seasonal visitor, opportunistic use in/to the survey area** This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. This species is knowbn tro persist in the Pilbara. The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).

Table note:

Status (see Appendix B for full explanation)

EPBC Act – Species listed as one or more of the following: MiT = migratory terrestrial species, Vu = Vulnerable, En = Endangered

WC Act - Species listed as CR = critically endangered, En = endangered, Vu = Vulnerable, IA = international migratory agreement migratory birds, OS = other specially protected fauna

DPaW – Species listed as Priority (P) 1, 2, 3 or 4

5. Project constraints and approvals

This section provides preliminary environmental approvals and referrals advice based on the biological constraints identified within the survey area. As the project is in concept design there may be opportunities to avoid and minimise the impacts on these biological constraints through design refinement. If the biological constraints can be avoided or impacts to them minimised it may negate the need for environmental approvals or referral to Australian Government / State environmental agencies.

5.1 Key biological constraints

The key biological constraints identified within the survey area during the biological assessment are summarised below in Table 11.

5.2 Environmental approvals and referrals

5.2.1 Australian Government approvals

Referral to the DotE under the EPBC Act is triggered if a proposed action has or potentially has a significant impact on any MNES. Table 12 shows an assessment of the survey area against key biological MNES.

Table 11 Key biological constraints within the survey area

	Survey area
Flora of conservation significance	No flora taxa of conservation significance were recorded during the field assessment. The likelihood of occurrence assessment indicates that six flora taxa of conservation significance taxa are considered likely to be present within the survey area.
Fauna of conservation significance	Presence of six fauna species: • Northern Quoll (*Dasyurus hallucatus*) – One specimen recorded active, at least two specimens on camera trap, four latrine sites and prints obsertved. The range with rocky habitats, riverine and woodlands are all core habitat for the species. The remainder is potential foraging habitat and supportive only • Ghost Bat (*Macroderma gigas*) – One specimen recorded active at night in the survey area. No caves present in the survey area. The survey area is foraging habitat for the species • Greater Bilby (*Macrotis lagotis*) – three sets of print identified as potential Bilby and one old burrow system. Habitat is present, the species is known from the region • Rainbow Bee-eater (*Merops ornatus*) – 17 individuals recorded, foraging and potential breeding habitat • Western Pebble-mound Mouse (*Psudomys chapmani*) – recent evidence of seven active mounds was recorded within the survey area including 12 inactive mounds • Greater Egret (*Ardea modesta*) - Two specimens recorded in and close to the survey area. Water Body and woodlands are foraging and roosting habitat Potential presence of nine species and their habitats within the survey area are: • Grey Falcon (*Falco hypoleucos*) – Records within the survey area and the species is a potential resident with breeding and hunting habitat present • Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) – Records in the region and foraging habitat present in riverine, woodland and ranges. Foraging habitat available for the species throughout the survey area • Pilbara Olive Python *(Liasis olivaceus barroni*) - Records in the region and habitat present in riverine (water body), woodland and ranges, all considered core habitat • Peregrine Falcon (*Falco peregrinus*) – Records in the region and habitat present in riverine, woodland, and ranges, hunting (foraging) habitat available for the species throughout the survey area • Long-tailed Dunnart (*Sminthopsis longicaudata*) – Records in the region and habitat available for the species • Glossy Ibis *(Plegadis falcinellus)* – Records in the region and habitat available for the species • Wood Sandpiper *(Tringa glareola)* – Records in the region and habitat available for the species • Sharp-tailed Sandpiper *(Calidris acuminata)* – Records in the region and habitat available for the species • Common Sandpiper *(Actitis hypoleucos)* - Records in the region and habitat available for the species.

Table 12 Assessment of the key biological Matters of National Environmental Significance for the survey area

Key biological MNES	Present	Need for referral to DotE under EPBC Act (likely significant impact)
Listed Threatened Species and Ecological Communities	No EPBC listed flora species, or ecological communities were identified during the current survey or are considered likely to occur. The assessment identified the presence or likely presence of one EPBC listed fauna species: Northern Quoll (*Dasyurus hallucatus*). Greater Bilby (*Macrotis lagotis*) Pilbara Olive Python *(Liasis olivaceus barroni*) Ghost Bat (*Macroderma gigas*) Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	**Northern Quoll** **Referral Recommended** A review of the Significant Impact Guidelines (DotE 2013) and the species specific Northern Quoll referral guidelines (Commonwealth of Australia (CoA) 2016 – see Table 12) was undertaken to consider the need for referral to the DotE for the Northern Quoll. Referral is recommended for the Northern Quoll because: • The species was recorded during current surveys at numerous locations within the survey area via several methods including sighting, camera traps, latrine/scat sites and prints Visual observations of specimens recorded both male and females. It is likely (although not proven) that a population exists in the core habitat present • There is core habitat present for the species and a portion is to be impact (critical habitat) by the project which is considered core habitat for a population of the Northern Quoll The Northern Quoll was recorded moving in-between the range to the riverine environment in search of resources. The project proposes to put a loop road through these areas potentially bisecting habitat which may casue additional barrier effects. **Greater Bilby** **Referral Recommended** A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE for the Greater Bilby. Referral is recommended for the Greater Bilby because: • Observations of potential use were identified via prints in sand at 3 locations and a potential old burrow was located • There is a known population both north and south of the survey area within 20 km • Although no direct conclusive evidence was collected for this species, due to their presences in the region the precautionary principle is triggered and taken • With additional survey effort this conclusion could be refined and potential eliminate the need for referral for this species.

Key biological MNES	Present	Need for referral to DotE under EPBC Act (likely significant impact)
		Pilbara Olive Python **Referral Recommended** A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE for the Pilbara Olive Python. Referral is recommended for the Pilbara Olive Python because: • Habitat recorded in the survey area is considered core to the species including the rocky ranges, drainage lines, riverine and water bodies • There is a known population within the region and numerous specimens recorded within 80 km of the survey area • Although no direct conclusive evidence was collected for this species, due to their presences in the region the precautionary principle is triggered and taken • The species is likely to move in-between the range and riverine environment in search of resources. The proposed project is to put a road through these areas bisecting habitat causing additional barrier effects. The impact of this need to be mitigated • With additional survey effort this conclusion could be refined and potential eliminate the need for referral for this species. **Ghost Bat** **Referral unlikely** A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE for the Ghost Bat. Referral is unlikely for the Ghost Bat because: • No core habitat for the species was recorded during the current survey, foraging habitat is present only • There is a low risk of a substantial impact to critical habitat for a population of the Ghost Bat, no cave habitats were recorded in the survey area nor portions of the study area. Only foraging habitat is present in the environment. **Pilbara Leaf-nosed Bat** **Referral unlikely** A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE for the Pilbara Leaf-nosed Bat.

Key biological MNES	Present	Need for referral to DotE under EPBC Act (likely significant impact)
		Referral is unlikely for the Pilbara Leaf-nosed Bat because: • No core habitat for the species was recorded during the current survey, foraging habitat is present only • There is a low risk of a substantial impact to critical habitat for a population of the Pilbara Leaf-nosed Bat, no cave habitats were recorded in the survey area nor portions of the study area. Only foraging habitat is present in the environment.
Migratory Species	The assessment identified the presence of one EPBC listed migratory wetland fauna species: Rainbow Bee-eater (*Merops ornatus*). Greater Egret (*Ardea modesta*) Glossy Ibis (*Plegadis falcinellus*) Wood Sandpiper (*Tringa glareola*) Sharp-tailed Sandpiper (*Calidris acuminata*) Common Sandpiper (*Actitis hypoleucos*)	**Migratory Birds** **Referral unlikely** A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE for the Migratory birds. These species are are nomadic utilising habitats as required. Much of the habitat available to the wading species is restricted to the riverine environment and unlikely to be impacted by the proposed works. The Rainbow Bee-eater and Glossy Ibis are more widespread throughout Australia and occurs in a wide range of habitat types. The Rainbow Bee-eater is reasonably common bird and there is suitable breeding and foraging habitat within the greater study area. The Rainbow Bee-eater and Glossy Ibis are unlikely to rely on the habitats present within the survey area and clearing of habitat for the Project is unlikely to significantly impact a population of this species.

Table 13 Review of the Referral Guidelines for the Northern quoll

Aspect	Information	Outcome and risk assessment
Modelled distribution of northern quoll	Map 1 and Map 3 of the guideline (CoA 2016) DPaW 2007 –	Modelling indicates the species is known/likely to occur within the survey area. The survey area occurs within the Pilbara mainland region distribution of the species and is part of the area of the Pilbara regional population as described in the guideline. Prior to this survey there were no records of the species in the survey area however numerous records are present within 30 km of the survey area.

Aspect	Information	Outcome and risk assessment
Habitat critical to the survival of the Northern Quoll	Habitat critical to the survival of the species is listed on page 16 of the guidelines (CoA 2016). The species was identified via scat searches (4 locations) and camera trapping (two individuals) and an additional animal was recorded during night surveys. Prints were also recorded in the riverine environment. The Northern Quoll was confirmed to occur within the survey area during the field investigation from multiple locations and individuals. The fauna assessment determined that habitat within the survey area (ranges, rocky habitat, drainage lines, woodlands and riverine) are considered corehabitat for the species and the plain supportive. The survey area provides suitable hunting, refuge and denning habitat, (ranges, rocky habitat, drainage lines, woodlands and riverine). The habitas as a whole form key resources for the species and provide connectivity with habitats adjacent the survey area. The survey area may be part of the home range of more than two individuals.	Given the results of the survey it is possible that the survey area is a component of habitat critical to the survival of the regional population. The habitat within the survey area is part of a broader area of habitat for two or more individuals. It is considered that there is a risk of a substantial impact to critical habitat for a population of the Northern Quoll.
Populations important for the long-term survival of the Northern Quoll	High density populations are described by the guideline (pp16). The survey did not record evidence of at leat two Northern Quoll.	Considering the level of survey effort, and the evidence of the species presense in the survey area and greater study area, it is likely that the survey area is considered to be part of a high density quoll population, and therefore the core habitat identified significant to a population of Northern Quoll.

5.2.2 State approvals

Environmental Protection Authority

Significant proposals must be referred to the EPA under Section 38 of the EP Act. In deciding whether a proposal will be subject to the formal environmental impact assessment process, the EPA takes into account the environmental significance of any potential impacts that may result from the implementation of the scheme or proposal.

In the absence of a broader environmental assessment, the majority of the likely biological impacts associated with the project are linked to native vegetation clearing and loss of fauna habitat to conservation significant species recorded. The potential impacts from the loss of native vegetation and loss of fauna habitat can be effectively assessed through the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Therefore, with consideration of the biological values discussed in this report, it is considered unlikely that the project would require referral to the EPA under Section 38 of the EP Act.

Department of Environment and Regulation

The clearing of native vegetation in Western Australia requires a permit under Part V of the EP Act, unless an exemption applies. Main Roads has been granted a Statewide Purpose Clearing Permit (CPS 818) which allows Main Roads to clear native vegetation for road projects and associated activities.

The Australian and Western Australia governments have entered into a bilateral agreement under the EPBC Act relating to environmental assessment (assessment bilateral agreement). Specifically, this agreement now includes the clearing permit assessment process under Part V Division 2 of the EP Act. Under the assessment bilateral agreement, if a native vegetation clearing permit is required and the clearing will have or is likely to have an impact on a MNES, the assessment of the clearing application including the potential impacts to the MNES can be conducted by the DER or DMP under delegation.

Six DPaW Priority-listed flora species considered to likely occur in the survey area. Fifteen fauna of conservation significance are considered to occur or likely to occur in survey area. As such, any clearing permit application should assess the significance of any potential impacts of the proposed clearing area on these species.

6. Conclusions

6.1 Key findings

6.1.1 Vegetation and flora

Nine vegetation associations were identified and described from the survey area. A review of the aerial photography illustrates there is representation of this vegetation outside the survey area. The vegetation is also consistent with vegetation associations identified in the vegetation mapping for the area (Beard 1979; Payne and Schoknecht 2011).

The survey area is in a largely disturbed condition with signs of obvious disturbance, including fire, flood, grazing and road maintenance activities.

No EPBC Act, WC Act or Priority listed flora taxa were recorded within the survey area during the survey. The Likelihood of Occurrence assessment post-field survey concluded that two conservation significant flora taxa are considered likely and four conservation significant flora taxa may possibly occur within the survey area.

Ten introduced taxa were recorded within the survey area during the field survey. No introduced species listed as a Declared Pest under Section 22 of the BAM Act or a WoNS (DotE 2016) were recorded.

6.1.2 Fauna

The EPBC Act listed Northern Quoll (*Dasyurus hallucatus*), Ghost Bat (*Macroderma gigas*) Rainbow Bee-eater (*Merops ornatus*), Greater Egret (*Ardea modesta*), (potentially the) Greater Bilby (*Macrotis lagotis*) and Priority 4 listed Western Pebble-mound Mouse (*Pseudomys chapmani*) were recorded during the current survey.

Nine additional species are likely to occur in the survey area and include Grey Falcon (*Falco hypoleucos*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Pilbara Olive Python (*Liasis olivaceus barroni*), Peregrine Falcon (*Falco peregrinus*), Long-tailed Dunnart (*Sminthopsis longicaudata*), Glossy Ibis (*Plegadis falcinellus*), Wood Sandpiper (*Tringa glareola*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Common Sandpiper (*Actitis hypoleucos*).

A review of the Significant Impact Guidelines (DotE 2013) was undertaken to consider the need for referral to the DotE listed species and it was considered that the Northern Quoll, Greater Bilby and Pilbara Olive Python would require referral based on the presence of the species, knowledge of species in the region and habitats present within the survey area. Additionally the Northern Quoll was recorded and the Pilbara Olive Python likely to move in-between the range to the riverine environment in search of resources. The proposed project is to put a road through these areas bisecting habitat causing additional barrier effects. The impact of this needs to be explored and mitigated.

The Ghost Bat was recorded once in the survey area (at night foraging) and Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) is considered likely to utilise the survey area as foraging. No caves of a suitable nature were recorded for in the survey area nor within additional search areas in the study area. Both species are likely to only utilise the survey area opportunistically for foraging and unlikely trigger referral.

The Western Pebble-mound Mouse is endemic to the Pilbara region and regarded as common in most of its range. Seventeen mounds of the species were recorded during the survey with evidence of seven active mounds present and the remaining 12 mounds inactive. Typically this species is sedentary and restricted to stony habitats on hill slope or on undulating plain. The species is known to be susceptible to disturbance and will disappear from areas once this

occurs. The habitat within the survey area is probably well represented in the local area and within the larger study area. It is also most likely that the larger study area contains additional resources for this species. It is considered unlikely that the habitats within the survey area form a substantial portion or an important component of habitat for the species.

The Peregrine Falcon, Grey Falcon, Long-tailed Dunnart are known from the region and habitat is present for the species however, the habitat available is not critical to the survival of the species and generally restricted to only small portions of the survey area having little impact on the species.

The Rainbow Bee-eater and Greater Egret were recorded in the survey area while the Glossy Ibis, Wood Sandpiper, Sharp-tailed Sandpiper and Common Sandpiper have previously been recorded within 2 km of the survey area and habitats present in the survey area. All of these species may utilise the habitats present in the riverine environments but impacts likely minimal to the species.

6.2 Recommendations

There are several key recommendations that should be incorporated in to the design and impact area refinement for the project including:

- Minimisation of the clearing of native vegetation as much as practical
- Rehabilitation of all available areas should be conducted as soon as practicable after clearing
- Minimisation of clearing in drainage lines/riverine and rocky ranges and adjacent vegetation. This will limit the loss of the more important fauna habitat within the survey area and reduce the risk of weed spread
- Where possible avoid active Western Pebble-mound Mouse mounds to reduce impacts on the species
- Two EPBC fauna species (Pilbara Olive Python and Greater Bilby) occur or possibly likely occur in the survey area and have been recommended for referral. With additional survey effort the need to refer based on further evidence maybe refined.
- Fauna species are moving through the environment in search of resources (ranges to riverine and vice versa) the establishment of underpasses in the loop road and new Marble Bar Road construction is advised to assist in fauna movement and reduce road barrier affects. Also reduce road fatalities from the increase in road speeds through the Coongan Gorge.
- Rehabilitation of any cleared riverine areas should occur as soon as is practicable to reduce the risk of soil erosion
- Water / erosion management should be implemented to minimise alteration to hydrology and erosion of susceptible landscapes
- Weed management during roadwork activities should be a requirement for the project
- It is likely that conservation significant fauna species may occur in the survey area during the construction phase of the project. A management plan outlining strategies to avoid impacts to fauna during construction should be developed.

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Appendices

Appendix A – Figures

BIDYADANGA COMMUNITY

GREAT NORTHERN HIGHWAY

PORT HEDLAND

DAMPIER

WICKHAM

POINT SAMSON

ROEBOURNE

KARRATHA

MARBLE BAR

NORTH WEST COASTAL HIGHWAY

ONSLOW

PANNAWONICA

PANNAWONICA ROAD

ROEBOURNE WITTENOOM ROAD

ONSLOW ROAD

MARBLE BAR ROAD

MUNJINA ROY HILL ROAD

KARIJINI DRIVE

TOM PRICE

BURKE JIT ROAD

NANUTARRA WITTENOOM ROAD

PARABURDOO

TOM PRICE ROAD

NEWMAN

MARBLE BAR ROAD

DRAFT

Paper Size A3

0 20 40 60 80 100

Kilometres

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

LEGEND

Town

Survey area

Major Road

Minor Road

GHD

mainroads WESTERN AUSTRALIA

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Main Roads Western Australia
Coongan Gorge Realignment and Side-track Biological Survey

Job Number 61-34579
Revision A
Date 27 Jun 2016

Project Location

Figure 1

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Data source: Geoscience Australia: Landsat Imagery, Topo 250k Series III; MRWA: Survey Area 20160530; Landgate: Aerial Imagery - Site Inset (Virtual Mosaic). Created by:afeeney

999 Hay Street Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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7,700,000 7,690,000 7,680,000 7,670,000 7,660,000

COONGAN RIVER
PEAR CREEK
Marble Bar Road
WARRALONG CREEK
TALGA RIVER
YANDICOOGINA CREEK
LR3129/890

Threatened (Declared Rare) & Priority Fauna

- *Ardea modesta*
- *Dasyurus hallucatus*
- *Falco hypoleucos*
- *Falco peregrinus*
- *Leggadina lakedownensis*
- *Liasis olivaceus barroni*
- *Macrotis lagotis*
- *Merops ornatus*
- *Plegadis falcinellus*
- *Pseudomys chapmani*
- *Tringa glareola*

Paper Size A3

0 2 4 6 8 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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LEGEND

Threatened (Declared Rare) & Priority Flora

- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Major Road
- Minor Road
- Major Watercourse
- Minor Watercourse
- Waterbody
- DPaW Managed Lands
- Survey area

GHD

mainroads WESTERN AUSTRALIA

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Main Roads Western Australia
Coongan Gorge Realignment and Side-track Biological Survey

Job Number	61-34579
Revision	A
Date	28 Jun 2016

Biological Constraints

Figure 2

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Data source: Geoscience Australia: Landsat Imagery, Topo 250k Series III; MRWA: Survey Area 20160530, Roads - 20140723; Landgate: ; DPaW: Rare and Priority Flora - 2060523, Rare and Priority Fauna - 20160516. Created by:afeeney

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Marble Bar Road

Vegetation Association

- 1, Cleared/Degraded
- 2, Riparian Woodland
- 3, Floodplain Low Open Woodland
- 4, Spinifex Steppe on Calcareous Stony Lower Slopes
- 5, Spinifex Steppe with Emergent Scrub on Sandy Lower Slopes
- 6, Spinifex Steppe on Stony Mid Slopes
- 7, Spinifex Steppe on Stony Upper Slopes with Emergents
- 8, Terminalia - Atalaya Low Woodland on Steep Slopes
- 9, Atalaya-Fluggea Shrublands on Large Stony Scree

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0 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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LEGEND

Quadrat — Road

Relevé — Survey area

Main Roads Western Australia
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Date	28 Jun 2016

Vegetation Associations

Figure 3

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Data source: MRWA: Survey Area 20160530, Roads - 20140723; Landgate: Imagery (Virtual Mosaic); GHD: Quadrat and Relevé Locations, Vegetation Associations - 20160615. Created by:afeeney

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Marble Bar Road

Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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LEGEND

Road

Survey Area

Vegetation Condition (EPA and DPaW, 2015)

3
4
5
6
7

GHD

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Main Roads Western Australia
Coongan Gorge Realignment and Side-track Biological Survey

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Vegetation Condition

Figure 4

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Data source: MRWA: Survey Area 20160530, Roads - 20140723; Landgate: Aerial Imagery - Warrie Aug. 2013; GHD: Vegetation Condition - 20160615. Created by:afeeney

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cam 21
habitat 6
habitat 8
habitat 7
cam 24
habitat 3
cam ghdb
bat detector
cam 18
habitat 2
bat detector
cam 27
habitat 9
habitat 9
habitat 9
habitat 10
habitat 11
cam 15
cam 20
cam 11
habitat 1
habitat 4
Marble Bar Road

Fauna Results

- Ghost Bat
- Great Egret
- Northern Quoll (Prints)
- Northern Quoll (Scats)
- Northern Quoll (Sightings)
- Northern Quoll (Camera Capture)
- Pebble Mound (Active Mound)
- Pebble Mound (Inactive Mound)
- Potential Bilby Burrow
- Possible Bilby Prints
- Rainbow Bee-eater (Old Burrow)
- Rainbow Bee-eater (Sightings)

Paper Size A3

0 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

LEGEND

Fauna Method

- Bat Detector
- Camera
- Habitat Assessment Location
- Road
- Survey area

Main Roads Western Australia
Coongan Gorge Realignment and Side-track Biological Survey

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Fauna Methods and Results

Figure 5

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Data source: MRWA: Survey Area 20160530, Roads - 20140723; Landgate: Imagery (Virtual Mosaic); GHD: Fauna Survey Effort, Fauna Survey Results - 20160624. Created by:afeeney

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Appendix B – Relevant legislation, conservation codes and background information

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 take an action that has, will have, or is likely to have a significant impact MNES, without approval from the Federal Minister for the Environment.

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 Australian Government Minister for the Environment.

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. It provides for an Environmental Protection Authority (EPA), for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the above.

Clearing of native vegetation in Western Australia requires a permit from the Department of Environment Regulation (DER) (formerly the Department of Environment and Conservation – DEC), unless exemptions apply. Native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native, but not vegetation planted in a plantation or planted with commercial intent.

In the EP Act Section 51A, clearing is defined as the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage of some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above.

When making a decision to grant or refuse a permit to clear native vegetation 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.

There are a number of Environmentally Sensitive Areas (ESAs) within Western Australia where exemptions in regulations do not apply. ESAs include locations of threatened communities and species.

State *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

ESAs are declared by a notice under Section 51B of the EP Act. The Table below outlines the aspects of areas declared as ESA (under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 – Reg 6).

Aspects of Environmentally Sensitive Areas

Aspects of Environmentally Sensitive Areas
A declared World Heritage property as defined in Section 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
An area that is registered on the Register of the National Estate (RNE), because of its natural values, under the *Australian Heritage Commission Act 1975* 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.
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 TEC.
A Bush Forever Site.
The areas covered by the following policies:
a) The *Environmental Protection (Gnangara Mound Crown Land) Policy 1992*.
b) The *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2002*.
The areas covered by the lakes to which the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (SCPL) (EPP Lakes) applies.
Protected wetlands as defined in the *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998*.
Areas of fringing native vegetation in the policy area as defined in the *Environmental Protection (Swan and Canning Rivers) Policy 1997*.

State *Wildlife Conservation Act 1950*

The *Wildlife Conservation Act 1950* (WC Act) provides for the conservation and protection of wildlife. It is administered by the Department of Parks and Wildlife (DPaW) (formerly the DEC) 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*

Under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), a Declared Pest is a prohibited organism or an organism for which a declaration under Section 22(2) is in force. The Department of Agriculture and Food Western Australia (DAFWA) maintains a list of Declared Pests for Western Australia. If a Pest is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to comply with the specific category of control. Declared plants are gazetted under categories, which define the action required. The category may apply to the whole of the State, districts, individual properties or even paddocks. Categories of control are defined below. Among the factors considered in categorising Declared Pests are:

- The impact of the plant on individuals, agricultural production and the community in general
- Whether it is already established in the area
- The feasibility and cost of possible control measures

The BAM Act replaces the repealed *Agriculture and Related Resources Protection Act 1976* (ARRP Act).

Department of Agriculture and Food (Western Australia) Categories for Declared Pests under the *Biosecurity and Agriculture Management Act 2007*

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 and conservation codes

Reserves and conservation areas

Department of Parks and Wildlife managed lands and waters

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

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” (DotE 2016a). 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” (DotE 2016a).

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 (DotE 2016b):

- 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) and in Environmental Protection Authority (EPA) Position Statement No. 2 on environmental protection of native vegetation in Western Australia (EPA 2000).

From a purely biodiversity perspective and taking no account of any other land degradation issues, there are a number of key criteria now being applied to the clearing of native vegetation in Western Australia (EPA 2000).

- The “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30 percent of the pre-European extent of the vegetation type.
- A level of 10 percent of the original extent is regarded as being a level representing Endangered.
- Clearing which would put the threat level into the class below should be avoided.
- From a biodiversity perspective, stream reserves should generally be in the order of at least 200 metres (m) wide.

Vegetation condition

The vegetation condition in the Victoria Bonaparte IBRA bioregion can be assessed in accordance with the vegetation condition rating scale for the Eremaean and Northern Botanical Provinces (devised by Trudgen (1988) and adapted by EPA and DPaW (2015). The scale recognises the intactness of vegetation and consists of six rating levels as outlined below.

Vegetation condition rating scale

Class	Eremaean and Northern Botanical Provinces description
2	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
3	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
4	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
5	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
6	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
7	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their 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.

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 administered by the Department of the Environment (DotE) (formerly Department of Sustainability, Environment, Water, Population and Communities – DSEWPaC). The DPaW 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 TEC that do not meet survey criteria are added to the DPaW 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.

Conservation codes and definitions for Threatened Ecological Communities endorsed by the Western Australian Minister for the Environment and listed under the *Environment Protection and Biodiversity Conservation Act 1999*

Western Australia conservation categories		Federal Government Conservation Categories (EPBC Act)	
Presumed Totally Destroyed (PD)	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.	Critically Endangered (CR)	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future
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)	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future
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)	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term 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 Priority Ecological Communities as listed by the Department of Parks and Wildlife

Category	Description
Priority 1	**Poorly known ecological communities.** Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100 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.
Priority 2	**Poorly known ecological communities.** Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200 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.
Priority 3	**Poorly known ecological communities.** (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: (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; (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. 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.
Priority 4	**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.** (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. (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. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

Category	Description
Priority 5	**Conservation Dependent ecological communities.** 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.

Other significant vegetation

Vegetation may be significant for a range of reasons, other than a statutory listing as TEC or because the extent is below a threshold level. The EPA (2004) states that significant vegetation may include vegetation that includes the following:

- Scarcity
- Unusual species
- Novel combinations of species
- 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 the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- A restricted distribution

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).

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 DotE 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 the Conservation of Nature and Natural Resources (IUCN).

Threatened species have been published as Specially Protected under the WC Act 1950, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora. The schedules align with the categories of the EPBC Act. Threatened species are those are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk 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 DPaW Priority species are considered conservation significant.

Conservation categories and definitions for *Environment Protection and Biodiversity Conservation Act 1999* listed flora & fauna species

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

Conservation codes and descriptions for Western Australian flora and fauna

Code	Conservation category	Description
Wildlife Conservation Act 1950		
T	Threatened species	Published as Specially Protected under the *Wildlife Conservation Act 1950,* 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 (which may also be referred to as Declared Rare Flora). ***Threatened fauna*** is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. ***Threatened flora*** 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 Wildlife Conservation Act. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	Critically endangered species	Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	Endangered species	Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
VU	Vulnerable species	Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	Presumed extinct species	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
IA	Migratory birds protected under an international agreement	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.
CD	Conservation dependent fauna	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.
OS	Other specially protected fauna	Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Code	Conservation category	Description
DPaW Priority Listed		
1	Priority One: Poorly-known taxa	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.
2	Priority Two: Poorly-known taxa	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.
3	Priority Three: Poorly-known taxa	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.
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	(a) Rare. Species 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 species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Migratory species listed under the EPBC Act

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)

Other significant flora and fauna

Flora species, subspecies, varieties, hybrids and ecotypes may be significant for a range of reasons, other than as Threatened (Declared Rare) Flora or Priority Flora. The EPA (2004) states that significant flora may include taxa that have:

- A keystone role in a particular habitat for threatened species or supporting large populations representing a significant proportion of the local regional population of a species
- Relic status
- 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
- Being poorly reserved

The application of the degree of significance may apply at a range of scales.

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 (Australian Government 2014).

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Appendix C – Desktop searches

EPBC Act PMST Report (40 km buffer)

NatureMap Flora Report (40 km buffer)

NatureMap Fauna Report (40 km buffer)

Australian Government

Department of the Environment

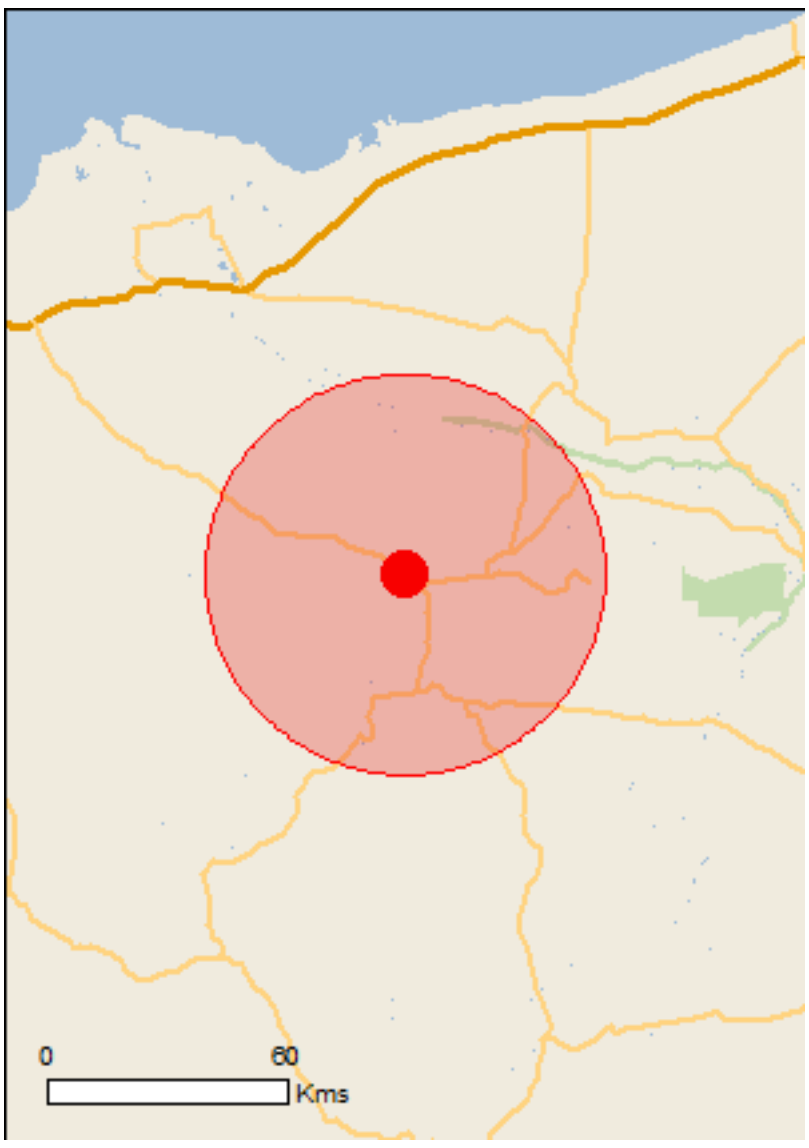
EPBC Act Protected Matters Report

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.

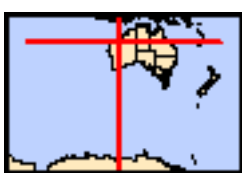
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/16 16:55:58



Coordinates

Buffer: 50.0Km



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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	12

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.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Breeding known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Roosting known to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Sharks		
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Name	Threatened	Type of Presence
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to 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
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Meenthena Station	WA

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		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
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
De Grey River	WA

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

-20.9177 119.80427

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
-Parks and Wildlife Commission NT, Northern Territory Government
-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, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-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.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Joshua Foster on 16/05/2016

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 119° 48' 23" E,20° 54' 58" S
Buffer 40km
Group By Family

Family	Species	Records
Acanthizidae	2	4
Acariformes	5	5
Acarosporaceae	1	1
Accipitridae	10	71
Actinopodidae	1	1
Aegothelidae	1	1
Aeolosomatidae	2	5
Aeshnidae	1	1
Agamidae	7	51
Aizoaceae	4	9
Alaudidae	2	6
Amaranthaceae	28	80
Ameiridae	2	5
Anatidae	6	67
Anhingidae	1	34
Anthelidae	1	1
Apocynaceae	3	5
Araliaceae	2	2
Araneidae	2	5
Arctiidae	3	3
Ardeidae	7	120
Arrenuridae	3	3
Artamidae	8	55
Asphodelaceae	1	2
Asteraceae	18	36
Aturidae	2	2
Baetidae	2	4
Bdelloidea	2	7
Belonolaimidae	1	1
Belostomatidae	2	3
Bignoniaceae	1	1
Blattidae	1	1
Bogidiellidae	1	3
Boidae	4	6
Boraginaceae	11	40
Bostrichidae	1	2
Bothriuridae	1	1
Brachionidae	5	5
Brassicaceae	1	1
Bryaceae	1	1
Bufonidae	1	3
Buprestidae	1	1
Burhinidae	1	15
Byblidaceae	1	2
Cacatuidae	1	55
Caenidae	3	8
Campephagidae	4	59
Candonidae	10	20
Canthocamptidae	1	7
Caprimulgidae	1	1
Carphodactylidae	1	1
Caryophyllaceae	1	2
Centropodidae	2	5
Cephalobidae	1	1
Ceratopogonidae	10	17
Charadriidae	6	79
Cheluidae	1	2
Chenopodiaceae	9	15
Chironomidae	34	62
Chrysomelidae	1	2
Chydoridae	4	5
Cicadidae	1	5
Ciconiidae	1	15
Cleomaceae	4	15
Climacteridae	4	8
Clupeidae	1	1
Coenagrionidae	3	4
Columbidae	8	143
Combretaceae	1	7
Commelinaceae	1	2
Convolvulaceae	11	27
Copepoda	3	4
Corixidae	6	9
Corvidae	4	49
Cracticidae	5	97
Crambidae	1	1
Cuculidae	3	28

Cucurbitaceae	2	2
Culicidae	2	2
Cyclopidae	7	15
Cyperaceae	17	32
Cyprididae	10	19
Cypridopsidae	2	2
Daphniidae	1	1
Darwinulidae	3	5
Dasyuridae	7	43
Diatom Family	20	20
Dicaeidae	1	1
Dicruridae	3	144
Diplodactylidae	4	29
Dolichopodidae	1	2
Droseraceae	1	2
Dytiscidae	15	21
Ecnomidae	1	4
Ectinosomatidae	1	2
Elapidae	10	31
Elatinaceae	2	2
Elmidae	1	1
Emballonuridae	2	10
Enchytraeidae	1	3
Ephydridae	1	1
Estrilidae	5	112
Euchlanidae	2	3
Euglyphiidae	1	1
Euphorbiaceae	11	15
Eylaidae	1	1
Fabaceae	88	250
Falconidae	8	41
Felidae	1	1
Floscullariidae	1	1
Funariaceae	1	1
Gekkonidae	5	59
Gerridae	1	2
Gomphidae	1	1
Goodeniaceae	11	22
Hadziidae	1	2
Halcyonidae	6	89
Haliplidae	1	1
Haloragaceae	2	9
Hebridae	1	2
Hexarthridae	1	1
Hipposideridae	1	1
Hirundinidae	3	7
Hoplolaimidae	2	2
Hydraenidae	5	6
Hydrocharitaceae	2	3
Hydrochidae	5	9
Hydrodromidae	1	2
Hydrophilidae	14	19
Hydropsychidae	2	2
Hydroptilidae	2	2
Hygrobatidae	2	3
Hylidae	2	16
Ilyocryptidae	1	1
Ilyocyprididae	2	2
Isostictidae	1	1
Lamiaceae	2	2
Lecanidae	6	8
Lepadellidae	2	4
Lepidoptera	1	1
Leptoceridae	3	4
Lesquereusidae	1	1
Libellulidae	3	5
Limnesiidae	4	8
Limnichidae	1	1
Limnocytheridae	5	11
Loranthaceae	1	2
Lycaenidae	1	2
Lycosidae	3	4
Lymnaeidae	2	5
Lythraceae	2	7
Macropodidae	4	6
Maluridae	7	23
Malvaceae	28	60
Marsileaceae	2	2
Megadermatidae	1	26
Melanotaeniidae	2	5
Meliphagidae	16	157
Melitidae	2	7
Meropidae	2	66
Microcerberidae	1	6
Molluginaceae	2	4
Molossidae	1	7
Mononchidae	1	2
Moraceae	2	6
Motacillidae	1	2
Muridae	7	29
Muscidae	1	1
Myrmeleontidae	2	2
Myrtaceae	14	38
Mytilinidae	1	1
NO FAMILY	1	5
Naididae	9	20
Nematoda	4	4
Nepidae	1	1
Noctuidae	12	18
Nolidae	1	1
Nyctaginaceae	4	7
Ochteridae	1	1
Oligochaeta	1	1
Onagraceae	1	1
Orobanchaceae	1	1

Ostracoda	1	6
Otididae	1	1
Pachycephalidae	7	32
Papaveraceae	2	6
Paramelitidae	4	15
Parastenocarididae	1	1
Pardalotidae	4	48
Passifloraceae	1	1
Pedaliaceae	2	3
Pelecanidae	1	31
Phalacrocoracidae	2	60
Phasianidae	1	6
Phasmatidae	1	1
Philosciidae	1	2
Phreodrilidae	4	17
Phyllanthaceae	4	5
Planorbidae	4	7
Plantaginaceae	2	2
Pleidae	1	2
Plotosidae	1	2
Poaceae	70	194
Podargidae	1	1
Podicipedidae	2	13
Polycentropodidae	1	1
Polygalaceae	1	1
Pomatostomidae	2	27
Portulacaceae	6	9
Potamogetonaceae	1	3
Proteaceae	6	10
Psittacidae	9	81
Pygopodidae	5	19
Pyralidae	3	3
Rallidae	4	12
Recurvirostridae	1	9
Ricciaceae	2	2
Rotifera	1	1
Rubiaceae	4	8
Santalaceae	1	1
Sapindaceae	1	3
Scarabaeidae	1	1
Scincidae	22	121
Sciomyzidae	1	1
Scirtidae	1	1
Scolopacidae	4	16
Scrophulariaceae	1	1
Sididae	1	1
Simuliidae	2	5
Solanaceae	10	31
Sparassidae	2	8
Staphylinidae	1	1
Stratiomyidae	1	3
Strigidae	7	20
Sylviidae	4	39
Tabanidae	1	1
Tachyglossidae	1	1
Teloschistaceae	1	1
Terapontidae	1	5
Testudinellidae	1	2
Tettigoniidae	1	1
Theridiidae	1	1
Threskiornithidae	4	21
Thylacomyidae	1	3
Thymelaeaceae	1	2
Trichocercidae	2	3
Trichotriidae	1	2
Turbellaria	2	5
Turnicidae	2	9
Unionicolidae	4	7
Urodacidae	1	1
Varanidae	3	4
Verrucariaceae	1	1
Vespertilionidae	3	111
Violaceae	1	3
Zosteropidae	2	2
Zygophyllaceae	6	8
TOTAL	**1052**	**4176**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	30948	*Smicrornis brevirostris (Weebill)*			
2.		*Smicrornis brevirostris subsp. ochrogaster*			
Acariformes					
3.		*Acariformes sp.*			
4.		*Oribatida group 1 (PSS)*			
5.		*Oribatida group 5 (PSS)*			
6.		*Oribatida sp. 4 (PSW)*			
7.		*Trombidioidea sp.*			
Acarosporaceae					
8.		*Acarospora sp.*			
Accipitridae					
9.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
10.	25536	*Accipiter fasciatus (Brown Goshawk)*			
11.	24285	*Aquila audax (Wedge-tailed Eagle)*			
12.	24288	*Circus approximans (Swamp Harrier)*			
13.	24289	*Circus assimilis (Spotted Harrier)*			
14.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*		IA	
15.	24295	*Haliastur sphenurus (Whistling Kite)*			
16.		*Hieraaetus (Hieraaetus) morphnoides subsp. morphnoides*			
17.	25542	*Milvus migrans (Black Kite)*			
18.		*Pandion cristatus*			
Actinopodidae					
19.		*Missulena rutraspina*			
Aegothelidae					
20.	25544	*Aegotheles cristatus (Australian Owlet-nightjar)*			
Aeolosomatidae					
21.		*Aeolosoma sp. 1 (PSS)*			
22.		*Aeolosoma sp. 3 (PSS)*			
Aeshnidae					
23.		*Aeshnidae sp.*			
Agamidae					
24.	30833	*Amphibolurus longirostris (Long-nosed Dragon)*			
25.	24865	*Ctenophorus caudicinctus subsp. caudicinctus (Ring-tailed Dragon)*			
26.	24876	*Ctenophorus isolepis subsp. isolepis (Crested Dragon, Military Dragon)*			
27.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
28.		*Diporiphora bilineata*			
29.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
30.		*Pogona sp.*			
Aizoaceae					
31.	44240	*Trianthema cusackianum*			
32.	44261	*Trianthema oxycalyptrum var. oxycalyptrum*			
33.	44305	*Trianthema pilosum*			
34.	29095	*Zaleya galericulata subsp. galericulata*			
Alaudidae					
35.		*Mirafra (Mirafra) javanica subsp. woodwardi*			
36.	25545	*Mirafra javanica (Horsfield's Bushlark, Singing Bushlark)*			
Amaranthaceae					
37.	2645	*Achyranthes aspera (Chaff Flower)*			
38.	2646	*Aerva javanica (Kapok Bush)*	Y		
39.	2648	*Alternanthera denticulata (Lesser Joyweed)*			
40.	2651	*Alternanthera nana (Hairy Joyweed)*			
41.	2652	*Alternanthera nodiflora (Common Joyweed)*			
42.	11035	*Amaranthus induratus*			
43.	2663	*Amaranthus interruptus (Native Amaranth)*			
44.	2666	*Amaranthus mitchellii (Boggabri Weed)*			
45.	20018	*Amaranthus undulatus*			
46.	18361	*Gomphrena affinis subsp. pilbarensis*			
47.	2680	*Gomphrena cunninghamii*			
48.	17894	*Gomphrena leptophylla*		P3	
49.	11131	*Gomphrena sordida*			
50.	2690	*Ptilotus aervoides*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
51.	2696	*Ptilotus astrolasius*			
52.	2698	*Ptilotus auriculifolius*			
53.	2699	*Ptilotus axillaris (Mat Mulla Mulla)*			
54.	2704	*Ptilotus calostachyus (Weeping Mulla Mulla)*			
55.	2711	*Ptilotus clementii (Tassel Top)*			
56.	2725	*Ptilotus fusiformis*			
57.	11236	*Ptilotus gomphrenoides var. gomphrenoides*			
58.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
59.	2734	*Ptilotus incanus*			
60.	2741	*Ptilotus macrocephalus (Featherheads)*			
61.	2744	*Ptilotus mollis*		P4	
62.	41001	*Ptilotus nobilis subsp. nobilis (Yellow Tails)*			
63.	2749	*Ptilotus petiolatus*			
64.		*Ptilotus sp.*			
Ameiridae					
65.		*Stygonitocrella bispinosa*			
66.		*Stygonitocrella trispinosa*			
Anatidae					
67.	24312	*Anas gracilis (Grey Teal)*			
68.	24316	*Anas superciliosa (Pacific Black Duck)*			
69.	24318	*Aythya australis (Hardhead)*			
70.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
71.	24322	*Cygnus atratus (Black Swan)*			
72.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
Anhingidae					
73.		*Anhinga novaehollandiae*			
Anthelidae					
74.		*Anthela callixantha*			
Apocynaceae					
75.	6567	*Carissa lanceolata (Conkerberry, Marnuwiji)*			
76.	6584	*Cynanchum floribundum (Dumara Bush, Tjipa)*			
77.	16537	*Marsdenia angustata*			
Araliaceae					
78.	6278	*Trachymene oleracea*			
79.	19043	*Trachymene oleracea subsp. oleracea*			
Araneidae					
80.		*Araneus sp.*			
81.		*Cyrtobill darwini*			
Arctiidae					
82.		*Amata sp.*			
83.		*Utetheisa lotrix*			
84.		*Utetheisa sp.*			
Ardeidae					
85.	25559	*Ardea intermedia (Intermediate Egret)*			
86.	41324	*Ardea modesta (Eastern Great Egret)*		IA	
87.	24341	*Ardea pacifica (White-necked Heron)*			
88.	24346	*Butorides striatus subsp. stagnatilis (Striated Heron, Mangrove Heron)*			
89.		*Egretta garzetta*			
90.		*Egretta novaehollandiae*			
91.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
Arrenuridae					
92.		*Arrenurus ensifer*			
93.		*Arrenurus tripartitus*			
94.		*Arrenurus vanderpalae*			
Artamidae					
95.		*Artamus (Angroyan) cinereus subsp. melanops*			
96.		*Artamus (Angroyan) minor subsp. derbyi*			
97.		*Artamus (Angroyan) minor subsp. minor*			
98.		*Artamus (Artamus) leucorynchus*			
99.		*Artamus (Campbellornis) personatus*			
100.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
101.	25567	*Artamus leucorynchus (White-breasted Woodswallow)*			
102.	24355	*Artamus minor (Little Woodswallow)*			
Asphodelaceae					

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
103.	36277	*Aloe vera var. officinalis*	Y		
Asteraceae					
104.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
105.	7893	*Calocephalus knappii*			
106.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
107.	7919	*Centipeda minima (Spreading Sneezewood, Kanjirralaa)*			
108.	19762	*Centipeda minima subsp. macrocephala*			
109.	12614	*Chrysocephalum pterochaetum*			
110.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
111.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
112.	13494	*Pentalepis trichodesmoides*			
113.	17816	*Pluchea ferdinandi-muelleri*			
114.	8168	*Pluchea rubelliflora*			
115.		*Pluchea sp.*			
116.	8170	*Pluchea tetranthera*			
117.	8192	*Pterocaulon sphacelatum (Apple Bush)*			
118.	13310	*Rhodanthe margarethae*			
119.	8235	*Streptoglossa bubakii*			
120.	8237	*Streptoglossa decurrens*			
121.	8240	*Streptoglossa odora*			
Aturidae					
122.		*Albia rectifrons*			
123.		*Axonopsella sp.*			
Baetidae					
124.		*Baetidae sp.*			
125.		*Cloeon sp.*			
Bdelloidea					
126.		*Bdelloidea sp.*			
127.		*Bdelloidea sp. 2:2*			
Belonolaimidae					
128.		*Morulaimus soldus*			Y
Belostomatidae					
129.		*Diplonychus eques*			
130.		*Lethocerus (Lethocerus) distinctifemur*			
Bignoniaceae					
131.	7115	*Dolichandrone heterophylla (Lemonwood)*			
Blattidae					
132.		*Desmozosteria flava*			Y
Bogidiellidae					
133.		*Bogidiellidae sp.*			
Boidae					
134.	25318	*Antaresia perthensis (Pygmy Python)*			
135.	25241	*Antaresia stimsoni subsp. stimsoni (Stimson's Python)*			
136.	25238	*Liasis olivaceus subsp. barroni (Pilbara Olive Python)*		T	
137.		*Liasis sp.*			
Boraginaceae					
138.	6705	*Heliotropium crispatum*			
139.	6706	*Heliotropium cunninghamii*			
140.	6712	*Heliotropium heteranthum*			
141.	17393	*Heliotropium murinum*		P3	
142.	17309	*Heliotropium pachyphyllum*			
143.	17313	*Heliotropium skeleton*			
144.	29535	*Heliotropium sp. Ord River (W. Fitzgerald 1611)*			
145.	17315	*Heliotropium tanythrix*			
146.	6718	*Heliotropium tenuifolium (Mamukata)*			
147.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
148.	11750	*Trichodesma zeylanicum var. zeylanicum*			
Bostrichidae					
149.		*Bostrychopsis jesuita*			
Bothriuridae					
150.		*Cercophonius granulosus*			
Brachionidae					
151.		*Brachionus budapestinensis*			

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152.		*Brachionus calyciflorus amphiceros*			Y
153.		*Brachionus plicatilis s.l.*			
154.		*Keratella procurva*			
155.		*Platyias quadricornis*			
Brassicaceae					
156.	3038	*Lepidium pholidogynum*			
Bryaceae					
157.		*Bryum pachytheca*			
Bufonidae					
158.	42306	*Platyplectrum spenceri (Centralian Burrowing Frog)*			
Buprestidae					
159.		*Chalcophorotaenia australasiae*			
Burhinidae					
160.	24359	*Burhinus grallarius (Bush Stone-curlew)*			
Byblidaceae					
161.	18073	*Byblis filifolia*			
Cacatuidae					
162.		*Eolophus roseicapillus*			
Caenidae					
163.		*Tasmanocoenis arcuata*			
164.		*Tasmanocoenis sp. M (PSW)*			
165.		*Tasmanocoenis sp. P (PSW)*			
Campephagidae					
166.		*Coracina (Coracina) papuensis*			
167.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
168.	24363	*Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)*			
169.	24367	*Lalage tricolor (White-winged Triller)*			
Candonidae					
170.		*'Amphitritecandona' 'seconda' (PSS)*			Y
171.		*'Kencandona' 'harleyi' (PSS)*			
172.		*'Leicacandona' 'halsei' (PSS)*			Y
173.		*'Leicacandona' 'jimi' (PSS)*			Y
174.		*'Leicacandona' 'makra' (PSS)*			Y
175.		*Areacandona cf. sp. 1 (PSS)*			
176.		*Candonid Genus 6 sp. 1 (PSS)*			Y
177.		*Candonopsis tenuis*			
178.		*Humphreyscandona 'capillus' (PSS)*			
179.		*Humphreyscandona cf. 'capillus' (PSS)*			
Canthocamptidae					
180.		*Elaphoidella humphreysi*			
Caprimulgidae					
181.	24368	*Eurostopodus argus (Spotted Nightjar)*			
Carphodactylidae					
182.	24969	*Nephrurus levis subsp. pilbarensis*			
Caryophyllaceae					
183.	2903	*Polycarpaea longiflora*			
Centropodidae					
184.	25600	*Centropus phasianinus (Pheasant Coucal)*			
185.	24430	*Centropus phasianinus subsp. highami (Pheasant Coucal)*			
Cephalobidae					
186.		*Acrobeles sp.*			Y
Ceratopogonidae					
187.		*Atrichopogon sp. P1 (PSW)*			
188.		*Bezzia sp. P1 (PSW)*			
189.		*Bezzia sp. P2 (PSW)*			
190.		*Culicoides sp.*			
191.		*Culicoides sp. P1 (PSW)*			
192.		*Dasyheleinae sp. P1 (PSW)*			
193.		*Dasyheleinae sp. P2 (PSW)*			
194.		*Monohelea sp. P1 (PSW)*			
195.		*Monohelea sp. P2 (PSW)*			
196.		*Nilobezzia sp. P1 (PSW)*			

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Charadriidae					
197.	24373	*Charadrius melanops (Black-fronted Dotterel)*			
198.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
199.	24378	*Charadrius veredus (Oriental Plover)*		IA	
200.		*Elseyornis melanops*			
201.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
202.	25577	*Vanellus miles (Masked Lapwing)*			
Cheluidae					
203.	25339	*Chelodina steindachneri (Flat-shelled Turtle)*			
Chenopodiaceae					
204.	33596	*Dysphania melanocarpa forma leucocarpa*			
205.	2504	*Dysphania plantaginella*			
206.	11653	*Dysphania rhadinostachya subsp. inflata*			
207.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
208.	12064	*Enchylaena tomentosa var. tomentosa (Barrier Saltbush)*			
209.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
210.		*Salsola sp.*			
211.	2604	*Sclerolaena costata*			
212.	2617	*Sclerolaena hostilis*			
Chironomidae					
213.		*Ablabesmyia hilli*			
214.		*Chironomus aff. alternans (V24) (CB)*			
215.		*Cladotanytarsus aff K4 (PSW)*			
216.		*Coelopynia pruinosa*			
217.		*Cricotopus albitarsus*			
218.		*Cryptochironomus griseidorsum*			
219.		*Dicrotendipes 'CA1' Pilbara type 3 (= 'K4', P3)) (PSW)*			
220.		*Dicrotendipes P5 (=balciunasi?) (PSW)*			
221.		*Dicrotendipes jobetus*			
222.		*Harnischia K1 (PSW)*			
223.		*Larsia albiceps*			
224.		*Microchironomus 'K1' (PSW)*			
225.		*Nanocladius sp. 1 (VCD7)*			
226.		*Parachironomus 'K2' (PSW)*			
227.		*Parakiefferiella sp P1 (PSW)*			
228.		*Paramerina sp C (PSW)*			
229.		*Paramerina sp.A (parva?) (SAP)*			
230.		*Paratanytarsus sp.*			
231.		*Paratanytarsus sp. P1 (PSW)*			
232.		*Pentaneurini sp. P1 (PSW)*			
233.		*Polypedilum leei*			
234.		*Polypedilum sp. K1 (PSW)*			
235.		*Polypedilum watsoni*			
236.		*Procladius Pilbara sp. 1 (PSW)*			
237.		*Procladius paludicola*			
238.		*Rheocricotopus sp. P1 (PSW)*			
239.		*Rheotanytarsus trivittatus*			
240.		*Tanytarsus sp. D (SAP)*			
241.		*Tanytarsus sp. H (SAP)*			
242.		*Tanytarsus sp. P1 (PSW)*			
243.		*Tanytarsus sp. P10 (PSW)*			
244.		*Tanytarsus sp. P7 (PSW)*			
245.		*Tanytarsus sp. P9 (PSW)*			
246.		*Thienemanniella sp. P1 (PSW)*			
Chrysomelidae					
247.		*Arsipoda sp.*			Y
Chydoridae					
248.		*Alona rigidicaudis*			
249.		*Dunhevedia crassa*			
250.		*Ephemeroporus barroisi s.l.*			
251.		*Leberis cf. diaphanus (striate) (PSW)*			
Cicadidae					
252.		*Tryella stalkeri*			
Ciconiidae					
253.	25578	*Ephippiorhynchus asiaticus (Black-necked Stork)*			

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Cleomaceae					
254.	2985	*Cleome oxalidea*			
255.	2987	*Cleome uncifera*			
256.	29101	*Cleome uncifera subsp. uncifera*			
257.	2988	*Cleome viscosa (Tickweed, Tjinduwadhu)*			
Climacteridae					
258.		*Climacteris (Climacteris) melanura subsp. melanura*			
259.		*Climacteris (Climacteris) melanura subsp. wellsi*			
260.	25582	*Climacteris melanura (Black-tailed Treecreeper)*			
261.	24395	*Climacteris melanura subsp. wellsi (Black-tailed Treecreeper)*			
Clupeidae					
262.		*Nematalosa erebi*			
Coenagrionidae					
263.		*Argiocnemis rubescens*			
264.		*Ischnura aurora aurora*			
265.		*Pseudagrion microcephalum*			
Columbidae					
266.	24401	*Geopelia cuneata (Diamond Dove)*			
267.		*Geopelia humeralis subsp. headlandi*			
268.	25585	*Geopelia striata (Zebra Dove)*			
269.	24403	*Geopelia striata subsp. placida (Peaceful Dove)*			
270.		*Geophaps (Lophophaps) plumifera subsp. ferruginea*			
271.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
272.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
273.	24409	*Phaps chalcoptera (Common Bronzewing)*			
Combretaceae					
274.	45698	*Terminalia circumalata*			
Commelinaceae					
275.	1165	*Commelina ensifolia (Wandering Jew, Buargu)*			
Convolvulaceae					
276.	11167	*Bonamia erecta*			
277.	6606	*Bonamia media*			
278.	6608	*Bonamia pannosa*			
279.	6609	*Bonamia rosea (Felty Bellflower)*			
280.	11200	*Evolvulus alsinoides var. villosicalyx*			
281.	6623	*Ipomoea coptica*			
282.	6637	*Ipomoea polymorpha*			
283.	13553	*Jacquemontia pannosa*			
284.	6653	*Polymeria ambigua (Morning Glory)*			
285.	17513	*Polymeria lanata*			
286.		*Polymeria sp.*			
Copepoda					
287.		*Calanoida sp.*			
288.		*Cyclopoida sp.*			
289.		*Harpacticoida sp*			
Corixidae					
290.		*Agraptocorixa eurynome*			
291.		*Micronecta adelaidae*			
292.		*Micronecta adelaidae (ex P4)*			
293.		*Micronecta annae illiesi*			
294.		*Micronecta micra*			
295.		*Micronecta nsp. P1 (PSW)*			
Corvidae					
296.	24416	*Corvus bennetti (Little Crow)*			
297.	25593	*Corvus orru (Torresian Crow)*			
298.	24418	*Corvus orru subsp. cecilae (Western Crow)*			
299.		*Corvus sp.*			
Cracticidae					
300.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
301.		*Cracticus nigrogularis subsp. picatus*			
302.	25595	*Cracticus tibicen (Australian Magpie)*			
303.		*Cracticus tibicen subsp. longirostris*			
304.	25596	*Cracticus torquatus (Grey Butcherbird)*			
Crambidae					

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305.		*Eclipsiodes homora*			Y
Cuculidae					
306.		*Cacomantis (Vidgenia) pallidus*			
307.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
308.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
Cucurbitaceae					
309.	33030	*Austrobryonia pilbarensis*			
310.	41721	*Cucumis variabilis*			
Culicidae					
311.		*Anopheles annulipes s.l.*			
312.		*Culex sp.*			
Cyclopidae					
313.		*Australoeucyclops karaytugi*			
314.		*Eucyclops australiensis*			
315.		*Mesocyclops darwini*			
316.		*Mesocyclops notius*			
317.		*Metacyclops sp.*			
318.		*Microcyclops varicans*			
319.		*Paracyclops sp. 8 (PSW)*			
Cyperaceae					
320.	751	*Bulbostylis burbidgeae*		P4	
321.	789	*Cyperus difformis (Rice Sedge)*			
322.	12808	*Cyperus hesperius*			
323.	798	*Cyperus iria*			
324.	799	*Cyperus ixiocarpus*			
325.		*Cyperus sp.*			
326.	814	*Cyperus squarrosus*			
327.	818	*Cyperus vaginatus (Stiffleaf Sedge)*			
328.	823	*Eleocharis atropurpurea*			
329.	858	*Fimbristylis leucocolea*			
330.	862	*Fimbristylis microcarya*			
331.	865	*Fimbristylis neilsonii*			
332.	878	*Fimbristylis rara*			
333.	12159	*Fimbristylis simulans*			
334.	952	*Lipocarpha microcephala*			
335.	963	*Schoenoplectus laevis*			
336.	16257	*Schoenoplectus subulatus*			
Cyprididae					
337.		*Bennelongia sp.*			
338.		*Bennelongia sp.2 (PSS)*			
339.		*Cypretta baylyi*			
340.		*Cypretta seurati*			
341.		*Cypretta sp PSW074*			
342.		*Cypricercus salinus*			
343.		*Cyprididae sp.*			
344.		*Heterocypris sp.*			
345.		*Ilyodromus sp BOS25*			
346.		*Stenocypris major*			
Cypridopsidae					
347.		*Cypridopsis sp.*			
348.		*Cypridopsis vidua*			
Daphniidae					
349.		*Simocephalus heilongjiangensis*			
Darwinulidae					
350.		*Penthesilenula brasiliensis*			
351.		*Vestalenula marmonieri*			
352.		*Vestalenula matildae*			
Dasyuridae					
353.	24091	*Dasykaluta rosamondae (Little Red Kaluta)*			
354.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
355.	24095	*Ningaui timealeyi (Pilbara Ningaui)*			
356.	24105	*Pseudantechinus roryi (Rory's Pseudantechinus)*			
357.	24115	*Sminthopsis longicaudata (Long-tailed Dunnart)*		P4	
358.	24116	*Sminthopsis macroura (Stripe-faced Dunnart)*			
359.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			

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Diatom Family					
360.		*Caloneis pulchra Messikommer*			
361.		*Craticula cuspidata (Grun. ex. Van Heurck) Mann*			
362.		*Cymbella cymbiformis Ag.*			
363.		*Epithemia argus (Ehr.) Kütz.*			
364.		*Epithemia smithii Carruthers*			
365.		*Epithemia turgida var. granulata*			Y
366.		*Fragilaria ulna (Nitz.) Lange Bertalot*			
367.		*Gyrosigma attenuatum (Kütz.) Rabh.*			
368.		*Mastogloia elliptica (Ag.) Cl.*			
369.		*Mastogloia elliptica var. danseii (thwaites) grun.*			
370.		*Mastogloia smithii Thwaites*			
371.		*Navicula spicula (Hickie) Cl.*			
372.		*Navicula subrhynchocephala Hust.*			
373.		*Nitzschia amphibia Grun.*			
374.		*Nitzschia compressa var. elongata (grun.) lange-bertalot*			
375.		*Nitzschia constricta (Greg.) Grun.*			
376.		*Nitzschia desertorum Hust.*			
377.		*Pleurosigma delicatulum W. Sm.*			
378.		*Pleurosigma elongatum W. Sm.*			
379.		*Rhopalodia gibba (Ehr.) O. Mull.)*			
Dicaeidae					
380.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
Dicruridae					
381.	24443	*Grallina cyanoleuca (Magpie-lark)*			
382.		*Rhipidura (Sauloprocta) leucophrys subsp. picata*			
383.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Diplodactylidae					
384.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
385.	24944	*Diplodactylus savagei (Southern Pilbara Beak-faced Gecko)*			
386.	30933	*Lucasium stenodactylum*			
387.	30934	*Lucasium wombeyi*			
Dolichopodidae					
388.		*Dolichopodidae sp.*			
Droseraceae					
389.	43544	*Drosera finlaysoniana*			
Dytiscidae					
390.		*Allodessus bistrigatus*			
391.		*Copelatus nigrolineatus*			
392.		*Cybister tripunctatus*			
393.		*Hydroglyphus grammopterus (=trilineatus)*			
394.		*Hydroglyphus leai*			
395.		*Hydroglyphus orthogrammus*			
396.		*Hydrovatus weiri*			
397.		*Hyphydrus lyratus*			
398.		*Laccophilus sharpi*			
399.		*Limbodessus compactus*			
400.		*Necterosoma regulare*			
401.		*Platynectes sp.*			
402.		*Sternopriscus pilbarensis*			
403.		*Sternopriscus sp.*			
404.		*Tiporus tambreyi*			
Ecnomidae					
405.		*Ecnomus pilbarensis*			
Ectinosomatidae					
406.		*Pseudectinosoma galassiae*			
Elapidae					
407.	25243	*Acanthophis pyrrhus (Desert Death Adder)*			
408.	25332	*Acanthophis wellsi (Pilbara Death Adder)*			
409.	25297	*Demansia rufescens (Rufous Whipsnake)*			
410.	25301	*Furina ornata (Moon Snake)*			
411.	25261	*Pseudechis australis (Mulga Snake)*			
412.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
413.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
414.		*Simoselaps semifasciatus*			

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415.	25269	*Suta fasciata (Rosen's Snake)*			
416.	25311	*Vermicella snelli*			
Elatinaceae					
417.	5183	*Bergia ammannioides*			
418.	11912	*Bergia perennis subsp. perennis*			
Elmidae					
419.		*Austrolimnius WA sp. 2 (= adult sp WA 2) (PSW)*			
Emballonuridae					
420.	24174	*Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)*			
421.	24175	*Taphozous georgianus (Common Sheathtail-bat)*			
Enchytraeidae					
422.		*Enchytraeus Pilbara sp. 1 (PSS)*			
Ephydridae					
423.		*Ephydridae sp.*			
Estrilidae					
424.	24631	*Emblema pictum (Painted Finch)*			
425.		*Neochmia (Neochmia) ruficauda subsp. subclarescens*			
426.	25685	*Neochmia ruficauda (Star Finch)*			
427.	30870	*Taeniopygia guttata (Zebra Finch)*			
428.	30871	*Taeniopygia guttata subsp. castanotis (Zebra Finch)*			
Euchlanidae					
429.		*Euchlanis cf. deflexa (6 primary teeth) (PSW)*			
430.		*Euchlanis dilatata*			
Euglyphiidae					
431.		*Euglypha sp.*			
Euphorbiaceae					
432.	17422	*Adriana tomentosa var. tomentosa*			
433.	35303	*Euphorbia australis var. subtomentosa*			
434.	9048	*Euphorbia careyi*			
435.	4622	*Euphorbia clementii*		P2	
436.	4630	*Euphorbia inappendiculata*			
437.	42860	*Euphorbia inappendiculata var. inappendiculata*		P2	
438.		*Euphorbia sp.*			
439.	12097	*Euphorbia tannensis subsp. eremophila (Desert Spurge)*			
440.	42879	*Euphorbia trigonosperma*			
441.	42876	*Euphorbia vaccaria var. vaccaria*			
442.	4650	*Euphorbia wheeleri*			
Eylaidae					
443.		*Eylais sp.*			
Fabaceae					
444.	3198	*Acacia acradenia*			
445.	3209	*Acacia ampliceps*			
446.	3214	*Acacia ancistrocarpa (Fitzroy Wattle)*			
447.	3241	*Acacia bivenosa*			
448.	17013	*Acacia colei var. colei*			
449.	13502	*Acacia coriacea subsp. pendens*			
450.	14087	*Acacia cyperophylla var. omearana*		P1	
451.	3326	*Acacia eriopoda (Broome Pindan Wattle)*			
452.	44582	*Acacia eriopoda x trachycarpa*			
453.	3377	*Acacia inaequilatera (Baderi)*			
454.	3434	*Acacia maitlandii (Maitland's Wattle)*			
455.	3471	*Acacia orthocarpa (Needleleaf Wattle)*			
456.	3501	*Acacia ptychophylla*			
457.	29015	*Acacia pyrifolia var. pyrifolia*			
458.	15203	*Acacia sabulosa*			
459.	13078	*Acacia sclerosperma subsp. sclerosperma*			
460.	29135	*Acacia sericophylla*			
461.		*Acacia sp.*			
462.	3551	*Acacia sphaerostachya*			
463.	3553	*Acacia spondylophylla*			
464.	19456	*Acacia stellaticeps*			
465.	13070	*Acacia synchronicia*			
466.	3579	*Acacia trachycarpa (Minni Ritchi, Balgali)*			
467.	29992	*Acacia trachycarpa x tumida var. pilbarensis*			
468.	3585	*Acacia tumida (Pindan Wattle, Walgali)*			

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469.	20319	*Acacia tumida var. pilbarensis*			
470.	19641	*Acacia tumida var. tumida*			
471.	3680	*Aeschynomene indica (Budda Pea)*			
472.	17147	*Alysicarpus muelleri*			
473.	12757	*Bauhinia cunninghamii*			
474.		*Bauhinia gilva*			Y
475.	10972	*Cajanus marmoratus*			
476.		*Cassia sp.*			
477.	3774	*Crotalaria cunninghamii (Green Birdflower, Bilbun)*			
478.	20175	*Crotalaria cunninghamii subsp. sturtii*			
479.	20179	*Crotalaria medicaginea var. neglecta*			
480.	11231	*Crotalaria novae-hollandiae subsp. novae-hollandiae*			
481.	19398	*Crotalaria ramosissima*			
482.	17433	*Cullen badocanum*			
483.	17439	*Cullen lachnostachys*			
484.	17118	*Cullen leucanthum*			
485.	17217	*Cullen pallidum*			
486.	17120	*Cullen pogonocarpum*			
487.	15714	*Cullen stipulaceum*			
488.	11117	*Gompholobium simplicifolium*			
489.	3973	*Indigofera colutea (Sticky Indigo)*			
490.	3978	*Indigofera hirsuta (Hairy Indigo)*			
491.	3980	*Indigofera linifolia*			
492.	3982	*Indigofera monophylla*			
493.	3987	*Indigofera trita*			
494.	31035	*Indigofera trita subsp. trita*			
495.	3989	*Isotropis atropurpurea (Poison Sage)*			
496.	3613	*Leucaena leucocephala (Leucaena)*	Y		
497.	3614	*Neptunia dimorphantha (Sensitive Plant)*			
498.	3675	*Petalostylis labicheoides (Slender Petalostylis)*			
499.	4190	*Rhynchosia australis (Rhynchosia)*			
500.	4191	*Rhynchosia minima (Rhynchosia)*			
501.	17720	*Rothia indica subsp. australis*		P1	
502.	17645	*Senna artemisioides*			
503.	12280	*Senna artemisioides subsp. oligophylla*			
504.	18449	*Senna glaucifolia*			
505.	18346	*Senna glutinosa*			
506.	12307	*Senna glutinosa subsp. glutinosa*			
507.	12309	*Senna glutinosa subsp. pruinosa*			
508.	12312	*Senna notabilis*			
509.	18450	*Senna symonii*			
510.	12319	*Senna venusta*			
511.	4196	*Sesbania cannabina (Sesbania Pea)*			
512.	4198	*Sesbania formosa (White Dragon Tree)*			
513.		*Sesbania grandiflora*			
514.	4223	*Swainsona decurrens*			
515.	12356	*Swainsona formosa*			
516.	4231	*Swainsona kingii*			
517.	4244	*Swainsona stenodonta*			
518.	4253	*Templetonia hookeri*			
519.		*Tephrosia brachyodon var. cloncurriensis*			
520.	19531	*Tephrosia rosea var. clementii*			
521.	4281	*Tephrosia simplicifolia*			
522.	15947	*Tephrosia sp. B Kimberley Flora (C.A. Gardner 7300)*			
523.	17768	*Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)*			
524.	41811	*Tephrosia sp. Fortescue (A.A. Mitchell 606)*			
525.	42442	*Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)*			
526.	13924	*Tephrosia spechtii*			
527.	4285	*Tephrosia supina*			
528.	4287	*Tephrosia virens*			
529.	30716	*Vachellia farnesiana (Mimosa Bush)*	Y		
530.	4323	*Vigna lanceolata (Maloga Vigna, Wega)*			
531.	31391	*Vigna sp. Hamersley Clay (A.A. Mitchell PRP 113)*			

Falconidae

532.		*Falco (Ieracidea) berigora subsp. berigora*			
533.		*Falco (Ieracidea) berigora subsp. occidentalis*			
534.		*Falco (Tinnunculus) cenchroides*			
535.	25621	*Falco berigora (Brown Falcon)*			
536.	25622	*Falco cenchroides (Australian Kestrel)*			
537.	24473	*Falco hypoleucos (Grey Falcon)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
				T	
538.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
539.	24476	*Falco subniger (Black Falcon)*			
Felidae					
540.	24041	*Felis catus (Cat)*	Y		
Flosculariidae					
541.		*Octotrocha speciosa*			Y
Funariaceae					
542.		*Funaria sp.*			
Gekkonidae					
543.	24956	*Gehyra pilbara*			
544.	24958	*Gehyra punctata*			
545.	24959	*Gehyra variegata*			
546.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
547.	24962	*Heteronotia spelea (Desert Cave Gecko)*			
Gerridae					
548.		*Limnogonus fossarum gilguy*			
Gomphidae					
549.		*Austroepigomphus (Xerogomphus) gordoni*			
Goodeniaceae					
550.	7424	*Dampiera candicans*			
551.	7509	*Goodenia forrestii*			
552.	7521	*Goodenia lamprosperma*			
553.	7526	*Goodenia microptera*			
554.	12552	*Goodenia muelleriana*			
555.	12574	*Goodenia prostrata*			
556.		*Goodenia sp.*			
557.	10982	*Goodenia stobbsiana*			
558.	7558	*Goodenia triodiophila*			
559.	7560	*Goodenia vilmoriniae*			
560.	13178	*Scaevola amblyanthera var. centralis*			
Hadziidae					
561.		*Nedsia sp.*			
Halcyonidae					
562.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
563.	24304	*Dacelo leachii subsp. leachii (Blue-winged Kookaburra)*			
564.		*Todiramphus (Cyanalcyon) pyrrhopygius*			
565.		*Todiramphus (Todiramphus) sanctus subsp. sanctus*			
566.	42351	*Todiramphus pyrrhopygius (Red-backed Kingfisher)*			
567.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Haliplidae					
568.		*Haliplus pilbarensis*			
Haloragaceae					
569.	23465	*Haloragis gossei var. gossei*			
570.	6201	*Myriophyllum verrucosum (Red Water Milfoil)*			
Hebridae					
571.		*Merragata hackeri*			
Hexarthridae					
572.		*Hexarthra sp P1 3-4/3-4 (PSW)*			Y
Hipposideridae					
573.	43368	*Rhinonicteris aurantia (Orange Leafnosed-bat)*		T	
Hirundinidae					
574.	24489	*Hirundo ariel (Fairy Martin)*			
575.	24491	*Hirundo neoxena (Welcome Swallow)*			
576.		*Petrochelidon (Petrochelidon) ariel*			
Hoplolaimidae					
577.		*Helicotylenchus sp.*			
578.		*Scutellonema sp.*			
Hydraenidae					
579.		*Hydraena brittoni*			
580.		*Hydraena nr. rudallensis (PSW)*			
581.		*Hydraena sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
582.		*Limnebius sp.*			
583.		*Ochthebius sp. P2 (PSW)*			
Hydrocharitaceae					
584.	139	*Najas tenuifolia (Water Nymph)*			
585.	17793	*Vallisneria annua*			
Hydrochidae					
586.		*Hydrochus burdekinensis*			
587.		*Hydrochus eurypleuron*			
588.		*Hydrochus group 3 "black" (PSW)*			
589.		*Hydrochus interioris*			
590.		*Hydrochus sp. P1 (PSW)*			
Hydrodromidae					
591.		*Hydrodroma sp.*			
Hydrophilidae					
592.		*Berosus dallasi*			
593.		*Berosus nr josephenae (was Pilbara sp 3) (PSW)*			
594.		*Berosus pulchellus*			
595.		*Chaetarthria nigerrimus*			
596.		*Enochrus deserticola*			
597.		*Georissus sp.*			
598.		*Helochares tatei*			
599.		*Laccobius matthewsi*			
600.		*Paracymus pygmaeus*			
601.		*Paracymus spenceri*			
602.		*Paranacaena horni*			
603.		*Regimbartia attenuata*			
604.		*Sternolophus australis*			
605.		*Sternolophus marginicollis*			
Hydropsychidae					
606.		*Cheumatopsyche dostinei*			
607.		*Cheumatopsyche wellsae*			
Hydroptilidae					
608.		*Hellyethira sp.*			
609.		*Orthotrichia sp.*			
Hygrobatidae					
610.		*Australiobates sp. P3 (nr crassisetus) (PSW)*			
611.		*Coaustraliobates minor*			
Hylidae					
612.	25375	*Cyclorana maini (Sheep Frog)*			
613.	25392	*Litoria rubella (Little Red Tree Frog)*			
Ilyocryptidae					
614.		*Ilyocryptus raridentatus*			
Ilyocyprididae					
615.		*Ilyocypris 'spiculata' (ms name) (SAP)*			
616.		*Ilyocypris australiensis*			
Isostictidae					
617.		*Eurysticta coolawanyah*			
Lamiaceae					
618.	13694	*Clerodendrum floribundum var. floribundum*			
619.		*Pityrodia sp.*			
Lecanidae					
620.		*Lecane batillifer*			
621.		*Lecane bulla*			
622.		*Lecane closterocerca*			
623.		*Lecane hornemanni*			
624.		*Lecane papuana*			
625.		*Lecane signifera*			
Lepadellidae					
626.		*Colurella sp.*			
627.		*Lepadella ovalis*			
Lepidoptera					
628.		*Lepidoptera (non-pyralid) Pilbara sp. 2 (hairy) (PSW)*			Y

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Leptoceridae					
629.		*Oecetis sp. Pilbara 4 (PSW)*			
630.		*Oecetis sp. Pilbara 8 (PSW)*			
631.		*Triplectides ciuskus seductus*			
Lesquereusidae					
632.		*Lesquereusia spiralis*			
Libellulidae					
633.		*Crocothemis nigrifrons*			
634.		*Diplacodes haematodes*			
635.		*Orthetrum pruinosum migratum*			
Limnesiidae					
636.		*Limnesia maceripalpis*			
637.		*Limnesia parasolida*			
638.		*Limnesia sp. 4 (PSW)*			
639.		*Limnesia sp. 7 (PSW)*			
Limnichidae					
640.		*Limnichidae sp. P1*			
Limnocytheridae					
641.		*Gomphodella 'hirsuta' (PSS)*			
642.		*Gomphodella 'quasihirsuta' (PSS)*			
643.		*Limnocythere dorsosicula*			
644.		*Limnocythere sp.*			
645.		*Limnocythere sp. 1 (PSS)*			
Loranthaceae					
646.	2396	*Lysiana casuarinae*			
Lycaenidae					
647.		*Nacaduba biocellata subsp. biocellata*			
Lycosidae					
648.		*Hogna hickmani*			
649.		*Lycosa sp.*			
650.		*Venatrix arenaris*			
Lymnaeidae					
651.		*Austropeplea sp.*			
652.		*Austropeplea vinosa*			
Lythraceae					
653.	5277	*Ammannia baccifera*			
654.	5278	*Ammannia multiflora*			
Macropodidae					
655.	24135	*Macropus robustus subsp. erubescens (Euro, Biggada)*			
656.		*Macropus robustus subsp. robustus*			
657.	24136	*Macropus rufus (Red Kangaroo, Marlu)*			
658.	24144	*Petrogale rothschildi (Rothschild's Rock-wallaby)*			
Maluridae					
659.	24540	*Amytornis striatus subsp. whitei (Striated Grasswren)*			
660.		*Malurus (Leggeornis) lamberti subsp. assimilis*			
661.		*Malurus (Malurus) splendens subsp. splendens*			
662.		*Malurus (Musciparus) leucopterus subsp. leuconotus*			
663.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
664.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
665.	24549	*Malurus leucopterus subsp. leuconotus (White-winged Fairy-wren)*			
Malvaceae					
666.	4886	*Abutilon amplum*			
667.	4895	*Abutilon lepidum*			
668.	40910	*Androcalva luteiflora (Yellow-flowered Rulingia)*			
669.	18410	*Corchorus carnarvonensis*			
670.	4857	*Corchorus elachocarpus*			
671.	17339	*Corchorus incanus*			
672.	25847	*Corchorus incanus subsp. incanus*			
673.	4862	*Corchorus parviflorus*			
674.	4867	*Corchorus walcottii (Woolly Corchorus)*			
675.	4910	*Gossypium australe (Native Cotton)*			
676.	4918	*Gossypium robinsonii (Wild Cotton)*			
677.	29317	*Hibiscus austrinus var. austrinus*			
678.	4930	*Hibiscus goldsworthii*			

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679.	4933	*Hibiscus leptocladus*			
680.	11651	*Hibiscus sturtii var. campylochlamys*			
681.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
682.	5051	*Melhania oblongifolia*			
683.	31758	*Sida arsiniata*			
684.	4972	*Sida clementii*			
685.	18149	*Sida rohlenae subsp. rohlenae*			
686.	33698	*Sida sp. Pilbara (A.A. Mitchell PRP 1543)*			
687.		*Sida sp. Pilbara (A.A.Mitchell PRP1543)*			
688.	4875	*Triumfetta chaetocarpa (Urchins)*			
689.	14942	*Triumfetta maconochieana*			
690.	17317	*Triumfetta propinqua*			
691.		*Triumfetta sp.*			
692.	5106	*Waltheria indica*			
693.	5107	*Waltheria virgata*			
Marsileaceae					
694.	75	*Marsilea exarata*			
695.		*Marsilea sp.*			
Megadermatidae					
696.	24180	*Macroderma gigas (Ghost Bat)*		P4	
Melanotaeniidae					
697.		*Melanotaenia australis*			
698.		*Melanotaenia sp.*			
Meliphagidae					
699.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
700.		*Conopophila (Conopophila) rufogularis*			
701.		*Epthianura (Parepthianura) tricolor*			
702.	42314	*Gavicalis virescens (Singing Honeyeater)*			
703.		*Lichmera (Lichmera) indistincta subsp. indistincta*			
704.	25661	*Lichmera indistincta (Brown Honeyeater)*			
705.		*Manorina (Myzantha) flavigula*			
706.		*Manorina (Myzantha) flavigula subsp. lutea*			
707.		*Manorina (Myzantha) flavigula subsp. wayensis*			
708.	24583	*Manorina flavigula (Yellow-throated Miner)*			
709.		*Melithreptus (Eidopsarus) gularis subsp. laetior*			
710.	25665	*Melithreptus gularis (Black-chinned Honeyeater)*			
711.	42323	*Ptilotula keartlandi (Grey-headed Honeyeater)*			
712.	42341	*Ptilotula penicillatus (White-plumed Honeyeater)*			
713.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
714.	42310	*Sugomel niger (Black Honeyeater)*			
Melitidae					
715.		*Melitidae sp.*			
716.		*Melitidae sp. 1 (PSS)*			
Meropidae					
717.		*Merops (Merops) ornatus*			
718.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
Microcerberidae					
719.		*Microcerberidae sp.*			
Molluginaceae					
720.	2835	*Glinus lotoides (Hairy Carpet Weed)*			
721.	29851	*Mollugo molluginea*			
Molossidae					
722.	24181	*Chaerephon jobensis (Northern Freetail-bat)*			
Mononchidae					
723.		*Mononchus sp.*			
Moraceae					
724.	31578	*Ficus aculeata var. indecora (Ranji)*			
725.	19648	*Ficus brachypoda*			
Motacillidae					
726.		*Anthus (Anthus) novaeseelandiae subsp. novaeseelandiae*			
Muridae					
727.	24217	*Leggadina lakedownensis (Short-tailed Mouse, Karekanga)*		P4	
728.	24223	*Mus musculus (House Mouse)*	Y		
729.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse, Ngadji)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
				P4	
730.	24234	*Pseudomys delicatulus (Delicate Mouse)*			
731.	24235	*Pseudomys desertor (Desert Mouse)*			
732.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
733.	24248	*Zyzomys argurus (Common Rock-rat)*			
Muscidae					
734.		*Muscidae sp.*			
Myrmeleontidae					
735.		*Bandidus handschini*			Y
736.		*Heoclisis ramosa*			
Myrtaceae					
737.	14650	*Corymbia flavescens*			
738.	17093	*Corymbia hamersleyana*			
739.		*Corymbia sp.*			
740.		*Corymbia terminalis*			
741.	17084	*Corymbia zygophylla*			
742.	5580	*Eucalyptus camaldulensis (River Gum, Yabalinyba)*			
743.	35345	*Eucalyptus camaldulensis subsp. obtusa (Blunt-budded River Red Gum)*			
744.	35343	*Eucalyptus camaldulensis subsp. refulgens*			
745.	18088	*Eucalyptus leucophloia subsp. leucophloia*			
746.	14548	*Eucalyptus victrix*			
747.	5875	*Melaleuca argentea (Silver Cadjeput, Bandaran)*			
748.	5915	*Melaleuca glomerata*			
749.	5923	*Melaleuca lasiandra*			
750.	5933	*Melaleuca linophylla*			
Mytilinidae					
751.		*Mytilina ventralis macracantha*			
NO FAMILY					
752.		*No invertebrates*			
Naididae					
753.		*Allonais pectinata*			
754.		*Allonais ranauana*			
755.		*Chaetogaster diastrophus*			
756.		*Dero furcata*			
757.		*Dero nivea*			
758.		*Monopylephorus n. sp. WA29 (ex Pristina WA3) (PSS)*			
759.		*Nais communis*			
760.		*Pristina longiseta*			
761.		*Tubificidae WA28 (SAP))*			
Nematoda					
762.		*Nematoda sp.*			
763.		*Nematoda sp. 14 (PSS)*			
764.		*Nematoda sp. 2 (PSS)*			
765.		*Nematoda sp. P8 (PSW)*			
Nepidae					
766.		*Laccotrephes (Laccotrephes) tristis*			
Noctuidae					
767.		*Acontia clerana*			Y
768.		*Athetis tenuis*			
769.		*Diatenes aglossoides*			
770.		*Heliocheilus canusina*			
771.		*Heliocheilus ionola*			
772.		*Heliocheilus melibaphes*			
773.		*Heliocheilus pallida*			
774.		*Ipanica cornigera*			
775.		*Niguza oculita*			
776.		*Pandesma submurina*			
777.		*Prorocopis melanochorda*			
778.		*Xanthograpta purpurascens*			Y
Nolidae					
779.		*Armactica conchidia*			Y
Nyctaginaceae					
780.	2769	*Boerhavia burbidgeana*			
781.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
782.	2772	*Boerhavia gardneri*			

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783.		*Boerhavia sp.*			
Ochteridae					
784.		*Ochterus nr eurythorax*			
Oligochaeta					
785.		*Oligochaeta sp.*			
Onagraceae					
786.	6136	*Ludwigia perennis*			
Orobanchaceae					
787.	12492	*Striga squamigera*			
Ostracoda					
788.		*Ostracoda (unident.)*			
Otididae					
789.	24610	*Ardeotis australis (Australian Bustard)*			
Pachycephalidae					
790.		*Colluricincla (Colluricincla) harmonica subsp. rufiventris*			
791.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
792.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
793.	24618	*Oreoica gutturalis (Crested Bellbird)*			
794.		*Pachycephala (Alisterornis) lanioides subsp. carnarvoni*			
795.		*Pachycephala (Alisterornis) rufiventris subsp. rufiventris*			
796.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Papaveraceae					
797.	2961	*Argemone ochroleuca (Mexican Poppy)*	Y		
798.	17797	*Argemone ochroleuca subsp. ochroleuca*	Y		
Paramelitidae					
799.		*Paramelitidae sp.*			
800.		*Paramelitidae sp. 2 (PSS)*			
801.		*Paramelitidae sp. 6 (PSS)*			
802.		*Paramelitidae sp. 7 (PSS)*			
Parastenocarididae					
803.		*Parastenocaris sp.*			
Pardalotidae					
804.		*Pardalotus (Pardalotinus) rubricatus subsp. rubricatus*			
805.		*Pardalotus (Pardalotinus) striatus subsp. uropygialis*			
806.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
807.	25682	*Pardalotus striatus (Striated Pardalote)*			
Passifloraceae					
808.	14096	*Passiflora foetida var. hispida*	Y		
Pedaliaceae					
809.	7118	*Josephinia eugeniae (Josephinia Burr)*			
810.	19261	*Josephinia sp. Mt Edgar Station (N.T. Burbidge 1194)*			
Pelecanidae					
811.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
Phalacrocoracidae					
812.		*Microcarbo melanoleucos*			
813.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
Phasianidae					
814.	25701	*Coturnix ypsilophora (Brown Quail)*			
Phasmatidae					
815.		*Hyrtacus caurus*			
Philosciidae					
816.		*Philosciidae sp.*			
Phreodrilidae					
817.		*Insulodrilus lacustris s.l. Pilbara type 2/3 = WA35 (PSS)*			
818.		*Phreodrilid with dissimilar ventral chaetae*			
819.		*Phreodrilid with similar ventral chaetae*			
820.		*Phreodrilus peniculus*			
Phyllanthaceae					
821.	12013	*Flueggea virosa subsp. melanthesoides (Dogwood, Guwal)*			
822.	38421	*Notoleptopus decaisnei*			

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823.	4680	*Phyllanthus maderaspatensis*			
824.		*Phyllanthus sp.*			
Planorbidae					
825.		*Ferrissia (Pettancylus) petterdi*			
826.		*Ferrissia sp.*			
827.		*Gyraulus (Gyraulus) hesperus*			
828.		*Gyraulus hesperus*			
Plantaginaceae					
829.	7098	*Stemodia grossa (Marsh Stemodia, Mindjaara)*			
830.	7102	*Stemodia viscosa (Pagurda)*			
Pleidae					
831.		*Paraplea n. sp. (ANIC 6)*			
Plotosidae					
832.		*Neosilurus hyrtlii*			
Poaceae					
833.	204	*Aristida burbidgeae*			
834.	207	*Aristida contorta (Bunched Kerosene Grass)*			
835.	12063	*Aristida holathera var. holathera*			
836.	211	*Aristida hygrometrica (Northern Kerosene Grass)*			
837.	215	*Aristida latifolia (Feathertop Wiregrass)*			
838.	240	*Bothriochloa ewartiana (Desert Bluegrass)*			
839.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
840.	29721	*Cenchrus setiger (Birdwood Grass)*	Y		
841.	270	*Chloris pumilio*			
842.	273	*Chrysopogon fallax (Golden Beard Grass)*			
843.	279	*Cymbopogon ambiguus (Scentgrass)*			
844.	281	*Cymbopogon obtectus (Silkyheads)*			
845.	303	*Dichanthium fecundum (Curly Bluegrass)*			
846.	13741	*Dichanthium sericeum subsp. humilius*			
847.	310	*Digitaria brownii (Cotton Panic Grass)*			
848.	313	*Digitaria ctenantha (Comb Finger Grass)*			
849.	328	*Echinochloa colona (Awnless Barnyard Grass)*	Y		
850.	357	*Enneapogon caerulescens (Limestone Grass)*			
851.	360	*Enneapogon lindleyanus (Wiry Nineawn, Purple-head Nineawn)*			
852.	365	*Enneapogon polyphyllus (Leafy Nineawn)*			
853.	20377	*Enneapogon robustissimus*			
854.	368	*Enteropogon ramosus (Windmill Grass, Curly Windmill Grass)*			
855.	16730	*Eragrostis crateriformis*		P3	
856.	375	*Eragrostis cumingii (Cuming's Love Grass)*			
857.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
858.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangurnu)*			
859.	388	*Eragrostis leptocarpa (Drooping Lovegrass)*			
860.	391	*Eragrostis parviflora (Weeping Lovegrass)*			
861.	395	*Eragrostis speciosa (Handsome Lovegrass)*			
862.	398	*Eragrostis tenellula (Delicate Lovegrass)*			
863.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
864.	400	*Eriachne aristidea*			
865.	403	*Eriachne benthamii (Swamp Wanderrie)*			
866.	404	*Eriachne ciliata (Slender Wandarrie Grass)*			
867.	410	*Eriachne glauca (Pan Wandarrie Grass)*			
868.	411	*Eriachne helmsii (Buck Wanderrie Grass)*			
869.	413	*Eriachne mucronata (Mountain Wanderrie Grass)*			
870.	414	*Eriachne obtusa (Northern Wandarrie Grass)*			
871.	415	*Eriachne ovata*			
872.	16485	*Eriachne pulchella subsp. dominii*			
873.	11011	*Eulalia aurea*			
874.	443	*Heteropogon contortus (Bunch Speargrass)*			
875.	458	*Iseilema dolichotrichum*			
876.	471	*Leptochloa digitata (Whorled Cane Grass)*			
877.	19124	*Leptochloa fusca subsp. fusca*			
878.	503	*Panicum decompositum (Native Millet, Kaltu-kaltu)*			
879.	515	*Paraneurachne muelleri (Northern Mulga Grass)*			
880.	10975	*Paspalidium basicladum*			
881.	518	*Paspalidium clementii (Clements Paspalidium)*			
882.	606	*Setaria dielsii (Diels' Pigeon Grass)*			
883.	612	*Setaria surgens (Pigeon Grass)*			
884.	613	*Setaria verticillata (Whorled Pigeon Grass)*	Y		
885.	619	*Sorghum plumosum (Plume Canegrass)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
886.	628	*Sporobolus actinocladus (Ray Grass, Katoora)*			
887.	629	*Sporobolus australasicus (Fairy Grass)*			
888.	673	*Themeda triandra*			
889.	679	*Triodia angusta*			
890.	681	*Triodia brizoides*			
891.	13131	*Triodia epactia*			
892.	689	*Triodia lanigera*			
893.	690	*Triodia longiceps (Giant Grey Spinifex)*			
894.	17873	*Triodia schinzii*			
895.	700	*Triodia secunda*			
896.	704	*Triodia wiseana (Limestone Spinifex)*			
897.	706	*Triraphis mollis (Needle Grass)*			
898.	11321	*Urochloa holosericea subsp. velutina*			
899.	717	*Urochloa piligera*			
900.	728	*Whiteochloa cymbiformis*			
901.	729	*Xerochloa barbata (Rice Grass)*			
902.	732	*Yakirra australiensis*			
Podargidae					
903.	25703	*Podargus strigoides (Tawny Frogmouth)*			
Podicipedidae					
904.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
905.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
Polycentropodidae					
906.		*Paranyctiophylax sp AV5 (KIM-UWA)*			
Polygalaceae					
907.	41363	*Polygala galeocephala*			
Pomatostomidae					
908.		*Pomatostomus (Pomatostomus) temporalis subsp. rubeculus*			
909.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
Portulacaceae					
910.	40825	*Calandrinia pentavalvis*			
911.	2866	*Calandrinia quadrivalvis*			
912.	2870	*Calandrinia stagnensis*			
913.	2878	*Portulaca conspicua*			
914.	2884	*Portulaca oleracea (Purslane, Wakati)*			
915.	2886	*Portulaca pilosa (Djanggara)*	Y		
Potamogetonaceae					
916.	20426	*Potamogeton tepperi*			
Proteaceae					
917.	2079	*Grevillea pyramidalis (Caustic Bush, Tjungu)*			
918.	19570	*Grevillea pyramidalis subsp. leucadendron*			
919.	15975	*Grevillea pyramidalis subsp. pyramidalis*			
920.	13440	*Grevillea wickhamii subsp. aprica*			
921.	19478	*Grevillea wickhamii subsp. hispidula*			
922.	19137	*Hakea lorea subsp. lorea*			
Psittacidae					
923.		*Barnardius zonarius*			
924.		*Barnardius zonarius subsp. zonarius*			
925.	24725	*Cacatua roseicapilla subsp. assimilis (Galah)*			
926.	25716	*Cacatua sanguinea (Little Corella)*			
927.		*Cacatua sp.*			
928.	24736	*Melopsittacus undulatus (Budgerigar)*			
929.		*Neopsephotus bourkii*			
930.	24742	*Nymphicus hollandicus (Cockatiel)*			
931.	24751	*Platycercus zonarius subsp. zonarius (Port Lincoln Parrot)*			
Pygopodidae					
932.	24998	*Delma elegans*			
933.	25001	*Delma nasuta*			
934.	25002	*Delma pax*			
935.	25004	*Delma tincta*			
936.	25005	*Lialis burtonis*			
Pyralidae					
937.		*Pyralidae Pilbara sp 2 (PSW)*			
938.		*Pyralidae sp.*			
939.		*Pyralidae sp. 3 of JHH (PSW) (= Margarosticha ?repetitalis)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Rallidae					
940.	25727	*Fulica atra (Eurasian Coot)*			
941.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
942.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
943.	24771	*Porzana tabuensis (Spotless Crake)*			
Recurvirostridae					
944.	25734	*Himantopus himantopus (Black-winged Stilt)*			
Ricciaceae					
945.		*Riccia macrospora*			
946.		*Riccia sp.*			
Rotifera					
947.		*Rotifera sp.*			
Rubiaceae					
948.	7338	*Oldenlandia crouchiana*			
949.	7339	*Oldenlandia galioides*			
950.	7363	*Synaptantha tillaeacea*			
951.	13339	*Synaptantha tillaeacea var. tillaeacea*			
Santalaceae					
952.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
Sapindaceae					
953.	4740	*Atalaya hemiglauca (Whitewood)*			
Scarabaeidae					
954.		*Eupoecila inscripta*			
Scincidae					
955.	25015	*Carlia munda (Shaded-litter Rainbow Skink)*			
956.	25036	*Ctenotus duricola*			
957.	25043	*Ctenotus grandis subsp. titan*			
958.	25045	*Ctenotus helenae*			
959.	25064	*Ctenotus pantherinus subsp. ocellifer (Leopard Ctenotus)*			
960.	25062	*Ctenotus piankai*			
961.	25070	*Ctenotus robustus*			
962.	25072	*Ctenotus rubicundus*			
963.	25073	*Ctenotus saxatilis (Rock Ctenotus)*			
964.	25090	*Cyclodomorphus melanops subsp. melanops (Slender Blue-tongue)*			
965.	25092	*Egernia depressa (Southern Pygmy Spiny-tailed Skink)*			
966.	41408	*Egernia epsisolus (Eastern Pilbara Spiny-tailed Skink)*			
967.	25125	*Lerista bipes*			
968.	30929	*Lerista jacksoni*			
969.	42411	*Lerista timida*			
970.	30925	*Lerista verhmens*			
971.	25184	*Menetia greyii*			
972.	25187	*Menetia surda subsp. surda*			
973.	25193	*Morethia ruficauda subsp. exquisita*			
974.	25197	*Notoscincus ornatus subsp. ornatus*			
975.	25199	*Proablepharus reginae*			
976.	25202	*Tiliqua multifasciata (Central Blue-tongue)*			
Sciomyzidae					
977.		*Sciomyzidae sp.*			
Scirtidae					
978.		*Scirtidae sp.*			
Scolopacidae					
979.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
980.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
981.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
982.	24808	*Tringa nebularia (Common Greenshank)*		IA	
Scrophulariaceae					
983.		*Eremophila sp.*			
Sididae					
984.		*Latonopsis australis*			
Simuliidae					
985.		*Cnephia nr aurantiacum*			
986.		*Simulium sp. P1 (cf tonnoiri) (PSW)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Solanaceae					
987.	6962	*Datura leichhardtii (Native Thornapple)*	Y		
988.	6971	*Nicotiana benthamiana (Tjuntiwari)*			
989.	11856	*Nicotiana occidentalis subsp. occidentalis*			
990.	6980	*Nicotiana umbratica*		P3	
991.	6998	*Solanum cleistogamum*			
992.	7001	*Solanum dioicum (Gilu)*			
993.	7002	*Solanum diversiflorum*			
994.	7014	*Solanum horridum*			
995.	7029	*Solanum phlomoides*			
996.		*Solanum sp.*			
Sparassidae					
997.		*Holconia sp.*			
998.		*Typostola pilbara*			Y
Staphylinidae					
999.		*Staphylinidae sp.*			
Stratiomyidae					
1000.		*Stratiomyidae sp.*			
Strigidae					
1001.		*Ninox (Ninox) novaeseelandiae*			
1002.		*Ninox (Ninox) novaeseelandiae subsp. boobook*			
1003.		*Ninox (Ninox) novaeseelandiae subsp. ocellata*			
1004.	25747	*Ninox connivens (Barking Owl)*			
1005.	24819	*Ninox connivens subsp. connivens (Barking Owl (southwest pop P2), Barking Owl)*		P2	
1006.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
1007.		*Ninox novaeseelandiae subsp. carteri*			Y
Sylviidae					
1008.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
1009.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
1010.	24837	*Eremiornis carteri (Spinifex-bird)*			
1011.	25758	*Megalurus gramineus (Little Grassbird)*			
Tabanidae					
1012.		*Tabanidae sp.*			
Tachyglossidae					
1013.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
Teloschistaceae					
1014.	27627	*Caloplaca cupulifera*			
Terapontidae					
1015.		*Leiopotherapon unicolor*			
Testudinellidae					
1016.		*Testudinella patina*			
Tettigoniidae					
1017.		*Antipodectes brevicaudus*			
Theridiidae					
1018.		*Latrodectus hasseltii*			
Threskiornithidae					
1019.	24842	*Platalea regia (Royal Spoonbill)*			
1020.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
1021.	24844	*Threskiornis molucca (Australian White Ibis)*			
1022.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
Thylacomyidae					
1023.	24168	*Macrotis lagotis (Bilby, Dalgyte)*		T	
Thymelaeaceae					
1024.	5230	*Pimelea ammocharis*			
Trichocercidae					
1025.		*Trichocerca pusilla*			
1026.		*Trichocerca sp.*			
Trichotriidae					
1027.		*Macrochaetus altamirai*			
Turbellaria					
1028.		*Microturbellaria sp.*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1029.		*Turbellaria sp.*			
Turnicidae					
1030.		*Turnix (Alphaturnia) velox*			
1031.	24851	*Turnix velox (Little Button-quail)*			
Unionicolidae					
1032.		*Koenikea sp. 2/3 (Pilbara) (PSW)*			
1033.		*Neumania sp.*			
1034.		*Recifella sp.*			
1035.		*Recifella tinka*			
Urodacidae					
1036.		*Urodacus yaschenkoi*			
Varanidae					
1037.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
1038.	25216	*Varanus giganteus (Perentie)*			
1039.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
Verrucariaceae					
1040.		*Catapyrenium sp.*			
Vespertilionidae					
1041.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
1042.	24200	*Scotorepens greyii (Little Broad-nosed Bat)*			
1043.	24205	*Vespadelus finlaysoni (Finlayson's Cave Bat)*			
Violaceae					
1044.	5215	*Hybanthus aurantiacus*			
Zosteropidae					
1045.	24857	*Zosterops luteus (Yellow White-eye)*			
1046.		*Zosterops luteus subsp. balstoni*			
Zygophyllaceae					
1047.	4368	*Tribulopis angustifolia*			
1048.	4377	*Tribulus hirsutus*			
1049.	4379	*Tribulus macrocarpus*			
1050.	4380	*Tribulus occidentalis (Perennial Caltrop)*			
1051.	4381	*Tribulus platypterus (Cork Hopbush)*			
1052.	4383	*Tribulus terrestris (Caltrop)*	Y		

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

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely 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

Quadrat data

Flora taxa recorded from the survey area

Family	Genus	Species	Status	Gorge	Sidetrack
Amaranthaceae	*Aerva*	*javanica*	*	x	x
Amaranthaceae	*Amaranthus*	*undulatus*			x
Amaranthaceae	*Ptilotus*	*calostachyus*			x
Amaranthaceae	*Ptilotus*	*clementii*		x	
Amaranthaceae	*Ptilotus*	*nobilis*			x
Apocynaceae	*Calotropis*	*procera*	*	x	x
Asteraceae	*Chrysocephalum*	*pterochaetum*			x
Asteraceae	*Pluchea*	*dentex*			x
Asteraceae	*Pluchea*	*ferdinandi-muelleri*			x
Asteraceae	*Pluchea*	*tetranthera*		x	x
Asteraceae	*Streptoglossa*	*macrocephala*			x
Boraginaceae	*Ehretia*	*saligna*		x	
Boraginaceae	*Heliotropium*	*cunninghamii*			x
Boraginaceae	*Heliotropium*	*heteranthum*		x	x
Boraginaceae	*Heliotropium*	sp. (insufficient material)			x
Boraginaceae	*Trichodesma*	*zeylanicum*		x	
Caryophyllaceae	*Polycarpaea*	*longiflora*		x	
Chenopodiaceae	*Dysphania*	*plantaginella*			x
Chenopodiaceae	*Salsola*	*australis*			x
Cleomaceae	*Cleome*	*uncifera*			x
Cleomaceae	*Cleome*	*viscosa*		x	x
Combretaceae	*Terminalia*	*circumalata*		x	
Convolvulaceae	*Bonamia*	*erecta*			x
Convolvulaceae	*Operculina*	*aequisepala*		x	
Convolvulaceae	*Polymeria*	*ambigua*			x
Cucurbitaceae	*Citrullus*	*lanatus*	*		x
Cucurbitaceae	*Cucumis*	*variabilis*		x	x
Cyperaceae	*Cyperus*	*castaneus*		x	
Cyperaceae	*Cyperus*	*vaginatus*		x	x
Euphorbiaceae	*Euphorbia*	*coghlanii*			x
Euphorbiaceae	*Euphorbia*	*hirta*	*		x
Euphorbiaceae	*Euphorbia*	*trigonosperma*		x	x
Fabaceae	*Acacia*	*ampliceps*		x	x
Fabaceae	*Acacia*	*bivenosa*		x	
Fabaceae	*Acacia*	*inaequilatera*		x	x
Fabaceae	*Acacia*	*orthocarpa*		x	x
Fabaceae	*Acacia*	*ptychophylla*		x	x
Fabaceae	*Acacia*	*spondylophylla*		x	x
Fabaceae	*Acacia*	*trachycarpa*		x	x
Fabaceae	*Acacia*	*tumida var. Pilbarensis*		x	x
Fabaceae	*Crotalaria*	*cunninghamii*			x
Fabaceae	*Crotalaria*	*medicaginea*		x	
Fabaceae	*Cullen*	*stipulaceum*			x

Family	Genus	Species	Status	Gorge	Sidetrack
Fabaceae	*Erythrina*	*vespertilio*			x
Fabaceae	*Indigofera*	*monophylla*		x	x
Fabaceae	*Petalostylis*	*labicheoides*		x	x
Fabaceae	*Rhynchosia*	*minima*		x	x
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*			x
Fabaceae	*Senna*	*artemisioides* subsp. *oligophylla*		x	
Fabaceae	*Senna*	*glutinosa* subsp. *glutinosa*		x	x
Fabaceae	*Senna*	*notabilis*		x	x
Fabaceae	*Senna*	*symonii*		x	x
Fabaceae	*Senna*	*venusta*			x
Fabaceae	*Sesbania*	*formosa*			x
Fabaceae	*Tephrosia*	*rosea* var. *clementii*		x	x
Fabaceae	*Tephrosia*	sp. B Kimberley Flora (C.A. Gardner 7300)		x	x
Fabaceae	*Vachellia*	*farnesiana*	*	x	x
Fabaceae	*Vigna*	*lanceolata*			x
Goodeniaceae	*Dampiera*	*incana*			x
Goodeniaceae	*Goodenia*	*lamprosperma*			x
Goodeniaceae	*Goodenia*	*stobbsiana*		x	x
Goodeniaceae	*Scaevola*	*parvifolia*			x
Haloragaceae	*Myriophyllum*	*verrucosum*			x
Hydrocharitaceae	*Vallisneria*	*annua*			x
Lamiaceae	*Clerodendrum*	*floribundum*		x	
Lauraceae	*Cassytha*	sp. (insufficient material)		x	
Lythraceae	*Ammannia*	*baccifera*			x
Malvaceae	*Corchorus*	*parviflorus*		x	x
Malvaceae	*Gossypium*	*australe*		x	x
Malvaceae	*Hibiscus*	*burtonii*		x	
Malvaceae	*Hibiscus*	*coatesii*		x	
Malvaceae	*Melhania*	*oblongifolia*			x
Malvaceae	*Triumfetta*	*chaetocarpa*		x	x
Menispermaceae	*Tinospora*	*smilacina*		x	
Molluginaceae	*Mollugo*	*molluginea*			x
Moraceae	*Ficus*	*aculeata*			x
Moraceae	*Ficus*	*brachypoda*		x	
Myrtaceae	*Corymbia*	*hamersleyana*		x	x
Myrtaceae	*Eucalyptus*	*camaldulensis*		x	x
Myrtaceae	*Eucalyptus*	*victrix*		x	
Myrtaceae	*Melaleuca*	*argentea*		x	x
Nyctaginaceae	*Boerhavia*	*coccinea*		x	x
Onagraceae	*Ludwigia*	*perennis*			x
Papaveraceae	*Argemone*	*ochroleuca*	*		x
Passifloraceae	*Passiflora*	*foetida*	*		x
Phyllanthaceae	*Flueggea*	*virosa*		x	x

Family	Genus	Species	Status	Gorge	Sidetrack
Phyllanthaceae	*Sauropus*	*lissocarpus*		x	
Plantaginaceae	*Stemodia*	*grossa*		x	x
Plantaginaceae	*Stemodia*	*viscosa*			x
Poaceae	*Cenchrus*	*ciliaris*	*	x	x
Poaceae	*Chloris*	*barbata*	*		x
Poaceae	*Chrysopogon*	*fallax*			x
Poaceae	*Cymbopogon*	*ambiguus*		x	x
Poaceae	*Cynodon*	*dactylon*	*		x
Poaceae	*Enneapogon*	*caerulescens*		x	
Poaceae	*Enneapogon*	*lindleyanus*		x	x
Poaceae	*Eragrostis*	*tenellula*		x	x
Poaceae	*Eriachne*	*helmsii*		x	
Poaceae	*Eriachne*	*mucronata*		x	x
Poaceae	*Eriachne*	*obtusa*			x
Poaceae	*Eriachne*	*pulchella* subsp. *dominii*		x	
Poaceae	*Themeda*	*triandra*			x
Poaceae	*Triodia*	*epactia*		x	x
Poaceae	*Triodia*	*longiceps*		x	x
Poaceae	*Triodia*	*pungens*			x
Poaceae	*Triodia*	*schinzii*			x
Poaceae	*Triodia*	sp. (insufficient material)		x	
Poaceae	*Triodia*	*wiseana*		x	
Portulacaceae	*Calandrinia*	*quadrivalvis*			x
Potamogetonaceae	*Potamogeton*	*tricarinatus*			x
Proteaceae	*Grevillea*	*pyramidalis*		x	x
Proteaceae	*Grevillea*	*wickhamii*		x	x
Proteaceae	*Hakea*	*lorea*		x	x
Rubiaceae	*Oldenlandia*	*crouchiana*		x	
Sapindaceae	*Atalaya*	*hemiglauca*		x	x
Solanaceae	*Solanum*	*diversiflorum*			x
Violaceae	*Hybanthus*	*aurantiacus*		x	x
Zygophyllaceae	*Tribulus*	*macrocarpus*			x
Zygophyllaceae	*Tribulus*	*platypterus*		x	
Zygophyllaceae	*Tribulus*	sp. (insufficient material)		x	

Refer to Appendix A for conservation codes; * denotes introduced species

Flora Likelihood of Occurrence assessment guidelines

Likelihood of Occurrence	Guideline
Known	Species recorded within study area from field survey results.
Likely	Species previously recorded within 10 km and large areas of suitable habitat occur in the study area.
Possible	Species previously recorded within 10 km and areas of suitable habitat occur/may occur in the study area.
Unlikely	Species previously recorded within 10 km, but suitable habitat does not occur in the study area.
Highly unlikely	Species not previously recorded within 10 km, suitable habitat does not occur in the study area and/or the study 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

Definitions

Study area = a 20 km buffer around the survey area

Source information - desktop searches

PMST – DotE Protected Matters Search Tool (PMST) to identify flora listed under the EPBC Act potentially occurring within the study area
DPaW – DPaW (2007 -) records of threatened flora, database search within the study area (accessed May 2016)
NM – DPaW NatureMap (accessed May 2016)
Survey – recorded within the survey area during the 2016 survey

References

Craven, LA 1996, A Taxonomic Revision of Heliotropium (Boraginaceae) in Australia, Australian Systematic Botany, vol. 9, pp 521-657.

Flora Likelihood of Occurrence assessment

Species Name	Status	Source	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Nearest Record	Within Known Range	Within Known Habitat	Likelihood
	DPaW	NM								
Acacia cyperophylla var. *omearana*	P1	x	Tree, 4-10 m high, 'minni-ritchi' bark.	Stony and gritty alluvium. Along drainage lines.	Fl. yellow, Mar to Apr.	22	30 km west	Yes	Yes	Possible - not recorded during field survey.
Rothia indica subsp. *australis*	P1	x	Prostrate annual, herb, to 0.3m high, densely covered in spreading hairs.	Sandy soils. Sandhills and sandy flats	Fl. Apr to Aug.	19	37 km northwest	Yes	Marginal	Unlikely - not recorded during field survey
Euphorbia clementii	P2	x	Erect herb, to 0.6 m high	-	Gravelly hillsides, stony grounds	33	14 km east	Yes	Yes	Likely - not recorded during field survey.
Euphorbia inappendiculata var. *inappendiculata*	P2	x	Spreading, procumbent herb, to 0.4 m high.	Fl. Pink, Aug	Clay soils. Among broken rocky screes	5	37 km northwest	Yes	No	Unlikely - not recorded during field survey
Eragrostis crateriformis	P3	x	Annual, grass-like or herb, 0.17-0.42m high.	Fl. Jan to May or Jul.	Clayey loam or clay. Creek banks, depressions	28	37 km northwest	Yes	No	Unlikely - not recorded during field survey
Gomphrena leptophylla	P3	x	Prostrate or erect to spreading annual, hrb, to 0.15 m high	Fl. White, Mar to Sep.	Sand, sandy to clayey loam, granite, quartzite. Open flats, sandy creek beds, edges salt pans and marshes, stony hillsides	11	26 km southeast	Yes	Yes	Possible - not recorded during field survey.
Heliotropium murinum	P3	x	Short-lived perennial, herb, up to 0.4 m high.	Fl. May or Sep	Red sand. Plains	14	20 km south	Yes	No	Unlikely - not recorded during field survey

Species Name	Status	Source	Description	Preferred Habitat	Preferred Flowering Time	NatureMap Counts	Nearest Record	Within Known Range	Within Known Habitat	Likelihood
	DPaW	NM								
Nicotiana umbratica	P3	x	Erect, short-lived annual or perennial, herb, 0.3-0.7m high.	Fl. White, Apr to Jun	Shallow soils. Rocky outcrops	30	6 km north	Yes	Yes	Likely - not recorded during field survey.
Bulbostylis burbidgeae	P4	x	Tufted, erect to spreading annual, grass-like or herb (sedge), 0.03 - 0.25 m high, spikelets in a simple umbel or rarely solitary; stamens 3; involucral bracts long, hairy.	Fl. Brown, Mar or Jun to Aug.	Granitic soils. Granite outcrops	31	12 km west	Yes	Yes	Possible - not recorded during field survey.
Ptilotus mollis	P4	x	Compact, perennial shrub, to 0.5 m high, soft, grey foliage.	Fl. White/pink, May or Sep.	Stony hills and screes	37	37 km northwest	Yes	Yes	Possible - not recorded during field survey.

Site	Q1	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	New Alignment		**Easting:**	792933	**Northing:**	7683800	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3584	**Camera:**	NW	
Site Disturbance:	Weeds, tracks nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	no					
Veg Condition:	4	**Field Vegetation Type:**	Shrubs on large scree					
Drainage:	Good							
Fire Frequency:	Nil	**Fire Intensity:**	no damage					
Surface Component:	10% gravel (20-60mm), 10% cobbles (60-200mm), 20% stones (200-600mm), 60% boulders (>600mm)	**Soil Type:** **Major Component:**	Rock			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Steep (south)					
Landform:	Outcrop, hill crest							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**						
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				<2	2-10	2-10	10-30	2-10
Ht range (m)				2-4	1-2	0.4-1.0	0.7-1.1	0.4-1
Av ht (m)				4	1.3	0.9	0.9	0.7

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Clerodendrum	*floribundum*		M1	<2T	4
Flueggea	*virosa*		M1	2-10	4
Ehretia	*saligna*		M1	<2T	4
Atalaya	*hemiglauca*		M1	<2T	4
Grevillea	*wickhamii*		M1	<2T	4
Atalaya	*hemiglauca*		M2	<2T	1.4
Flueggea	*virosa*		M2	2-10	1.9
Ehretia	*saligna*		M2	10-30	1.4
Gossypium	*australe*		M2	<2T	1.1
Senna	*glutinosa* subsp. *glutinosa*		M2	<2T	1.4
Atalaya	*hemiglauca*		M3	<2T	0.4
Ehretia	*saligna*		M3	2-10	0.5
Acacia	*inaequilatera*		M3	<2T	0.9
Triodia	*wiseana*		G1	30-70	1.1
Enneapogon	*lindleyanus*		G2	2-10	0.6
Eriachne	*mucronata*		G2	<2N	0.3
Cymbopogon	*ambiguus*		G2	<2N	0.5
Cenchrus	*ciliaris*	*	G2	2-10	0.4

Site	Q2	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	New Alignment		**Easting:**	792628	**Northing:**	7683949	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3593	**Camera:**	NW	
Site Disturbance:	cattle, tracks nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	no					
Veg Condition:	4	**Field Vegetation Type:**	Upper Slope with outcrops					
Drainage:	Good							
Fire Frequency:	Nil, old >5yr	**Fire Intensity:**	no damage					
Surface Component:	20% pebbles (6-20mm) 20% gravel (20-60mm), 20% cobbles (60-200mm), 20% stones (200-600mm), 20% boulders (>600mm),	**Soil Type:** **Major Component:**	Sandy Loam, Rock			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Steep (south)					
Landform:	Outcrop, hill crest							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**						
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				<2	<2	10-30	10-30	10-30
Ht range (m)				2-5	1-2	0.2-1.0	0.4-1.1	0.1-1.1
Av ht (m)				4	1.3	0.8	0.9	0.7

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Grevillea	*wickhamii*		M1	<2T	5
Atalaya	*hemiglauca*		M1	<2T	4
Flueggea	*virosa*		M1	<2T	3
Hakea	*lorea*		M1	<2T	5
Gossypium	*australe*		M2	<2T	1.5
Acacia	*inaequilatera*		M2	<2T	1.5
Grevillea	*wickhamii*		M2	<2T	1.4
Senna	*glutinosa* subsp. *glutinosa*		M2	<2T	1.2
Acacia	*ptychophylla*		M2	10-30	1.2
Hakea	*lorea*		M3	<2T	0.9
Grevillea	*pyramidalis*		M3	<2T	0.4
Acacia	*ptychophylla*		M3	<2T	0.9
Gossypium	*australe*		M3	<2N	0.5
Triodia	*wiseana*		G1	10-30	1.1
Enneapogon	*lindleyanus*		G2	10-30	0.7
Cymbopogon	*ambiguus*		G2	<2N	0.5
Eriachne	*mucronata*		G2	2-10	0.3
Cenchrus	*ciliaris*	*	G2	<2N	0.4
Euphorbia	*trigonosperma*		G2a	<2T	0.1
Cucumis	*variabilis*		G2a	<2T	climber

Site	Q3	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	Central		**Easting:**	791645	**Northing:**	7684101	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			nil	**Camera:**	NW	
Site Disturbance:	cattle, tracks nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	?water					
Veg Condition:	6	**Field Vegetation Type:**	Burnt					
Drainage:	Good							
Fire Frequency:	Recent <1yr	**Fire Intensity:**	total damage					
Surface Component:	10% soil, 10% fines (2-6mm), 30% pebbles (6-20mm) 30% gravel (20-60mm), 20% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam, Rock			**Minor:**		
Leaf Litter:	Nil	**Wood Litter:**	Nil					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Moderate to Steep (north)					
Landform:	Slope – middle/lower							

GROWTH FORM TABLE:					
Tree >10 m		**Tree 2-10 m**			
Tree <2 m		**Tree Mallee**			
Palm		**Shrub >2 m**	M1		
Shrub 1-2 m		**Shrub <1 m**	M2		
Cycads		**Tussock Grass**			
Hummock Grass	G1	**Sedge**			
Vine		**Herbs**	G2		
Other		**Mallee Shrub**			
Heath Shrub		**Samphire Shrub**			
Chenopod		**Rush**			
Grass Tree		**Other**			

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				<2	<2		2-10	<2
Ht range (m)				4	0.4		0.1-0.4	0.1-0.4
Av ht (m)				4	0.4		0.2	0.1

No Quadrat Photograph - Quadrat location arrowed

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Acacia	*inaequilatera*		M1	<2T	4
Acacia	*inaequilatera*		M2	<2N	0.4
Indigofera	*monophylla*		M2	<2T	0.2
Tephrosia	*rosea* var. *clementii*		M2	<2T	0.1
Acacia	*ptychophylla*		M2	<2N	0.8
Triodia	sp. (insufficient material)		G1	2-10	0.4
Cleome	*viscosa*		G2	<2T	0.1
Tribulus	sp. (insufficient material)		G2	<2T	0.1
Ptilotus	*clementii*		G2	<2T	0.4

Site	Q4	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	Central		**Easting:**	791137	**Northing:**	7684606	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3601	**Camera:**	NW	
Site Disturbance:	old infrastructure, cattle, flood, old road works	**Frequency:**	current (animal), infrastructure >10 yrs					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	5	**Field Vegetation Type:**	Spinifex Steppe on Stony Lower slopes					
Drainage:	Good							
Fire Frequency:	Nil, old >5yr	**Fire Intensity:**	no damage					
Surface Component:	10% soil, 10% fines (2-6mm), 20% pebbles (6-20mm) 20% gravel (20-60mm), 10% cobbles (60-200mm), 10% stones (200-600mm), 20% boulders (>600mm)	**Soil Type:** **Major Component:**	Sandy Loam, Rock			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Gentle to Moderate (south)					
Landform:	Slope – middle/lower							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	<2	>70	2-10
Ht range (m)	4-5			2-6	1-2	0.4-1	0.2-1.1	0.1-0.7
Av ht (m)	5			5	1.4	0.8	1.0	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	5
Acacia	*inaequilatera*		M1	2-10	6
Grevillea	*wickhamii*		M1	<2T	6
Hakea	*lorea*		M1	<2T	4.5
Acacia	*spondylophylla*		M2	<2T	1.4
Acacia	*inaequilatera*		M2	<2T	1.3
Grevillea	*wickhamii*		M2	<2T	1.3
Indigofera	*monophylla*		M3	<2T	0.5
Acacia	*spondylophylla*		M3	<2T	0.9
Corchorus	*parviflorus*		M3	<2T	0.8
Grevillea	*wickhamii*		M3	<2T	0.8
Senna	*notabilis*		M3	<2T	0.2
Boerhavia	*coccinea*		G2a	<2N	0.1
Triodia	*epactia*		G1	>70	1.1
Cenchrus	*ciliaris*	*	G2	<2N	0.5
Cymbopogon	*ambiguus*		G2	<2N	0.6
Eriachne	*mucronata*		G2	<2N	0.5
Goodenia	*stobbsiana*		G2a	<2T	0.4
Cassytha	sp. (insufficient material)		G2a	<2T	climber
Heliotropium	*heteranthum*		G2a	<2T	0.05
Acacia	*trachycarpa*		M3	<2T	0.9

Site	Q5	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	Western End		**Easting:**	790476	**Northing:**	7685984	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3607	**Camera:**	NW	
Site Disturbance:	cattle, old ?rail line	**Frequency:**	current (animal), infrastructure >10 yrs					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	?water					
Veg Condition:	4	**Field Vegetation Type:**	Spinifex Steppe on Stony Calcareous Lower Slopes					
Drainage:	Good							
Fire Frequency:	Mod 1-5 yr	**Fire Intensity:**	most trees killed					
Surface Component:	20% soil, 20% fines (2-6mm), 20% pebbles (6-20mm) 30% gravel (20-60mm), 10% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam, Rock			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (north)					
Landform:	Lower Slope – Plain							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**						
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**						
Shrub 1-2 m		**Shrub <1 m**	M1					
Cycads		**Tussock Grass**						
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**	G2					
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						
STRATUM	**U1**	**U2**	**U3**	**M1**	**M2**	**M3**	**G1**	**G2**
% cover				<2			>70	<2
Ht range (m)				0.8			0.3-1.3	0.4
Av ht (m)				0.8			0.8	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Acacia	*spondylophylla*		M1	<2T	0.8
Acacia	*trachycarpa*		M1	<2T	0.9
Corchorus	*parviflorus*		M1	2-10	0.9
Grevillea	*pyramidalis*		M1	<2T	0.9
Grevillea	*wickhamii*		M1	<2T	0.9
Acacia	*inaequilatera*		M1	<2T	0.9
Bonamia	*erecta*		M1	<2T	0.4
Triodia	*epactia*		G1	>70	1.1
Triodia	*longiceps*		G1	<2N	1.1
Triodia	*epactia*		G1	<2N	1.1
Stemodia	*grossa*		G2	<2T	0.4

Site	Q6	project			Coongan Gorge Upgrade			
Date:	2505/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	north west		**Easting:**	792192	**Northing:**	7685766	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3612	**Camera:**	NW	
Site Disturbance:	cattle, gravel track	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	5	**Field Vegetation Type:**	Spinifex Steppe on Stony Calcareous Lower Slopes					
Drainage:	Good							
Fire Frequency:	Old >5yr	**Fire Intensity:**	Mostly killed					
Surface Component:	20% soil, 20% fines (2-6mm), 20% pebbles (6-20mm) 30% gravel (20-60mm), 10% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam, Rock			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange, Grey	**Slope (if present):**	Gentle (north)					
Landform:	Plain							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m		**Shrub <1 m**	M2					
Cycads		**Tussock Grass**						
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**	G2					
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			<2	2-10		30-70	<2
Ht range (m)	3-5			3	0.1-1		0.1-1.2	0.1-0.5
Av ht (m)	5			3	0.7		1.0	0.1

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	5
Acacia	*inaequilatera*		M1	<2T	3
Corchorus	*parviflorus*		M2	<2N	0.4
Acacia	*inaequilatera*		M2	<2N	0.4
Hakea	*lorea*		M2	<2T	0.4
Triodia	*epactia*		G1	2-10	1
Triodia	*longiceps*		G1	10-30	1.1
Triodia	*epactia*		G1	2-10	0.8
Cleome	*viscosa*		G2	<2T	0.1
Heliotropium	sp. (insufficient material)		G2	<2N	0.1
Salsola	*australis*		G2	<2T	0.1
Goodenia	*stobbsiana*		G2	<2T	0.5

Site	Q7	project			Coongan Gorge Upgrade			
Date:	26/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	east		**Easting:**	793072	**Northing:**	7685297	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3651	**Camera:**	NW	
Site Disturbance:	cattle, fire, old rail, old fencing	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	5	**Field Vegetation Type:**	Spinifex Steppe on Stony Calcareous Lower Slopes					
Drainage:	Good							
Fire Frequency:	?Recent ?<1yr to Mod 1-5 yr	**Fire Intensity:**	Mostly killed					
Surface Component:	10% soil, 10% fines (2-6mm), 20% pebbles (6-20mm) 20% gravel (20-60mm), 20% cobbles (60-200mm) , 10% stones (200-600mm), 10% boulders/plates (>600mm)	**Soil Type:** **Major Component:**	Loamy Sand, rock			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (north)					
Landform:	Lower Slope							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**						
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**						
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**	G2					
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				<2	<2	2-10	30-70	<2
Ht range (m)				2.5-4	1-2	0.4-1	0.1-0.7	0.2-0.5
Av ht (m)				2.5	1.2	0.7	0.5	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Acacia	*inaequilatera*		M1	<2T	4
Acacia	*inaequilatera*		M2	<2T	1.1
Corchorus	*parviflorus*		M3	10-30	0.7
Bonamia	*erecta*		M3	<2T	0.2
Pluchea	*tetranthera*		M3	<2T	0.5
Scaevola	*parvifolia*		M3	<2T	0.4
Acacia	*inaequilatera*		M3	<2T	0.3
Tephrosia	sp. B Kimberley Flora (C.A. Gardner 7300)		M3	<2T	0.2
Triodia	*pungens*		G1	10-30	0.7
Triodia	*epactia*		G1	10-30	0.7
Cleome	*viscosa*		G2	<2T	0.5
Senna	*notabilis*		G2	<2T	0.2

Site	Q8	project			Coongan Gorge Upgrade			
Date:	26/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	north east		**Easting:**	792341	**Northing:**	7685648	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3661	**Camera:**	NW	
Site Disturbance:	cattle, fire, old rail, flood	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water?					
Veg Condition:	5	**Field Vegetation Type:**	gusher / sandy plain					
Drainage:	Good							
Fire Frequency:	Mod 1-5 yr	**Fire Intensity:**	Mostly killed					
Surface Component:	20% soil, 20% fines (2-6mm), 20% pebbles (6-20mm) 20% gravel (20-60mm), 10% cobbles (60-200mm) , 10% stones (200-600mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (north)					
Landform:	Lower Slope, sheetwash (drainage line)							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	10-30	30-70	2-10
Ht range (m)	4.5-5.5			2-4	1-2	0.1-1	0.1-1.0	0.2-1.1
Av ht (m)	5			3	1.4	0.7	0.6	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	5
Petalostylis	*labicheoides*		M1	2-10	4
Acacia	*inaequilatera*		M2	<2T	1.7
Grevillea	*wickhamii*		M2	<2T	1.3
Corchorus	*parviflorus*		M2	<2T	1.2
Acacia	*ptychophylla*		M2	<2T	1.1
Corchorus	*parviflorus*		M3	10-30	0.8
Acacia	*spondylophylla*		M3	<2N	0.9
Bonamia	*erecta*		M3	<2N	0.4
Streptoglossa	*macrocephala*		M3	<2T	0.4
Indigofera	*monophylla*		M3	<2T	0.2
Acacia	*ptychophylla*		M3	<2T	0.4
Triodia	*epactia*		G1	10-30	0.7
Triodia	*pungens*		G1	10-30	0.7
Cenchrus	*ciliaris*	*	G2	<2N	0.2
Eriachne	*obtusa*		G2	<2N	0.4
Eriachne	*mucronata*		G2	<2N	0.7
Cymbopogon	*ambiguus*		G2	<2T	1.1
Senna	*notabilis*		G2a	<2T	0.2
Euphorbia	*trigonosperma*		G2a	<2N	0.2
Cleome	*uncifera*		G2a	<2N	0.2
Boerhavia	*coccinea*		G2a	<2N	0.7
Goodenia	*stobbsiana*		G2a	<2T	0.4
Heliotropium	*cunninghamii*		G2a	<2T	0.1
Polymeria	*ambigua*		M3	<2N	0.2
Triumfetta	*chaetocarpa*		M3	<2T	0.6
Acacia	*inaequilatera*		M3	<2T	0.4
Grevillea	*pyramidalis*		M3	<2T	0.9
Ptilotus	*calostachyus*		M3	<2T	0.8
Corymbia	*hamersleyana*		M3	<2T	0.5
Pluchea	*ferdinandi-muelleri*		M3	<2T	0.7
Triodia	*schinzii*		G1	<2T	0.3

Site	Q9	project			Coongan Gorge Upgrade			
Date:	26/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	south east		**Easting:**	793488	**Northing:**	7684465	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3670	**Camera:**	NW	
Site Disturbance:	cattle, fire, old rail, flood, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	6	**Field Vegetation Type:**	Floodplain with Buffel					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	No damage					
Surface Component:	30% soil, 20% fines (2-6mm), 20% pebbles (6-20mm) 20% gravel (20-60mm), 10% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**	?Clay (bulldust)	
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Gentle (east)					
Landform:	Plain – floodplain							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**						
Shrub 1-2 m	M1	**Shrub <1 m**	M2					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	10-30			<2	<2		10-30	30-70
Ht range (m)	2-6			1-2	0.5		0.1-1.3	0.1-0.3
Av ht (m)	5.5			1.3	0.5		1.1	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	10-30	6
Acacia	*trachycarpa*		M1	<2T	1.3
Hakea	*lorea*		M1	<2N	1.5
Acacia	*trachycarpa*		M2	<2N	0.5
Pluchea	*tetranthera*		M2	<2T	0.3
Corchorus	*parviflorus*		M2	<2T	0.3
Hakea	*lorea*		M2	<2T	0.8
Pluchea	*ferdinandi-muelleri*		M2	<2N	0.9
Acacia	*inaequilatera*		M2	<2T	0.4
Triodia	*longiceps*		G1	10-30	1.1
Triodia	*longiceps*		G1	<2T	1.1
Triodia	*epactia*		G1	<2T	1.1
Cenchrus	*ciliaris*	*	G2	30-70	0.2
Heliotropium	*heteranthum*		G2a	<2T	0.05

Site	Q10	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	eastern end		**Easting:**	794070	**Northing:**	7683200	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3687	**Camera:**	NW	
Site Disturbance:	cattle, fire, old rail, flood, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	6	**Field Vegetation Type:**	Riparian Woodland on narrow channel					
Drainage:	Good							
Fire Frequency:	Nil - south, burnt recent on north side	**Fire Intensity:**	No damage (south), scars north					
Surface Component:	80% soil, 10% pebbles (6-20mm) 10% gravel (20-60mm)	**Soil Type:** **Major Component:**	Loamy Sand			**Minor:**		
Leaf Litter:	Plentiful	**Wood Litter:**	Moderate					
Soil Colour:	Red Orange, Brown	**Slope (if present):**	Gentle (north)					
Landform:	Creekline							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G1					
Hummock Grass	G2a	**Sedge**	G2					
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	30-70			2-10	<2	<2	30-70	2-10
Ht range (m)	4-8			2-5	1-2	0.1-1	0.1-1	0.1-1.1
Av ht (m)	7			3	1.2	0.7	0.5	1.0

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	2-10	5
Eucalyptus	*camaldulensis*		U1	10-30	8
Eucalyptus	*victrix*		U1	10-30	8
Eucalyptus	*camaldulensis*		U2	<2N	1.5
Eucalyptus	*victrix*		U2	<2N	1.5
Acacia	*ampliceps*		M1	<2T	5
Acacia	*trachycarpa*		M1	<2N	2.1
Flueggea	*virosa*		M1	<2T	2.1
Acacia	*trachycarpa*		M2	<2T	1.4
Acacia	*inaequilatera*		M2	<2T	1.1
Acacia	*tumida*		M2	<2T	1.5
Vachellia	*farnesiana*	*	M2	<2T	1.7
Acacia	*trachycarpa*		M3	<2T	0.7
Vachellia	*farnesiana*	*	M3	<2N	0.7
Atalaya	*hemiglauca*		M3	<2T	0.8
Grevillea	*wickhamii*		M3	<2T	0.7
Corchorus	*parviflorus*		M3	<2T	0.8
Pluchea	*tetranthera*		M3	<2T	0.5
Cenchrus	*ciliaris*	*	G1	30-70	0.8
Triodia	*longiceps*		G2a	2-10	1.1
Cyperus	*vaginatus*		G2	10-30	0.9

Site	Q11	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	eastern end		**Easting:**	793700	**Northing:**	7683451	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3688	**Camera:**	NE (due to sun)	
Site Disturbance:	cattle, fire, old rail, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	6	**Field Vegetation Type:**	Spinifex steppe on stony plains					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	Minor					
Surface Component:	10% soil, 10% fins (2-6mm), 30% pebbles (6-20mm) 20% gravel (20-60mm), 20% cobbles (60-200mm), stones (200-600mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (north)					
Landform:	Lower Slope / Plain							

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	U1
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	2-10	30-70	<2
Ht range (m)	6			3	1-2	0.2-1	0.1-1	0.4
Av ht (m)	6			3	1.3	0.8	0.8	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	6
Grevillea	*wickhamii*		M1	<2T	3
Acacia	*inaequilatera*		M1	<2T	3
Acacia	*orthocarpa*		M1	2-10	3
Grevillea	*wickhamii*		M2	<2T	1.5
Acacia	*orthocarpa*		M2	<2T	1.8
Acacia	*tumida*		M2	<2T	1.3
Senna	*symonii*		M2	<2T	1.3
Acacia	*ptychophylla*		M2	<2T	1.1
Acacia	*spondylophylla*		M2	<2T	1.1
Acacia	*ptychophylla*		M3	2-10	0.8
Senna	*symonii*		M3	<2T	0.5
Corchorus	*parviflorus*		M3	<2T	0.2
Acacia	*inaequilatera*		M3	<2T	0.2
Triodia	*epactia*		G1	30-70	1
Eriachne	*mucronata*		G2	<2T	0.2
Goodenia	*stobbsiana*		G2a	<2T	0.4

Site	Q12	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	eastern end new alignment		**Easting:**	793185	**Northing:**	7683728	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3700	**Camera:**	SE (due to sun)	
Site Disturbance:	cattle, flood, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	5	**Field Vegetation Type:**	Spinifex steppe on stony plains with creek and dense shrub layer					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	30% soil, 20% fines (2-6mm), 20% pebbles (6-20mm) 20% gravel (20-60mm), 10% cobbles (60-200mm)	**Soil Type: Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Moderate	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (north-east)					
Landform:	Lower Slope / Creekline							

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	U1
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			10-30	2-10	<2	30-70	2-10
Ht range (m)	5.5			2-5	1-2	0.2-1	0.1-1.2	0.1-0.5
Av ht (m)	5.5			4	1.1	0.9	1.0	0.3

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	5.5
Acacia	*tumida*		M1	10-30	4.5
Grevillea	*wickhamii*		M1	2-10	3.5
Acacia	*inaequilatera*		M1	<2N	4
Grevillea	*wickhamii*		M2	2-10	1.9
Acacia	*inaequilatera*		M2	<2T	1.8
Acacia	*ptychophylla*		M2	2-10	1.1
Acacia	*tumida*		M2	<2T	1.2
Senna	*glutinosa* subsp. *glutinosa*		M2	<2T	1.6
Grevillea	*pyramidalis*		M2	<2T	1.5
Acacia	*inaequilatera*		M3	<2T	0.8
Grevillea	*pyramidalis*		M3	<2T	0.5
Gossypium	*australe*		M3	<2T	0.5
Grevillea	*wickhamii*		M3	<2N	0.8
Acacia	*spondylophylla*		M3	<2T	0.9
Triodia	*epactia*		G1	30-70	1.1
Cenchrus	*ciliaris*	*	G2	2-10	0.1
Euphorbia	*trigonosperma*		G2a	<2N	0.3
Boerhavia	*coccinea*		G2a	<2T	0.2
Cyperus	*vaginatus*		G2b	<2T	0.4
Eriachne	*helmsii*		G2	<2N	0.5
Hibiscus	*coatesii*		M2	<2T	1.4
Tephrosia	sp. B Kimberley Flora (C.A. Gardner 7300)		M2	<2T	1.1

Site	Q13	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	east end		**Easting:**	791588	**Northing:**	7684254	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3702	**Camera:**	SE (due to sun)	
Site Disturbance:	?cattle, road nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	3	**Field Vegetation Type:**	Spinifex steppe on upper slopes					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	5% soil, 5% fines (2-6mm), 10% pebbles (6-20mm), 20% gravel (20-60mm), 20% cobbles (60-200mm), 20% stones (200-600mm), 20% boulders (>600mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Steep (south)					
Landform:	Middle to Upper slope							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	<2	>70	2-10
Ht range (m)	4.5			2-4	1-2	0.4-1	0.1-1	0.1-0.3
Av ht (m)	4.5			3.5	1.2	0.9	0.8	0.3

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	4.5
Grevillea	*wickhamii*		M1	<2T	4
Acacia	*inaequilatera*		M1	2-10	4
Hakea	*lorea*		M1	<2T	3
Atalaya	*hemiglauca*		M1	<2T	2.5
Acacia	*spondylophylla*		M2	<2T	1.2
Acacia	*ptychophylla*		M2	<2N	1.3
Acacia	*inaequilatera*		M2	<2T	1.4
Hakea	*lorea*		M2	<2T	1.5
Atalaya	*hemiglauca*		M2	<2T	1.7
Flueggea	*virosa*		M2	<2T	1.6
Acacia	*spondylophylla*		M3	<2T	0.9
Hakea	*lorea*		M3	<2T	0.4
Acacia	*ptychophylla*		M3	<2T	0.9
Indigofera	*monophylla*		M3	2-10	0.7
Corchorus	*parviflorus*		M3	2-10	0.5
Triodia	*epactia*		G1	>70	0.8
Eriachne	*mucronata*		G2	2-10	0.6
Cymbopogon	*ambiguus*		G2	2-10	1.1
Cucumis	*variabilis*		G2a	<2T	climber
Euphorbia	*trigonosperma*		G2a	<2T	0.2

Site	Q14	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	West end		**Easting:**	790263	**Northing:**	7685646	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3725	**Camera:**	NW	
Site Disturbance:	?cattle, road nearby	**Frequency:**	old >10yr					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	4	**Field Vegetation Type:**	chert hills/foothills					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	10% soil, 5% fines (2-6mm), 10% pebbles (6-20mm), 20% gravel (20-60mm), 20% cobbles (60-200mm), 20% stones (200-600mm), 50% boulders (>600mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Moderate (west)					
Landform:	Lower Slope							

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	U1
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	G2
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	<2	30-70	<2
Ht range (m)	4			2-4	1-2	0.4-1	0.1-1.3	0.2
Av ht (m)	4			3	1.3	0.7	1.1	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	4
Acacia	*inaequilatera*		M1	2-10	4
Acacia	*inaequilatera*		M2	<2T	1.3
Senna	*symonii*		M2	<2T	1.1
Acacia	*ptychophylla*		M2	<2T	1.3
Senna	*glutinosa* subsp. *glutinosa*		M2	<2T	1.4
Acacia	*inaequilatera*		M3	<2T	0.8
Acacia	*spondylophylla*		M3	<2T	0.7
Acacia	*ptychophylla*		M3	<2T	0.7
Triodia	*epactia*		G1	30-70	1.3
Triodia	*longiceps*		G1	<2N	1.1
Boerhavia	*coccinea*		G2	<2T	0.2

Site	Q15	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	West end		**Easting:**	790254	**Northing:**	7685376	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3726	**Camera:**	NW	
Site Disturbance:	?cattle, road nearby, historical pit?	**Frequency:**	old >10yr					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	5	**Field Vegetation Type:**	Gusher, broad sheet wash? With calcareous next to					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	20% soil, 20% fines (2-6mm), 20% pebbles (6-20mm), 20% gravel (20-60mm), 20% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	Gentle (west)					
Landform:	Lower Slope / Plain / Creekline							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	2-10			2-10	2-10	<2	>70	<2
Ht range (m)	3-5			2-4	1-2	0.2-1	0.1-1.2	0.4
Av ht (m)	4.5			2.2	1.7	0.7	1.0	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	2-10	5
Acacia	*inaequilatera*		M1	2-10	2.5
Petalostylis	*labicheoides*		M1	<2T	2.5
Hakea	*lorea*		M1	<2T	2.2
Grevillea	*wickhamii*		M1	<2T	2.5
Corchorus	*parviflorus*		M2	<2T	1.1
Petalostylis	*labicheoides*		M2	2-10	1.7
Acacia	*spondylophylla*		M2	<2T	1.1
Grevillea	*wickhamii*		M2	<2T	1.3
Petalostylis	*labicheoides*		M3	<2T	0.4
Acacia	*spondylophylla*		M3	<2T	0.5
Corchorus	*parviflorus*		M3	<2T	0.2
Grevillea	*wickhamii*		M3	<2T	0.5
Triodia	*epactia*		G1	30-70	1.1
Triodia	*longiceps*		G1	2-10	1.1
Cenchrus	*ciliaris*	*	G2	<2N	0.4
Goodenia	*stobbsiana*		G2a	<2T	0.4

Site	Q16	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	West end		**Easting:**	790169	**Northing:**	7685201	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3727	**Camera:**	NW	
Site Disturbance:	?cattle, road nearby, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	5	**Field Vegetation Type:**	Floodplain					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	minor scars					
Surface Component:	80% soil, 10% fines (2-6mm), 10% pebbles (6-20mm)	**Soil Type:** **Major Component:**	Loamy Sand			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange	**Slope (if present):**	Negligible (west)					
Landform:	Plain							

GROWTH FORM TABLE:			
Tree >10 m		**Tree 2-10 m**	U1
Tree <2 m		**Tree Mallee**	
Palm		**Shrub >2 m**	M1
Shrub 1-2 m	M2	**Shrub <1 m**	M3
Cycads		**Tussock Grass**	G2
Hummock Grass	G1	**Sedge**	
Vine		**Herbs**	
Other		**Mallee Shrub**	
Heath Shrub		**Samphire Shrub**	
Chenopod		**Rush**	
Grass Tree		**Other**	

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	10-30			10-30	2-10	<2	30-70	10-30
Ht range (m)	3-6			2-5	1-2	0.7-1	0.1-1.2	0.1-0.3
Av ht (m)	6			4	1.6	0.8	0.7	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	10-30	5
Eucalyptus	*camaldulensis*		U1	<2T	5
Acacia	*inaequilatera*		M1	10-30	4.5
Acacia	*trachycarpa*		M1	<2T	2.2
Acacia	*inaequilatera*		M2	2-10	1.8
Acacia	*trachycarpa*		M2	<2N	1.2
Hakea	*lorea*		M2	<2T	1.2
Acacia	*inaequilatera*		M3	2-10	0.8
Corchorus	*parviflorus*		M3	<2T	0.4
Hakea	*lorea*		M3	<2T	0.7
Grevillea	*pyramidalis*		M3	<2T	0.5
Triodia	*epactia*		G1	10-30	1.1
Triodia	*longiceps*		G1	30-70	1.1
Cenchrus	*ciliaris*	*	G2	10-30	0.3
Euphorbia	*trigonosperma*		G2a	<2T	0.2

Site	Q17	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	West end		**Easting:**	790248	**Northing:**	7684956	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3728	**Camera:**	NW	
Site Disturbance:	?cattle, road nearby, weeds	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	4	**Field Vegetation Type:**	calcareous lower slope					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	most killed?					
Surface Component:	10% soil, 10% fines (2-6mm), 30% pebbles (6-20mm), 30% gravel (20-60mm), 10% cobbles (60-200mm), 10% stones (200-600mm)	**Soil Type:** **Major Component:**	?Clayey Loam			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange, ?White	**Slope (if present):**	Gentle (west)					
Landform:	Lower Slope							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m	U2	**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2	<2		<2	<2	<2	>70	<2
Ht range (m)	3	1.2		3	1.3	0.2-1	0.1-1.1	0.3
Av ht (m)	3	1.2		3	1.3	0.7	0.8	0.3

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	3
Corymbia	*hamersleyana*		U2	<2T	1.2
Acacia	*inaequilatera*		M1	<2T	3
Senna	*glutinosa* subsp. *glutinosa*		M1	<2T	2
Corchorus	*parviflorus*		M2	<2T	1.2
Acacia	*inaequilatera*		M2	<2T	1.1
Senna	*glutinosa* subsp. *glutinosa*		M2	<2T	1.2
Acacia	*spondylophylla*		M3	<2T	0.8
Corchorus	*parviflorus*		M3	<2T	0.4
Triodia	*epactia*		G1	>70	1.1
Triodia	*longiceps*		G1	<2N	0.7
Eriachne	*mucronata*		G2	<2N	0.3
Heliotropium	*heteranthum*		G2a	<2T	0.1

Site	Q18	project			Coongan Gorge Upgrade			
Date:	27/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	Coongan River		**Easting:**	790047	**Northing:**	7684737	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3729	**Camera:**	NW	
Site Disturbance:	clearing, cattle, weeds, flood, various infrastructure	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	6	**Field Vegetation Type:**	Riparian Woodland					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	50% soil, 20% fines (2-6mm), 10% pebbles (6-20mm), 10% gravel (20-60mm)	**Soil Type:** **Major Component:**	Sand			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange (pale)	**Slope (if present):**	negligible (river flow north)					
Landform:	Riparian bank							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m	U2	**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass		**Sedge**	G1					
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	10-30	10-30		2-10	<2	<2	2-10	2-10
Ht range (m)	10-14	6-10		2-5	1-2	0.8	1.1	0.05-0.3
Av ht (m)	312	9		4	1.3	0.8	1.1	0.1

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Eucalyptus	*camaldulensis*		U1	10-30	12
Eucalyptus	*camaldulensis*		U2	2-10	8
Melaleuca	*argentea*		U2	2-10	9
Atalaya	*hemiglauca*		M1	2-10	6
Calotropis	*procera*	*	M1	2-10	4
Acacia	*inaequilatera*		M1	<2T	5
Petalostylis	*labicheoides*		M2	<2T	1.1
Atalaya	*hemiglauca*		M2	<2N	1.8
Acacia	*trachycarpa*		M2	<2T	1.3
Acacia	*spondylophylla*		M2	<2T	1.5
Acacia	*spondylophylla*		M3	<2T	0.8
Atalaya	*hemiglauca*		M3	<2T	0.8
Acacia	*inaequilatera*		M3	<2T	0.5
Crotalaria	*medicaginea*		M3	<2T	0.3
Corchorus	*parviflorus*		M3	<2T	0.9
Hakea	*lorea*		M3	<2T	0.5
Cyperus	*vaginatus*		G1	2-10	1.1
Eragrostis	*tenellula*		G2	<2T	0.1
Cenchrus	*ciliaris*	*	G2	2-10	0.3
Triodia	*longiceps*		G2a	<2T	1
Cleome	*viscosa*		G2b	<2N	0.3
Boerhavia	*coccinea*		G2b	<2N	0.2
Euphorbia	*trigonosperma*		G2b	<2N	0.2
Cucumis	*variabilis*		G2b	<2T	climber
Operculina	*aequisepala*		G2b	<2T	climber

Site	Q19	project			Coongan Gorge Upgrade			
Date:	28/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	Talga River		**Easting:**	793549	**Northing:**	7685214	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3755	**Camera:**	NW	
Site Disturbance:	clearing, cattle, weeds, flood, various infrastructure	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	6	**Field Vegetation Type:**	Riparian Woodland					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	nil					
Surface Component:	65% fines (2-6mm), 15% pebbles (6-20mm), 20% gravel (20-60mm)	**Soil Type:** **Major Component:**	Sand			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange (pale)	**Slope (if present):**	negligible (river flow north-west)					
Landform:	Riparian bank / Creekline							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**						
Hummock Grass		**Sedge**	G1					
Vine		**Herbs**	G2					
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	30-70			<2	<2	<2	10-30	2-10
Ht range (m)	4-10			3	1-2	0.5	0.8-1.1	0.05-0.5
Av ht (m)	8			3	1.1	0.5	1.0	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Melaleuca	*argentea*		U1	30-70	10
Sesbania	*formosa*		U1	<2T	8
Eucalyptus	*camaldulensis*		U1	<2T	5
Melaleuca	*argentea*		M1	2-10	4
Crotalaria	*cunninghamii*		M1	<2T	2.1
Sesbania	*formosa*		M2	<2T	1.1
Calotropis	*procera*	*	M2	<2T	1.4
Sesbania	*formosa*		M3	<2N	0.3
Calotropis	*procera*	*	M3	<2N	0.2
Petalostylis	*labicheoides*		M3	<2T	0.3
Hybanthus	*aurantiacus*		M3	<2T	0.4
Cyperus	*vaginatus*		G1	10-30	1.1
Cenchrus	*ciliaris*	*	G2	<2N	0.3
Chloris	*barbata*	*	G2	<2N	0.8
Eragrostis	*tenellula*		G2	<2T	0.2
Cynodon	*dactylon*	*	G2	<2N	0.3
Cleome	*viscosa*		G2a	<2N	0.4
Citrullus	*lanatus*	*	G2a	<2T	0.3
Calandrinia	*quadrivalvis*		G2a	<2N	0.15
Stemodia	*viscosa*		G2a	<2N	0.2
Amaranthus	*undulatus*		G2a	<2T	0.15
Ammannia	*baccifera*		G2a	<2N	0.4
Myriophyllum	*verrucosum*		G2a	<2T	-
Euphorbia	*hirta*	*	G2a	<2N	0.3
Vigna	*lanceolata*		G2a	<2T	climber
Stemodia	*grossa*		G2a	<2T	0.5
Cucumis	*variabilis*		G2a	<2T	climber

Site	Q20	project			Coongan Gorge Upgrade			
Date:	28/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Sidetrack	North		**Easting:**	791496	**Northing:**	7685950	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3766	**Camera:**	NE (due to sun)	
Site Disturbance:	clearing, cattle, weeds, flood, various infrastructure	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	5	**Field Vegetation Type:**	Gusher, broad sheet wash					
Drainage:	Good							
Fire Frequency:	Recent <1yr	**Fire Intensity:**	most killed					
Surface Component:	60% soil, 15% fines (2-6mm), 20% pebbles (6-20mm), 5% gravel (20-60mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligibe					
Soil Colour:	Red Orange	**Slope (if present):**	negligible (north)					
Landform:	Plain, broad sheetwash							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			<2	<2	30-70	10-30	2-10
Ht range (m)	6			2-4	1-2	0.2-1	0.1-1.0	0.1-0.3
Av ht (m)	6			3.5	1.3	0.7	0.5	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	5
Grevillea	*pyramidalis*		M1	<2T	4
Acacia	*inaequilatera*		M1	<2T	3.5
Hakea	*lorea*		M1	<2T	3
Grevillea	*pyramidalis*		M2	<2N	1.5
Acacia	*inaequilatera*		M2	<2T	1.3
Acacia	*trachycarpa*		M2	<2T	1.1
Corchorus	*parviflorus*		M3	30-70	0.8
Acacia	*ptychophylla*		M3	<2T	0.4
Grevillea	*pyramidalis*		M3	<2N	0.8
Bonamia	*erecta*		M3	<2N	0.2
Solanum	*diversiflorum*		M3	<2T	0.3
Acacia	*tumida*		M3	<2T	0.4
Triodia	*epactia*		G1	2-10	1
Cenchrus	*ciliaris*	*	G2	2-10	0.2
Cleome	*uncifera*		G2a	<2N	0.4
Mollugo	*molluginea*		G2a	<2N	0.2
Indigofera	*monophylla*		M3	<2T	0.2
Tephrosia	*rosea* var. *clementii*		M3	<2T	0.2

Site	Q21	project			Coongan Gorge Upgrade			
Date:	29/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	west end of new alignment		**Easting:**	792359	**Northing:**	7683912	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3779	**Camera:**	NW	
Site Disturbance:	clearing, cattle, weeds, fire various infrastructure	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	6	**Field Vegetation Type:**	Large Scree slope					
Drainage:	Good							
Fire Frequency:	Recent <1yr	**Fire Intensity:**	most killed					
Surface Component:	10% pebbles (6-20mm), 10% gravel (20-60mm), 20% cobbles (60-200mm), 30% stones (200-600mm, 30% boulders (>600mm)	**Soil Type: Major Component:**	Sandy Loam (Rock)			**Minor:**		
Leaf Litter:	Negligible	**Wood Litter:**	Negligibe					
Soil Colour:	Red Orange	**Slope (if present):**	Steep (west)					
Landform:	Outcrop, Upper Slope							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			<2	<2	<2	2-10	2-10
Ht range (m)	4.5			2-3	1-2	0.1-1	0.1-0.7	0.1-0.8
Av ht (m)	4.5			3	1.1	0.3	0.3	0.2

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Atalaya	*hemiglauca*		U1	<2T	4.5
Atalaya	*hemiglauca*		M1	<2T	3
Flueggea	*virosa*		M1	<2T	3
Atalaya	*hemiglauca*		M2	<2T	1.3
Flueggea	*virosa*		M2	<2T	1
Gossypium	*australe*		M2	<2T	1
Acacia	*ptychophylla*		M2	<2T	1.1
Trichodesma	*zeylanicum*		M2	<2T	1.2
Clerodendrum	*floribundum*		M2	<2T	1.5
Gossypium	*australe*		M3	2-10	0.8
Rhynchosia	*minima*		M3	<2T	0.3
Atalaya	*hemiglauca*		M3	<2T	0.8
Grevillea	*wickhamii*		M3	<2T	0.2
Senna	*artemisioides* subsp. *oligophylla*		M3	<2T	0.5
Corchorus	*parviflorus*		M3	<2T	0.6
Triodia	*epactia*		G1	2-10	0.7
Cenchrus	*ciliaris*	*	G2	<2N	0.7
Eriachne	*mucronata*		G2	<2N	0.3
Cymbopogon	*ambiguus*		G2	<2N	0.8
Cucumis	*variabilis*		G2a	<2T	climber
Tinospora	*smilacina*		G2a	<2T	climber

Site	Q22	project			Coongan Gorge Upgrade			
Date:	29/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	east end		**Easting:**	792298	**Northing:**	7684011	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	50 x 50	**Photo:**			p3783	**Camera:**	SE (due to slope)	
Site Disturbance:	cattle, weeds, road nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	nil					
Veg Condition:	3	**Field Vegetation Type:**	Upper slope – unburnt					
Drainage:	Good							
Fire Frequency:	Old >5 yr	**Fire Intensity:**	?no damage					
Surface Component:	10% soil, 10% fines (2-6mm), 10% pebbles (6-20mm), 20% gravel (20-60mm), 20% cobbles (60-200mm), 20% stones (200-600mm, 10% boulders (>600mm)	**Soil Type:** **Major Component:**	Sandy Loam (Rock)			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Sparse					
Soil Colour:	Red Orange	**Slope (if present):**	Steep (south)					
Landform:	Upper Slope							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**						
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover				2-10	<2	10-30	>70	2-10
Ht range (m)				2-5	1-2	0.2-1	0.1-1.0	0.1-0.7
Av ht (m)				4	1.5	0.9	0.9	0.4

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Atalaya	*hemiglauca*		M1	2-10	4
Acacia	*inaequilatera*		M1	<2N	4.5
Grevillea	*wickhamii*		M1	<2T	4
Acacia	*ptychophylla*		M2	<2N	1.2
Acacia	*inaequilatera*		M2	<2T	1.2
Atalaya	*hemiglauca*		M2	<2N	1.2
Triumfetta	*chaetocarpa*		M2	<2T	1.1
Hakea	*lorea*		M2	<2T	1.3
Acacia	*ptychophylla*		M3	10-30	0.9
Corchorus	*parviflorus*		M3	2-10	0.6
Indigofera	*monophylla*		M3	<2N	0.7
Acacia	*spondylophylla*		M3	<2T	0.8
Trichodesma	*zeylanicum*		M3	<2T	0.7
Senna	*glutinosa* subsp. *glutinosa*		M3	<2T	0.7
Triodia	*epactia*		G1	>70	1
Eriachne	*mucronata*		G2	<2N	0.6
Cymbopogon	*ambiguus*		G2	<2N	1
Cyperus	*vaginatus*		G2a	<2T	0.7
Cucumis	*variabilis*		G2b	<2T	climber
Cassytha	sp. (insufficient material)		G2b	<2N	climber

Site	Q23	project			Coongan Gorge Upgrade			
Date:	29/05/2016	**Described by:**			J Foster, G Gaikhorst			
Location:	Coongan Gorge	central		**Easting:**	792126	**Northing:**	7684019	
MGA Zone:	50, WGS 84	**Site Type:**			Q			
Dimensions:	25 x 100	**Photo:**			p3787	**Camera:**	NE (due to sun)	
Site Disturbance:	cattle, weeds, road nearby	**Frequency:**	current					
Climate:	Dry, plants not stressed	**Water or Wind Erosion Evidence:**	water					
Veg Condition:	5	**Field Vegetation Type:**	Upper slope – unburnt					
Drainage:	Good							
Fire Frequency:	Mod 1-5yr	**Fire Intensity:**	most killed					
Surface Component:	20% soil, 20% fines (2-6mm), 20% pebbles (6-20mm), 20% gravel (20-60mm), 20% cobbles (60-200mm)	**Soil Type:** **Major Component:**	Sandy Loam			**Minor:**		
Leaf Litter:	Sparse	**Wood Litter:**	Negligible					
Soil Colour:	Red Orange	**Slope (if present):**	gentle (west)					
Landform:	Lower Slope / Plain / Creekline							

GROWTH FORM TABLE:								
Tree >10 m		**Tree 2-10 m**	U1					
Tree <2 m		**Tree Mallee**						
Palm		**Shrub >2 m**	M1					
Shrub 1-2 m	M2	**Shrub <1 m**	M3					
Cycads		**Tussock Grass**	G2					
Hummock Grass	G1	**Sedge**						
Vine		**Herbs**						
Other		**Mallee Shrub**						
Heath Shrub		**Samphire Shrub**						
Chenopod		**Rush**						
Grass Tree		**Other**						

STRATUM	U1	U2	U3	M1	M2	M3	G1	G2
% cover	<2			2-10	<2	10-30	>70	<2
Ht range (m)	4.5			2-5	1-2	0.2-1	0.1-1.1	0.1-1.1
Av ht (m)	4.5			4	1.2	0.9	0.7	0.3

Genus	Species	Status	Sub-stratum (NVIS)	% Foliage Cover	Height (m)
Corymbia	*hamersleyana*		U1	<2T	4.5
Acacia	*inaequilatera*		M1	2-10	4.5
Acacia	*inaequilatera*		M2	<2N	1.7
Grevillea	*pyramidalis*		M2	<2T	1.5
Acacia	*ptychophylla*		M2	<2T	1.2
Acacia	*trachycarpa*		M2	<2T	1.7
Grevillea	*wickhamii*		M2	<2T	1.9
Acacia	*ptychophylla*		M3	10-30	0.9
Hakea	*lorea*		M3	<2T	0.4
Aerva	*javanica*	*	M3	<2T	0.5
Indigofera	*monophylla*		M3	<2N	0.3
Acacia	*inaequilatera*		M3	<2N	0.3
Corchorus	*parviflorus*		M3	<2N	0.4
Triodia	*epactia*		G1	>70	0.7
Cenchrus	*ciliaris*	*	G2	<2N	0.1
Euphorbia	*trigonosperma*		G2a	<2T	0.3
Boerhavia	*coccinea*		G2a	<2T	0.3
Goodenia	*stobbsiana*		G2	<2T	0.8

Appendix E – Fauna Data

Fauna species list

Fauna Likelihood of Occurrence assessment guidelines

Fauna Likelihood of Occurrence assessment

Fauna recorded during GHD survey

Family	Genus	Species	Common Name	Status	O
Birds					
Accipitridae	*Accipiter*	*fasciatus fasciatus*	Brown Goshawk		
Accipitridae	*Aquila*	*audax*	Wedge-tailed Eagle		
Accipitridae	*Haliastur*	*sphenurus*	Whistling Kite		
Accipitridae	*Hieraaetus*	*morphnoides*	Little Eagle		
Accipitridae	*Milvus*	*migrans*	Black Kite		
Anatidae	*Anas*	*gracilis*	Grey Teal		
Anatidae	*Anas*	*superciliosa*	Black Duck		
Anhingidae	*Anhinga*	*novaehollandiae*	Australasian Darter		
Aegothelidae	*Aegotheles*	*cristatus*	Australian Owlet-nightjar		
Ardeidae	*Ardea*	*pacifica*	White-necked Heron		
Ardeidae	*Ardea*	*modesta*	Greater Egret	S5, Mi	
Ardeidae	*Egretta*	*garzetta*	Little Egret		
Ardeidae	*Egretta*	*novaehollandiae*	White-faced Heron		
Artamidae	*Artamus*	*cinereus*	Black-faced Woodswallow		
Artamidae	*Artamus*	*minor*	Little Woodswallow		
Artamidae	*Cracticus*	*nigrogularis*	Pied Butcherbird		
Burhinidae	*Burhinus*	*grallarius*	Bush Stone-curlew		
Cacatuidae	*Cacatua*	*sanguinea westralensis*	Little Corella		
Cacatuidae	*Eolophus*	*roseicapilla*	Galah		
Cacatuidae	*Nymphicus*	*hollandicus*	Cockatiel		
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-Shrike		
Casuariidae	*Dromaius*	*novaehollandiae*	Emu		
Charadriidae	*Elseyornis*	*melanops*	Black-fronted Dotterel		
Columbidae	*Phaps*	*chalcoptera*	Common Bronzewing		
Columbidae	*Geophaps*	*plumifera*	Spinifex Pigeon		
Columbidae	*Geopelia*	*cuneata*	Diamond Dove		
Columbidae	*Geopelia*	*striata*	Peaceful Dove		
Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon		
Corvidae	*Corvus*	*orru*	Torresian Crow		
Estrildidae	*Emblema*	*pictum*	Painted Finch		
Estrildidae	*Taeniopygia*	*guttata*	Zebra Finch		
Eurostopodidae	*Eurostopodus*	*argus*	Spotted Nightjar		
Falconidae	*Falco*	*cenchroides*	Nankeen Kestrel		
Falconidae	*Falco*	*berigora*	Brown Falcon		
Halcyonidae	*Dacelo*	*leachii*	Blue-winged Kookaburra		
Halcyonidae	*Todiramphus*	*sanctus*	Sacred Kingfisher		
Hirundinidae	*Petrochelidon*	*nigricans*	Tree Martin		
Maluridae	*Amytornis*	*striatus whitei*	Striated Grasswren		
Maluridae	*Malurus*	*lamberti*	Variegated Fairy-wren		
Megaluridae	*Eremiornis*	*carteri*	Spinifexbird		
Meliphagidae	*Lichenostomus*	*keartlandi*	Grey-headed Honeyeater		
Meliphagidae	*Lichenostomus*	*penicillatus*	White-plumed Honeyeater		
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater		
Meliphagidae	*Lichmera*	*indistincta*	Brown Honeyeater		
Meliphagidae	*Manorina*	*flavigula*	Yellow-throated Miner		
Meliphagidae	*Melithreptus*	*gularis*	Black-chinned Honeyeater		
Meropidae	*Merops*	*ornatus*	Rainbow Bee-eater	S5, Mi	
Monarchidae	*Grallina*	*cyanoleuca*	Magpie-lark		
Motacillidae	*Anthus*	*novaeseelandiae*	Australasian Pipit		
Otididae	*Ardeotis*	*australis*	Australian Bustard		
Pachycephalidae	*Colluricincla*	*harmonica*	Grey Shrike-thrush		
Pachycephalidae	*Pachycephala*	*rufiventris*	Rufous Whistler		
Pardalotidae	*Pardalotus*	*striatus*	Striated Pardalote		
Pelecanidae	*Pelecanus*	*conspicillatus*	Australian Pelican		
Phalacrocoracidae	*Microcarbo*	*melanoleucos*	Little Pied Cormorant		

Phalacrocoracidae	*Phalacrocorax*	*sulcirostris*	Little Black Cormorant		
Podicipedidae	*Poliocephalus*	*poliocephalus*	Hoary-headed Grebe		
Podicipedidae	*Tachybaptus*	*novaehollandiae*	Australasian Grebe		
Pomatostomidae	*Pomatostomus*	*temporalis*	Grey-crowned Babbler		
Psittacidae	*Barnardius*	*zonarius zonarius*	Port Lincoln Parrot		
Psittacidae	*Melopsittacus*	*undulatus*	Budgerigar		
Ptilonorhynchidae	*Ptilonorhynchus*	*guttatus*	Western Bowerbird		
Rhipiduridae	*Rhipidura*	*leucophrys*	Willie Wagtail		
Strigidae	*Ninox*	novaeseelandiae	Boobook Owl		
Threskiornithidae	*Threskiornis*	*spinicollis*	Straw-necked Ibis		
Tunicidae	*Turnix*	*velox*	Little Button-quail		
Reptiles					
Agamidae	*Amphibolurus*	*longirostris*	Long-snouted Water Dragon		
Agamidae	*Ctenophorus*	*caudocinctus caudocinctus*	Ringtail Dragon		
Agamidae	*Ctenophorus*	*isolepis isolepis*	Central Military Dragon		
Agamidae	*Ctenophorus*	*nuchalis*	Central Netted Dragon		
Cheluidae	*Chelodina*	*steindachneri*	Plate-shelled Turtle		p
Gekkonidae	*Gehyra*	*pilbara*	Pilbara Dtella		
Gekkonidae	*Gehyra*	*punctata*	Spotted Dtella		
Gekkonidae	*Gehyra*	*variegata*	Tree Dtella		
Gekkonidae	*Heteronotia*	*binoei*	Bynoe's Gecko		
Scincidae	*Carlia*	*munda*	Striped Rainbow Skink		
Scincidae	*Cryptoblephurus*	*ustulatus*	Russet Snake-eyed Skink		
Scincidae	*Ctenotus*	*grandis grandis*	Titan Skink		
Scincidae	*Ctenotus*	*pantherinus ocellifer*	Panther's Skink		
Scincidae	*Ctenotus*	*piankii*	Pianki's Ctenotus		
Scincidae	*Ctenotus*	*saxatalis*	Rock Ctenotus		
Scincidae	*Egernia*	*epsisolus*	Eastern Pilbara Spiny-tailed Skink		
Scincidae	*Menetia*	*greyii*	Common Dwarf Skink		
Scincidae	*Morethia*	*ruficauda exquisita*	Fire-tailed Skink		
Varanidae	*Vananus*	*accanthurus*	Ridge-tailed Monitor		
Varanidae	*Vananus*	*panopties rubidus*	Yellow spotted Monitor		tra
Mammals					
Bovidae	*Bos*	*taurus*	Cow	intro	
Camelidae	*Camelus*	*dromedarius*	Camel	intro	
Canidae	*Canus*	*lupis domesticus*	Dog	intro	
Dasyuridae	*Dasyurus*	*hallucatus*	Northern Quoll	En, S2	
Emballonuridae	*Saccolaimus*	*flaviventris*	Yellow-bellied Sheath-tailed Bat		
Emballonuridae	*Taphozous*	*georgianus*	Common Sheathtail-bat		
Emballonuridae	*Taphozous*	*georgianus/hilli*	Sheath-tailed Bat		
Equidae	*Equus*	*caballus*	Horse	intro	pri
Felidae	*Felis*	*catus*	Cat	intro	
Leporidae	*Oryctolagus*	*cuniculus*	Rabbit	intro	pote
Macropodidae	*Macropus*	*robustus*	Euro		
Macropodidae	*Macropus*	*rufus*	Red Kangaroo		
Macropodidae	*Petrogale*	*rothchildi*	Rothchilds Rock Wallaby		
Megadermatidae	*Macroderma*	*gigas*	Ghost Bat	Vu, S3	
Molossidae	*Austronomus*	*australis*	White-striped Free-tailed Bat		
Muridae	*Pseudomys*	*chapmani*	Pilbara Pebble-mound Mouse	P4	r
Muridae	*Zyzomys*	*argurus*	Common Rockrat		
Peramelidae	*Macrotis*	*lagotis*	Bilby	Vu, S3	pote
Tachyglossidae	*Tachyglossus*	*aculeatus*	Echidna		
Vespertilionidae	*Chalinolobus*	*gouldii*	Gould's Wattle Bat		
Vespertilionidae	*Chalinolobus*	*morio*	Chocolate Wattle Bat		
Vespertilionidae	*Nyctophilus*	*sp. group*	Long-eared Bats		
Vespertilionidae	*Scotorepens*	*greyii*	Little Broad-nosed Bat		
Vespertilionidae	*Vespadilus*	*finlaysoni*	Inland Cave Bat		
		S.falviventris/C.jobensis	Micro Bats		
		Taphozous sp/Ozimops lumsdenae	Micro Bats		

		C.gouildii/Ozimops sp.	Micro Bats		
Fish					
Clupeidae	Nematalosa	erebi	Bony Bream		
Melanotaeniidae	Melanotaenia	australis	Western Rainbow Fish		
Mugilidae	*Mugil*	cephalus	Sea Mullet		
Terapontidae	*Leiopotherapon*	unicolor	Spangled Perch		

Legend:

X or number = recorded during current survey or numbers recorded (observed or heard), many = many records

scats, tracks, prints or digs = Evidence of observation

calls = bat detector (SM2) record, SG= Species group, Pr= Probable

Potential prints = prints record and could be the species identified

Possibly= brief glimpse but not confirmed, species known in the region

intro= introduced species

Conservation codes – Appendix B

Parameters of fauna Likelihood of Occurrence assessment

Assessment outcome	Description
Present	Species recorded during the field survey or from recent, reliable records from within the survey area.
Likely	Species are likely 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 unlikely include: those species previously recorded within the study area however: • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area. 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 • Those species that have a known distribution overlapping with the survey area however: there is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the survey area 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.
Highly unlikely	Species that are considered highly unlikely to occur in the survey area include those species: • That have no suitable habitat within the survey area • That have become locally extinct, or are not known to have ever been present in the region of the survey area.

Status (see Appendix B for full explanation)

EPBC Act – Species listed as one or more of the following MM = migratory marine species, MW = migratory wetland species, MiT = migratory terrestrial species, Vu = Vulnerable, En = Endangered

WC Act - Species listed as CR = critically endangered, En = endangered, Vu = Vulnerable, CD = conservation dependent, IA = international migratory agreement migratory birds, OS = other specially protected fauna

DPaW – Species listed as Priority (P) 1, 2, 3 or 4

Source information - desktop searches

PMST = DotE PMST to identify fauna listed under the EPBC Act potentially occurring within the study area accessed May 2016

NM = DPaW NatureMap (2007 -) records of threatened fauna, database search within the study area (accessed May 2016),

DPaW = WA Government, Department of Parks and Wildlife Threatened and Priority fauna rankings (current as of 20 November 2015) - *Wildlife Conservation Act 1950* for the DPaW Pilbara region http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals

Definitions

study area = a 20 km buffer around the survey area

locality = the area within an approximate 50 km radius of the survey area

Fauna Likelihood of Occurrence assessment

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Night Parrot *Pezoporus occidentalis*	E	S1, Cr			X	The Night Parrot inhabits arid and semi-arid areas that are characterised by having dense, low vegetation. Based on accepted records, the habitat of the Night Parrot consists of Triodia grasslands in stony or sandy environments and of samphire and chenopod shrublands, including genera such as Atriplex, Bassia and Maireana, on floodplains and claypans, and on the margins of saltlakes, creeks or other sources of water (Parker, 1980). It has also been observed to enter dense Muehlenbecki growth when flushed from a more typical habitat (Boles et al. 1994).	**Unlikely –** This species is only known to occur in long unburnt areas of triodia hummock grasslands. Some habitat is present in the survey area however no specimens have been recorded in Western Australia since the mid 1990's. **Habitat** Some areas of unburnt habitat is present particularly at each end of the proposed side access road. **Records** The closest known record is from approximately 165 km south west of the survey area.
Fork-tailed Swift *Apus pacificus*	Mi, Ma	S5/ IA			X	In Pilbara WA there are scattered records along the coast, ranging along the west coast and inland. They are widespread in coastal and sub-coastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. This species is almost exclusively aerial, flying less than 1 m to at least 300 m above ground. This species is considered rare in the south-west region (DSEWPaC 2013).	**Unlikely** – This species is an opportunistic visitor to Australia only encounter when large storms or cyclones are present. **Habitat** This species is strictly aerial. **Records** The species has been recorded within 60 km of the survey area, however these observations are restricted to aerial habits (DPaW 2007).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Cattle Egret *Ardea ibis*	Mi, Ma	S5/ IA			X	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (Marchant & Higgins 1990).	**Unlikely** – The species is known to occasionally occur in the region, however may occur opportunistically during disbursal or as a vagrant. **Habitat** Habitat for this species only occurs along the water courses and flood plains in the region. Along the Coongan River several water bodies are present all suitable for this species. **Records** The species is known from very few records in the region and only two records surrounding the survey area.
Great Egret *Ardea modesta*	Mi, Ma	S5/ IA	X		X	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The Eastern Great Egret may retreat to permanent wetlands or coastal areas when	**Present** – This species was recorded once at a body of water associated to the Coongan River. **Habitat** Habitat for this species only occurs along the water courses and flood plains in the region. Along the Coongan River several water bodies are present all suitable for this species. Only a small amount of this habitat is present in the survey area. **Records** The species is known from the region.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
						other wetlands are dry (for example, during drought). This may occur annually in some regions with regular wet and dry seasons or erratically where the availability of wetland habitat is also erratic (Marchant & Higgins 1990).	
Oriental Plover *Charadrius veredus*	Mi, Ma	S5/ IA	X		X	Immediately after arriving in non-breeding grounds in northern Australia, Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland. Thereafter they usually inhabit flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps or open areas that have been recently burnt (Storr 1980).	**Unlikely** – The species is not known to persist in the region, however may occur opportunistically during migration. **Habitat** Habitat for this species only occurs open areas and open flood plains in the region. Along the Coongan River several water bodies are present all suitable for this species. **Records** The species is known from very few records in the region with the closest record 35 km south of the survey area.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Grey Falcon *Falco hypoleucos*		S3, Vu	X			The Grey Falcon inhabits lightly timbered country, especially stony plains and lightly timbered acacia scrub. This species is considered scarce to rare and is usually found singularly or sometimes in pairs (Morcombe 2004). In Pilbara WA, the grey falcon is very rare. The distribution of the Grey Falcon is centered on inland drainage systems, where it frequents timbered lowland plains, particularly acacia shrublands cross by tree-lined watercourses. It also hunts in treeless areas and frequents tussock grassland and open woodland, especially in winter, but it generally avoids deserts	**Likely** – This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. **Habitat** Habitat for this species only occurs along the water courses and plains in the survey area. **Records** The species is known from the area with one record from the Coongan Gorge.
Peregrine Falcon *Falco peregrinus*		S7	X			The Peregrine Falcon is seen occasionally anywhere in the Pilbara of Western Australia. It is found everywhere from woodlands to open grasslands, gorges and coastal cliffs - though less frequently in desert regions (Morcombe 2004).	**Likely** - The Peregrine Falcon has been recorded within 40 km of the survey area on three occasions and habitat is present for the species. **Habitat** The breakaway and steep rocky slopes habitat are potentially suitable breeding habitat and all of the habitat types in the survey area provide suitable foraging habitat for the species. **Records** The species is known from the region and populations persist in the Pilbara. Three records surround the survey area - 20 km south, 30 km north east and 40

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
							km north east (DPaW 2007–).
Oriental Pratincole *Glareola maldivarum*	Mi, Ma	S5/ IA			X	In non-breeding grounds in Australia, the Oriental Pratincole usually inhabits open plains, floodplains or short grassland (including farmland or airstrips), often with extensive bare areas. They often occur near terrestrial wetlands, such as billabongs, lakes or creeks, and artificial wetlands such as reservoirs, salt works and sewage farms, especially around the margins. The species also occurs along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons (Lloyd and Lloyd 1991).	**Unlikely** – The species is not known to persist in the region, however may occur opportunistically during migration. **Habitat** Habitat for this species only occurs along the water courses and plains in the region. **Records** The species is not known from the area only occurring with 100 km of the coast in the Pilbara (DPaW 2007–).
Barn Swallow *Hirundo rustica*	Mi, Ma	S5/ IA			X	In Australia, the Barn Swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Birds are often sighted perched on overhead wires, and also in or over freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland.	**Unlikely** – The species is not known to persist in the region, however may occur opportunistically during migration. **Habitat** Habitat for this species only occurs along the water courses and plains in the region. **Records** The species is not known from the area, only occurring with 80 km of the coast in the Pilbara (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Glossy Ibis *Plegadis falcinellus*		S5, IA	X			The Glossy Ibis' preferred habitats for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. Within Australia, the largest contiguous area of core habitat is inland and northern floodplains assiated with major rivers (Marchant & Higgins 1990).	**Likely** – This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).
Rainbow Bee-eater *Merops ornatus*	Mi, Ma	S5, IA	X		X	Open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It also inhabits sand dune systems in coastal areas and at inland sites that are in close proximity to water (Morcombe 2004).	**Present** - The Bee-eater was recorded on several occasions in most habitat types in the survey area. **Habitat** Habitat for this species occurs along the water courses and plains in the survey area. **Records** The species is known from the region with numerous observations recorded during the field survey.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Wood Sandpiper *Tringa glareola*	Mi, Ma	S5, IA	X			The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums Eucalyptus camaldulensis and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. They are also found at some small wetlands only when they are drying. They are rarely found using brackish wetlands, or dry stunted saltmarsh. Typically they do not use coastal flats, but are occasionally recorded in stony wetlands. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains (Higgins & Davies 1996). In Western Australia, within wetlands, birds often occur within a few metres of one another and are concentrated at a few sites in a wetland (Higgins & Davies 1996).	**Likely** – This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Sharp-tailed Sandpiper *Calidris acuminata*	Mi, Ma	S5, IA	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, sedgelands 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. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beachcast seaweed. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies 1996).	**Likely** – This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Common Sandpiper *Actitis hypoleucos*	Mi, Ma	S5, IA	X			The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al. 2007; Higgins & Davies 1996). Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands (Higgins & Davies 1996). Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins & Davies 1996).	**Likely** – This species has been recorded in the vicinity of the survey area previously and habitat is present for the species. **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** The species is known from the area with one record from the Doolena Gorge (within 2 km of the survey area). There are numerous additional records in the surrounding region.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Common Greenshank *Tringa nebularia*	Mi, Ma	S5, IA	X		X	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. The species is not generally found in dry grassland (Higgins & Davies 1996).	**Unlikely** – The species is not known to persist in the region, however may occur opportunistically during migration. **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** The species is not known from the area typically occurring with 100 km of the coast in the Pilbara (DPaW 2007–). However some scattered records are present throughout the Pilbara potentially utilising these areas while on transit during migration.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Grey Wagtail *Motacilla cinerea*	Mi, Ma	S5, IA			X	Like the Yellow Wagtail the Grey is a migratory species that regularly visits northern Australia particularly the area from Broome to Darwin (Morcombe 2004). The species prefers coastal habitat near to water where it prefers to forage. However the species has been recorded further inland feeding on plains (Morcombe 2004).	**Unlikely**- non-breeding seasonal visitor, may occasionally have opportunistic use **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** No records from the region (DPaW 2007–).
Yellow Wagtail *Motacilla flava*	Mi, Ma	S5, IA			X	A migratory species that regularly visits northern Australia particularly the area from Broome to Darwin (Morcombe 2004). The species prefers coastal habitat near to water where it prefers to forage. However the species has been recorded further inland feeding on plains (Morcombe 2004).	**Unlikely**- non-breeding seasonal visitor, may occasionally have opportunistic use **Habitat** Habitat for this species only occurs along the water courses and flood plains in and around the survey area. Only a small amount of this habitat is present in the survey area. **Records** No records from the region (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Letter-winged Kite *Elanus scriptus*		P4		X		The letter-winged kite is a conspicuous raptor with a core range in central Australia. The adult is a small and graceful, predominantly pale grey and white, bird with black shoulders and red eyes. Breeding is eruptive in response to population booms of the Long-haired Rat during good times. The letter-winged Kite is able to achieve a sudden population increase and during this time disburses in search of resources. The species is rarely recorded in Western Australia but has been seen in the Carnarvon, northern Deserts and Kimberley region during a population boom.	**Unlikely**- may occasionally have opportunistic use **Habitat**: Habitat is available for this species in the water course and plains. **Records** Very few records in WA, however one individual was recorded approximately 165 km south west of the survey area (DPaW 2007–).
Australian Painted Snipe *Rostratula australis*	E, Ma	S1/ En			X	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The species rarely occurs in Pilbara of Western Australia, where it was once more common (Marchant and Higgins 1993; Garnett and Crowley 2000).	**Unlikely**- may occasionally have opportunistic use **Habitat**: Habitat is available for this species in the water course and plains. **Records** Very few records in WA, however one individual was recorded approximately 175 km north east of the survey area (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Northern Brushtail Possum *Trichosurus vulpecula arnhemensis*		Vu		X		*Trichosurus vulpecula arnhemensis* is a sub species of the Common Brushtail Possum (*Trichosurus vulpecula vulpecula*), with its most distinguishing feature being its geographic range and in Western Australia and a smaller tail length. In Western Australia the subspecies is known from the Kimberley and Pilbara regions and is also found on Barrow Island (Nowak, 1999). The Northern Brushtail Possum is able to live in a variety of habitats, including residential areas, vine thickets, forests, woodlands and areas without trees that offer caves and burrows for shelter (such as those on Barrow Island). Typically the species is a nocturnal and solitary however the Northern Brushtail Possum has been known to partake in den sharing and to have a certain amount of tolerance for other individuals (Kerle, 1991). Males may occupy a territory of up to 4 hectares and females, up to 2 ha (Ganslosser, 1990).	**Unlikely** – This species has not been recorded in the study area previously however some habitat is present for the species in habitat unlikely to be affected by the project. **Habitat** Habitat for this species only occurs along the water courses in the survey area, particularly that along the Coongan and Talpa River. **Records** The species is not known from the study area with one record approximately 85 km south of the survey area.

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Brush-tailed Mulgara *Dasycercus blythi*		P4		X		*Dasycercus blythi* was originally described as distinct from *D. cristicauda*, but for more than thirty years it was assumed to be synonymous with that species (e.g., Groves 1993, 2005; Maxwell et al. 1996). Adams et al. (2000) conducted a limited molecular study of the genus Dasycercus and determined that there were two species to which the names *D. cristicauda* and *D. hillieri* were assigned. It has since been established that the correct names for the two species are *D. blythi* and *D. cristicauda* (Woolley 2005). The Brush-tailed Mulgara is primarily nocturnal, shelters in burrows and feeds on insects, other arthropods and small vertebrates. This species inhabits spinifex grasslands and, in central Australia, lives in burrows that it digs on the flats between low sand dunes (Van Dyck and Strahan 2008). The Mulgara is a solitary species exhibiting high site fidelity and a low propensity for dispersal once a home range has been established (Masters and Crowther 2003). Males and females maintain home ranges of 1.4 to 14 hectares (Masters and Crowther 2003) which on average, overlap by less than 20% (Masters and Crowther 2003).	**Unlikely** – The species is not known to persist in the immediate area and the habitats present are not suitable for the species. **Habitat** No sandy habitats are present for this species. Plains within the survey area are primarily heavy loams with rock present. **Records** The species is not known from the survey area with several records greater than 50 km away north and south of the survey area (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Northern Quoll *Dasyurus hallucatus*	E	S2, En	X		X	The Northern Quoll once occurred across the majority of northern Australia but its range has significantly contracted. It occurs in the Pilbara region but in disjunct populations. The Northern Quoll inhabits a range of vegetation associations but is especially abundant on dissected rocky escarpment and eucalypt woodland within 200 km of the coast. It is known to den in rock crevices and rock piles and favours rocky areas. They are predominantly nocturnal but are occasionally active during the day, particularly during the mating season and are known to have a large home range (Van Dyck and Strahan 2008).	**Present** - The species was recorded during the survey via head torching and camera traps. Numerous locations of scat were also recorded. **Habitat**: Habitat is available for this species in the rocky ridgelines, hills (with breakaways), water course and rocky plains. **Records** The species has not been recorded at Coongan Gorge previously however is known form the surrounding ranges in the area within 30 km of the survey area (DPaW 2007–).
Spectacled Hare-wallaby *Lagorchestes conspicillatus subsp. leichardti*		P3		X		The Spectacled Hare-wallaby was once widely distributed across the lower latitudes of northern Australia from eastern Queensland, through Northern territory to the Pilbara and Kimberley in Western Australia, with a subspecies on Barrow Island. In the Pilbara region this species has declined drastically, possibly due to fox predation and because frequent burning of spinifex grasslands has prevented the development of the large hummocks required for shelter (Van Dyck and Strahan 2008). They live in open woodlands, shrublands and hummock grasslands, sheltering under vegetation or in	**Unlikely** – The species is not known to persist in the immediate area and most of the survey area habitat is not suitable for the species. **Habitat** Some areas of unburnt habitat is present for this species, particularly at each end of the proposed side access road. However these area a relatively small and fragmented. **Records** The species is not known from the region with one record 65 km south of

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
						burrows during the day and searching for herbs, grass and fruits at night.	the survey area (DPaW 2007–).
Ghost Bat *Macroderma gigas*	V	S3, Vu	X		X	The Ghost Bat occurs in a wide range of habitats, and requires an undisturbed cave, deep fissure or disused mine shaft in which to roost. It is patchily distributed across Australia, and is sensitive to disturbance (Van Dyck and Strahan 2008).	**Present** - The Ghost bat was recorded in the survey area in flight around the water body associated with the side access track. **Habitat** No cave habitat was recorded in the survey area and several searches regionally failed to identify any cave suitable for Ghost Bat, however the entire area was not traversed. The habitats present in the survey area are all likely to be utilised for foraging. **Records** The species is not known from the survey area, however numerous records are known from approximately 40 km east and south (DPaW 2007–).
Bilby *Macrotis lagotis*	V	S3, Vu	X		X	The Greater Bilby distribution in Western Australia is restricted to the north, including the Pilbara, Sandy and Gibson Deserts. The Greater Bilby usually spends the daytime in burrows, often built against termite mounds, spinifex hummock or shrubs (Van Dyck and Strahan 2008). Extant population of the Greater Bilby occur in a variety of habitats, usually on landforms with level to low slope	**Likely** – Prints were recorded in the sand bed of the Coongan River in two localities. However this is also the northern limit of the rabbit which has a similar print. Broader area searches were undertaken in habitat suitable for both species with no recent additional evidence recorded. A very old burrow system was recorded on the northern

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
						topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. Laterite and rock feature substrates are an important part of Greater Bilby habitat. These habitat support shrub species, such as *Acacia kempeana*, *A. hilliana* and *A. rhodophylla*, which have root-dwelling larvae that provide a constant food source for the Greater Bilby. After dark they leave their burrows to feed and populations are known to move long distances when current habitat ranges become unsuitable. Bilbies are largely solitary, widely dispersed and found in low numbers. The current occurrence of the Greater Bilby is strongly associated with higher rainfall and temperatures, which promote areas of higher plant and food production. The Greater Bilby may also prefer these conditions as higher rainfall and temperatures are not well tolerated by foxes (Pavey 2006; Southgate et al. 2007).	side of the Coongan River, however it could not be distinguished as either Bilby or Rabbit due to its age. **Habitat** Some areas of habitat are present along the banks of the Coongan River and within the plain areas. **Records** The species is known from the region with one record approximately 20 km south of the survey area (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Lakeland Downs Mouse *Leggadina lakedownensis*		P4	X			The Lakeland Downs Mouse occupies a diverse range of habitats from the monsoon tropical coast to semiarid climates, including spinifex and tussock grasslands, samphire and sedgelands, Acacia shrublands, tropical Eucalyptus and Melaleuca woodlands and stony ranges. Most habitats, however, are seasonally inundated on red or white sandy-clay soils. They are nocturnal, largely solitary, and individuals spend the day in simple, single-chambered burrows (Van Dyck and Strahan 2008).	**Unlikely** – This species has been recorded in the study area previously limited habitat is available for the species. **Habitat** Limited habitat for this species is present within the survey area. Some habitat is present along the water courses and associated plains however this is mostly outside of the survey area. **Records** The species is known from the region with one record approximately 30 km north west of the survey area. This record is from habitat associated to cracking clays habitat.
Western Pebble-mound Mouse *Pseudomys chapmani*		P4	X			The Western Pebble-mound Mouse is restricted to the Pilbara region where it is recognised as an endemic species. Habitat for the Western Pebble-mound Mouse can be found on stony hillsides with hummocky grasslands and little or no soil. It constructs large mounds of pebbles on stony slopes which cover an area of 0.5-9.0 square metres. 'Active' mounds are characterized by volcano-like cones capped by 'craters' that mark occluded entrances to subterranean burrow systems in which the mice live, often gregariously (Van Dyck and Strahan 2008).	**Present** - The Western Pebble-mound Mouse was recorded via the presence of both active mounds and inactive mounds recorded in the survey area. **Habitat** The rocky hills and undulating stony plains are preferred habitat for the mouse. **Records** The species is well known in the region with over 50 records of the species within 40 km of the survey area (DPaW

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
							2007–).
Long-tailed dunnart *Sminthopsis longicaudata*		P4	X			The Long-tailed Dunnart was not recorded during desktop searches however is known to occur in the region (Atlas Iron Limited 2012) and was recorded during the assessment of the Wodgina DSO project. The Long-tailed Dunnart requires rocky areas to survive and is wide spread throughout the Goldfields, Murchison and Gascoyne. The Pilbara is the northern most portion of the species distribution (Van Dyck and Strahan 2008).	**Likely** - The species has previously been observed in the region and habitat is available to the species. **Habitat** The rocky hills and associated undulating stony plains (with small outcrops) are preferred habitat for the dunnart. **Records** The species is well known in the region with records within 20 km of the survey area (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia (Pilbara form)*	V	S3, Vu	X		X	The Pilbara Leaf-nosed Bat roosts in deep caves or mines in the wet season and forages nearby. This species occurs in the Pilbara region where its populations are scattered and localised. There are a few known populations of this species in the western Pilbara, roosting in caves formed in gorges that dissect massive siliceous sedimentary geology. It is most often observed in flight over waterholes in gorges (Van Dyck and Strahan 2008). Optimal roosts are thought to occur in caves that form between ascending rock layers, where humidity is maintained from seeping groundwater (Van Dyck and Strahan 2008). Roosts are commonly located over pools of water, or areas deep within the mine or cave structure which provides elevated temperature and humidity. Foraging habitat includes: Triodia hummock grasslands covering low rolling hills and shallow gullies, with *Eucalyptus camaldulensis* along the creeks; over small watercourses throughout granite boulder terrain; over pools and low shrubs in ironstone gorges; and in and around gravelly watercourses with *Melaleuca leucadendron*.	**Likely** – This species has been recorded in the region previously however no caves suitable for the species are present in the survey area. A broader area was traversed with no caves found. **Habitat** Only foraging habitat is available for this species across the survey area, however the riparian and water bodies along the Coongan and Talga Rivers would be significant to the species which is mostly outside of the survey area. **Records** The species is known from the region with several records within 40 km of the survey area (DPaW 2007–).

Species	Status		Source Information			Habitat and ecology	Likelihood of occurrence assessment
	EPBC listing	WC Act/ DPaW listing	NM	DPaW	PMST		
Olive Python (Pilbara subspecies) *Liasis olivaceus barroni*	V	S3, Vu	X		X	The Olive Python (Pilbara subspecies) is a dull olive-brown to pale fawn or rich-brown python with a white underside and pale finely dotted lips. This species reaches an average size of 2.5 m but can grow up to 4 m long. The Olive Python's range is restricted to the Pilbara region, north Western Australia, and the Dampier Archipelago. Habitat consists of rocky escarpments, gorges and waterholes within the Pilbara region. The preferred microhabitats for this species are under rock piles, on top of rocks, and under spinifex as well as in man-made features such as overburden heaps, railway embankments and sewerage treatment ponds. The species' breeding season occurs from June to August, with males moving long distances in search of breeding females (Wilson and Swan 2010).	**Likely** – This species has been recorded in the region previously and habitat is present for the species. **Habitat** Habitat is available for this species in the Coongan Gorge and associated hills, also riparian and water bodies along the Coongan and Talga Rivers would be significant to the species. **Records** The species is known from the region with several records within 80 km of the survey area (DPaW 2007–).

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Call analysis method

Ultrasonic detection surveys

The primary method of recording ultrasonic bat calls was the SM2BAT+ SongMeter recorder (Wildlife Acoustics Inc., USA). Bat calls were recorded between sunset and sunrise across consecutive nights with audio settings designed to optimise detection and recording of the target species (*Rhinonicteris aurantia*). Recorded call data were saved as 45 minute to 1 hour blocks in Wildlife Acoustics' patented WAC compressed audio format.

Craig Grabham from GHD completed the analysis of all data collected during the survey using ultrasonic bat detectors. Data from SM2 units was downloaded and viewed using Kaleidoscope Viewer (version 3.1.6, Wildlife Acoustics Inc 2016) as full-spectrum audio files. WAC files were also converted to Anabat sequence files (zero-crossing format) suitable for analysis in AnalookW version 4.1s (Corben 2015).

Call analysis

WAC files were viewed and bat calls were identified using Kaleidoscope Viewer (version 3.1.6, Wildlife Acoustics Inc. 2016) by visually comparing the Kaleidoscope Viewer spectrogram and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material (McKenzie and Bullen 2009; 2012, Armstrong and Cole 2007). The spectrogram displayed each call sequence (see below for call definition) with information on the number and timing of calls.

The call identification was also assisted by consulting distribution information for possible species (Atlas of Living Australia and DPAW NatureMap records) and previous GHD surveys within the region of the survey area. No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area.

The exception to this call definition is the Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*). The Pilbara Leaf-nosed Bat has a distinct call from all other microchripteran bat species in the Pilbara region. Unlike other species, the pulse structure is constant frequency (CF) with a characteristic frequency (Fc) of 118–128 kHz (DEWHA 2010). Their echolocation calls are readily identifiable from the characteristic (or more accurately the maximum or peak) frequency, pulse shape, enabling even short call sequences with few pulses to be successfully recognised (Hourigan 2011).

Identification for the PLNB was confirmed from a minimum of two or more consecutive pulses, each being > 4 ms in duration and < 500 ms (0.5 second) between the next consecutive pulse in a sequence within the characteristic range of the species.

Due to variability in the quality of calls, the lack of published information regarding non-search phase calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000) as summarised in the table below. Due to the absence of reference calls from the study area and the poor quality of some the recordings and known overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Species nomenclature follows Armstrong (2011), then van Dyck et al. (2013).

Identification	Description
D - Definite	Species identification not in doubt. Call sequence contains three or more consecutive pulses of similar frequency and shape. Call characteristics match those in referenced material or species reference calls.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail (e.g. number of pulses).
SG - Species Group	X = Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species

Summary of results and survey effort

Microchiropteran bat detector surveys were completed for 5 nights at two locations during May 2016 within the survey area.

Seven species were positively (Definite or Probable) identified of the 16 species that are known to occur from this part of the eastern Pilbara region (Armstrong 2011; NatureMap 2007 -). As many as four other species may also have been recorded using bat detectors, but poor data quality and/or interspecific call similarities precluded reliable identification of additional species.

The tables below provide site location details and a summary of the results for nights surveyed.

Summary of bat call analysis May 2016

Species / Group	**Site/Date**
	Coongan Gorge
	26-30/5/16
Austronomus australis	D
Saccolaimus flaviventris	D
Taphozous georgianus	D
Chalinolobus gouldii	D
Scotorepens greyii	Pr
Chalinolobus morio	D
Vespadelus finlaysoni	D
Nyctophilus sp	Y
S. falviventris/Chaeroephon jobensis	Y
T. georgianus/hilli	Y
Taphozous sp/Ozimops lumsdenae	Y
C.gouldii/S. greyii	Y
C.morio/V.finlaysoni	Y
Definite species recorded	7 x D
Survey effort	5 nights

Notes:
Total number of species recorded for each night/site is based on definite (D) identification only. Total number of D species for each night includes one Nyctophilus species where recorded.
See Table 1 for confidence rating e.g. D or Pr, - = not recorded. X = species group present.
CE, E, VU – species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, P1- 4 (priority species) species under the *Wildlife Conservation Act 1950*

Qualifications

Craig Grabham has completed microchiropteran bat surveys and assessments in WA, NSW, QLD, Vic, Tasmania and the NT employing a variety of methods including harp trapping, light tagging, habitat surveys (e.g. cave assessments), roost surveillance (using infrared and thermal video cameras), and echolocation survey (Wildlife Acoustic's SongMeter and Eco Meter devices and Titley Electronic Anabat devices) and analysis (Wildlife Acoustic's SongScope and Chris

Corben's Analook). He has completed bat surveys for infrastructure, residential, and mining projects. Craig has also completed bat inventory surveys for National Parks, Nature Reserves, catchment management areas and private land conservation projects. His honours project investigated the use of remnant and revegetated habitats by microchiropteran bats across a fragmented rural landscape in the Eastern Billabong Catchment (south-west slopes) in NSW.

Craig has completed the following training courses with regard to ultrasonic call recording and analysis:

- Anabat system training course – Titley Scientific (December 2012)
- Wildlife Acoustic's Song Meter and SongScope training – Faunatech/Austbat (July 2015).

To date Craig has completed echolocation analysis and reporting for more than 102 projects from WA, NSW, NT, QLD and Victoria since joining GHD in 2006 from calls collected during field surveys from Anabat detectors and/or Song Meter units and identified using Analook or SongScope software.

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