Jimblebar Creek

Riparian Flora and Vegetation Baseline Survey

Prepared for BHP Billiton Iron Ore Pty Ltd
January 2015

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Executive Summary

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) is preparing referrals to the Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act 1986 (EP Act) to develop new mining areas at Orebody 31 (OB31). As part of these referrals discharge options for the management of surplus water are being considered. Discharge into creeks within the OB31 area is one option being investigated. To support these investigations and future approvals, BHP Billiton Iron Ore commissioned Onshore Environmental Consultants Pty Ltd (Onshore Environmental) to undertake a detailed riparian flora and vegetation survey along a 20 km stretch of the Jimblebar Creek riparian zone, herein referred to as the study area. Additionally the survey design incorporated permanent monitoring plots to provide quantitative baseline data for plant biodiversity parameters prior to the commencement of discharge.

The study area is situated 40 km east of Newman, 6 km north of the Jimblebar Iron Ore Mine and in close proximity to the east of OB31 (Figure 1). OB31 is located at the eastern end of the Ophthalmia Range in the Eastern Pilbara region of Western Australia.

Level 2 Flora and Vegetation Assessment

A total number of 167 plant taxa (including varieties and subspecies) from 39 families and 97 genera were recorded from the study area at September 2014. Species representation was greatest among the Poaceae, Fabaceae, and Malvaceae families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (15 taxa), followed by *Senna* (8 taxa), *Eragrostis* (5 taxa) and *Eremophila* (5 taxa).

There were no plant taxa gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the WC Act, or listed under the EPBC Act recorded from the study area. In addition there were no Priority flora taxa recorded from the study area. Three of the plant taxa recorded were determined to represent range extensions based on the current known distribution of the total flora; *Chamaecrista symonii, Eragrostis speciosa* and *Halgania erecta.*

There were three introduced (weed) species recorded from the study area; **Cenchrus ciliaris, *Cenchrus setiger* and **Bidens bipinnata.* None of these taxa is listed as a Declared Pest under the BAM Act.

A total of 19 vegetation associations were described and mapped within the study area. Vegetation condition ranged from excellent to good, with the largest proportion of the study area rated as very good. The vegetation associations were classified into the following seven Broad Floristic Formations on the basis of dominant vegetation stratum:

1) *Eucalyptus* Woodland;
2) *Acacia* Low Open Forest;
3) *Acacia* Low Open Woodland;
4) *Acacia* High Shrubland;
5) *Triodia* Hummock Grassland;
6) *Triodia* Open Hummock Grassland; and
7) **Cenchrus* Tussock Grassland.

None of the vegetation associations within the study area had any affiliation with Federal or State listed TECs, or State listed PECs.

Riparian Vegetation Monitoring

At September 2014 a total number of 29 plant taxa was recorded along the five 20m by 1m belt transects assessed, including 28 natives and one introduced weed species, **Cenchrus ciliaris* (Buffel Grass). Species richness for individual transects ranged from three to 18 taxa and averaged ten taxa. Perennial plant density averaged 1.27 plants m^{-2} (1,270 per ha equivalent) and mean ground cover was 45.3 percent.

The three tree species occurring within the five 20 m by 20 m plots assessed were *Acacia citrinoviridis, Eucalyptus camaldulensis* and *Eucalyptus victrix.* Tree density ranged from 175 to 425 trees per hectare, averaging 320 trees per hectare. *Acacia citrinoviridis* was present at all five sites, while *Eucalyptus camaldulensis* was recorded from three sites and *Eucalyptus victrix* was present at two sites. The largest trees in terms of both height and stem circumference were *Eucalyptus camaldulensis* at Plot 3. Tree condition was predominantly rated as excellent (score 5) with the exceptions being two *Eucalyptus camaldulensis* trees at Plot 5 (scores of 3 and 4) and scattered *Acacia citrinoviridis* trees at Plots 3 and 4 (scores of 3 and 4). All *Eucalyptus victrix* trees were given the highest score of 5.

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1.0 INTRODUCTION

1.1 Preamble

BHP Billiton Iron Ore is preparing referrals to the Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act 1986 (EP Act) to develop new mining areas at Orebody 31 (OB31). As part of these referrals discharge options for the management of surplus water are being considered. Discharge into creeks within the OB31 area is one option being investigated. To support these investigations and future approvals, BHP Billiton Iron Ore commissioned Onshore Environmental to undertake a detailed riparian flora and vegetation survey along a 20 km stretch of the Jimblebar Creek riparian zone, herein referred to as the study area. Additionally the survey design incorporated permanent monitoring plots to provide quantitative baseline data for plant biodiversity parameters prior to the commencement of discharge.

The study area is situated 40 km east of Newman, 6 km north of the Jimblebar Iron Ore Mine and in close proximity to the east of OB31 (Figure 1). OB31 is located at the eastern end of the Ophthalmia Range in the Eastern Pilbara region of Western Australia.

1.2 Previous Surveys

At least 33 baseline flora and vegetation surveys have been completed at BHP Billiton Iron Ore tenements within a 25 km radius of the study area. These surveys are listed below and described in more detail in Section 3.1.1:

- OB31 Level 2 flora and vegetation survey (Onshore Environmental 2014a);
- OB 31 / Wheelarra Hill North Targeted Significant Flora Survey (Onshore Environmental 2014b);
- OB 18 to OB31 Infrastructure Corridor Targeted Flora Survey (Onshore Environmental 2014c);
- OB19 Level 2 flora and vegetation survey (Onshore Environmental 2013);
- South West Jimblebar flora and vegetation survey (Syrinx 2012);
- Wheelarra Hill North flora and vegetation survey (Syrinx 2012);
- Eastern Mines weed survey (Astron 2012);
- Level 1 flora and fauna surveys along the Great Northern Highway for Jimblebar mine module transport (Eco Logical 2012);
- OB31 flora and vegetation assessment (Syrinx 2011);
- RPG6 Jimblebar Hub (Water Pipeline) flora and vegetation assessment (ENV Australia 2010);
- Jimblebar Wye targeted Declared Rare Flora and Priority listed flora assessment (ENV Australia 2010);
- Jimblebar Ammonium Nitrate Storage Facility flora and vegetation assessment (ENV Australia 2009);
- Construction Water Supply Pipeline and Ammonium Nitrate Storage Facility flora and vegetation assessment (ENV Australia 2009);
- Jimblebar Hub flora and vegetation survey (Outback Ecology 2009);
- Eastern Pilbara Accommodation Camp flora and fauna assessment (Outback Ecology 2009);
- Jimblebar Wheelarra Hill flora and fauna assessment (Outback Ecology

2009);
- Wheelarra Hill Iron Ore Mine Modification flora and fauna assessment (Outback Ecology 2009);
- Rapid Growth Project 5: Repeater 9 Access Road flora and vegetation assessment (ENV Australia 2008);
- Draft Report for Wheelarra Hill (Jimblebar Mine Site) Priority species verification – *Goodenia hartiana* (GHD 2008);
- Jimblebar Access Road flora and vegetation assessment (ENV Australia 2008);
- Jimblebar Hashimoto flora and vegetation survey (Ecologia 2007);
- Jimblebar RPG4 Rail Loop flora and vegetation assessment 1 (ENV Australia 2007);
- Jimblebar Stage 2, Levee Banks and Communications Tower Redevelopment flora and vegetation assessment (ENV Australia 2007);
- Jimblebar West flora and vegetation assessment (ENV Australia 2007);
- Jimblebar Marra Mamba Exploration biological survey (Ecologia 2006);
- Jimblebar East Exploration Project biological survey (Ecologia 2005);
- Jimblebar Wheelarra Hill 3 flora and fauna assessment (Biota 2004);
- Jimblebar Wheelarra Hill Expansion biological survey (Ecologia 2004);
- Jimblebar flora and soil survey (Ecologia 1999);
- Jimblebar Rail Spur biological assessment survey (1996);
- OB18 biological assessment survey (Ecologia 1995);
- Jimblebar Mine Site biological survey (BHPBIO 1994); and
- Ecological Observations Jimblebar Railway Line (Dames and Moore 1993).

In addition to the above baseline surveys, Astron Environmental has undertaken ongoing monitoring of the riparian zone along Jimblebar Creek since 2011. The Astron Environmental monitoring sites are located upstream of the current study area and in close proximity to the Jimblebar Mine. The associated reports are listed below and discussed further in Section 3.1.2:

- Jimblebar Creek riparian vegetation monitoring program - survey 3, letter report, June 2014 (Astron 2014);
- Jimblebar Creek (Wheelarra Hill) riparian vegetation monitoring program – annual report (Astron 2013); and
- Jimblebar Creek (Wheelarra Hill) riparian vegetation monitoring program - annual report July 2011-June 2012 (Astron 2012).

190000 200000 210000 220000 230000

7460000 7450000 7440000 7430000 7420000 7410000 7400000

MARBLE BAR ROAD

Fortescue River

Jimblebar Creek

Caramulla Creek

WEELARRANA ETHEL CREEK ROAD

JIGALONG MISSION ROAD

OB31

ML 244SA

Orebody 18

ML 244SA

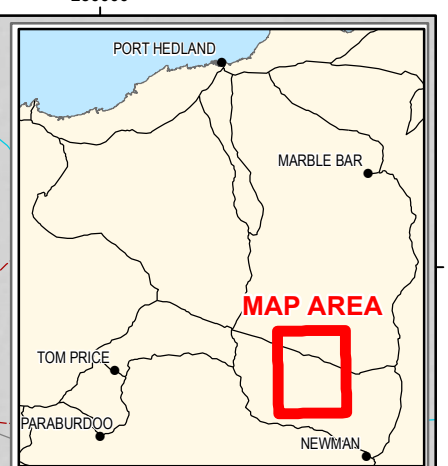
ML 244SA

Jimblebar

M 266SA

M 266SA

E 52/2591-I



LOCATION MAP

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LOCATION MAP

Jimblebar Creek Riparian
Flora and Vegetation

0 2 4 6 8 10
Kilometers

1:200,000

Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

Figure:	1	Date:	06/01/2015
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Legend

- Study Area
- BHP Tenements
- Highway
- Secondary Road
- Minor Road
- Track
- Operating Minesites
- Mineral Deposit

N

1.3 Climate

The Pilbara region has an arid to tropical climate with two distinct seasons; a hot summer from October to April and a mild winter from May to September. The majority of annual rainfall is received during the hot summer months. Summer and autumn rainfall is typically associated with cyclonic activity and thunderstorms, with falls being of higher intensity and shorter duration contributing to an erratic annual range (ANRA 2013).

Annual average rainfall for the Pilbara ranges from 180 mm to over 400 mm (Beard 1975) with the long-term average for nearby Newman Weather Station of 311.5 mm occurring over an annual average of 29.5 rain days. Most of the annual precipitation occurs between the four months from December to March. The average maximum summer temperatures typically range between 38°C and 40°C, while winter maximum temperatures range from 28°C to 30.5°C (BOM 2014).

There was significant summer rainfall received during January 2014 (220 mm) approximately three fold the long term average (Figure 2). However the following eight months received below average rainfall with the exception of May which was slightly above average (**Figure** , BOM 2014).

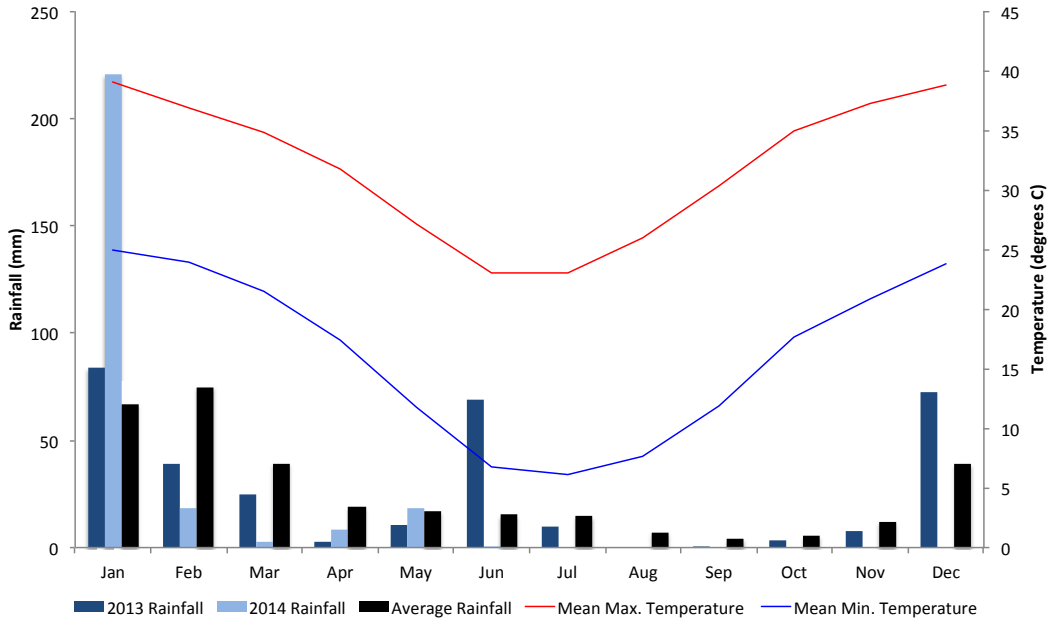

Figure 2 **Rainfall and climatic data recorded at Newman Airport between January 2013 and September 2014 (Bureau of Meteorology 2014).**

1.4 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information (Department of Environment 2013) and includes 419 sub-regions. The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study area is located in the Pilbara bioregion. The Pilbara bioregion consists of four sub-regions: Chichester, Fortescue, Hamersley and Roebourne. The study area is located on the southern edge of the Fortescue sub-region (PIL2), adjacent to the boundary of the Hamersley sub-region (PIL3).

The Fortescue sub-region is described as alluvial plains and river frontage with extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east (Kendrick 2001a). River gum woodlands fringe the drainage lines and it contains the northern limit of Mulga. It also contains a broad calcrete aquifer (originating within a paleo-drainage valley) that feeds many permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of River Gum *(Eucalyptus camaldulensis)* and Cadjeput *(Melaleuca argentea)* woodlands (Kendrick 2001a). Jimblebar Creek forms part of the Fortescue River catchment area and lies between the Fortescue River and Caramulla Creek.

The Hamersley sub-region is described as a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite) (Kendrick 2001b). It contains Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoide*s on skeletal soils of the ranges.

1.5 Existing Land Use

Land tenure in the Pilbara region consists of Aboriginal and leasehold reserves, national parks and reserves and Crown land which falls under a range of pastoral and mining leases. The dominant land uses in the Pilbara are mining, pastoralism in the form of cattle grazing, conservation, unallocated crown land, crown reserves and urban areas (Kendrick 2001a, 2001b).

1.6 Landforms

The study area is located at the eastern end of the Ophthalmia Range, which together with the Hamersley Range encompass the Hamersley Plateau. The Hamersley Plateau is characterised by long strike ridges rising 300 m or more above valley floors and flats. Other characteristic landforms of the general area include stony plains and some alluvial plains and sandplains (Tille 2007). The entire region contains mainly rounded ranges and hills in contrast to the characteristic ‘mesa form’ hills that are located further to the north-east. Jimblebar Creek begins at the base of these ranges and flows out into the sloping plains to the north which feed in to the Fortescue Marsh.

1.7 Soils

Tille (2007) classified the most recent and detailed mapping of Western Australia’s Rangelands and Arid Interior into a hierarchy of soil-landscape mapping units. The study area is located near the boundary of the following two soil units:

- 285 – Hamersley Plateaux Zone, located in the Fortescue Province is described as having stony soils with red shallow loams and some red/brown non-cracking clays and red loamy earths; and
- 290 – Bulloo Plains and Hills Zone, located in the Ashburton Province is described as having red shallow loams (often with hardpans), red loamy

earths, stony soils and red deep sands with some red shallow sands.

The Australian Soil Resource Information System (CSIRO 2006) described two soil types as occurring within the study area:

- MM16 - Alluvial plains dominated by deep cracking clays (Ug5.38) along with some areas of (Uf6.71) soils, and minor areas of (Dr2.33) soils; and
- Mz25- Plains associated with the Fortescue valley; there is a surface cover of stony gravels close to the ranges and hills: chief soils are acid red earths (Gn2.11) with some neutral red earths (Gn2.12); red-brown hardpan is absent. Associated are areas of calcareous earths (Gc) and loams (Um1) on calcrete (kunkar) and some hard red (Dr) soils around creek lines.

1.8 Geology

The geology of the wider Pilbara region is ancient and has been evolving over the past 3,500 million years (Trendall as cited in Johnson 2004). There are three main geological phases that comprise the development of the Pilbara region as it is today. These include the Precambrian basement rocks, the Phanerozoic sedimentary rocks and the Cainozoic deposits (Johnson 2004).

The Precambrian basement rocks were formed through sedimentation, intrusion and volcanism before being metamorphosed by movements in the Earths crust. These rocks cover most of the Pilbara but have been dissected by more recent intrusions. After a course of sea level changes, deposition of the large Phanerozoic sedimentary basins that cover the western and eastern areas of the Pilbara occurred. Following this, the erosion of the basement rocks and transportation of this sediment via drainages has lead to the deposition of Cainozoic superficial units that now cover most of the basement rocks and sedimentary basins (Johnson 2004).

The surface geology of the study area contains the geological formations outlined below (Williams and Tyler, 1991):

- Qa- This unit consists of alluvium; unconsolidated silt, sand and gravel within main drainage line of Jimblebar Creek
- Qw- Sheetwash plains occurring adjacent to the northern parts of the Jimblebar creek
- Qs- Areas of windblown sand surrounding the Jimblebar Creek.

1.9 Hydrology

Jimblebar Creek is located within the Fortescue River Catchment. The hydrology of the area is dominated by ephemeral creeks and drainage lines flowing into major drainage lines to the north and east of the study area. Jimblebar Creek, Caramulla Creek and the Fortescue River are the major drainage lines of the local area and all three flow north into the Fortescue River. All rivers in the Pilbara region are seasonal and require heavy rains to flow (Johnson 2004). Due to the hot dry climate and high evaporation rates groundwater is the most available source of water (Johnson 2004). The ground water table generally follows the surface topography, is recharged via infiltration from rainfall, and stored in large groundwater reserves in the valley fill alluvium of the Fortescue River and Hamersley Range (Johnson 2004).

The artificial Ophthalmia Dam is located approximately 20 km to the south-west of the study area. Ng *et al.* (1991), as cited in Payne and Mitchell (1999), showed that the Ophthalmia Dam may reduce the flow volume, peak flows, flooded width and frequency of flooding on the downstream floodplain.

1.10 Flora and Vegetation

The study area is located within the Fortescue Botanical District and close to the border of the Hamersley Botanical District, (both within the Pilbara IBRA region) which is part of the Eremaean Province (Beard 1990). It is dominated by tree and shrub – steppe communities consisting mainly of *Eucalyptus* and *Acacia* species; *Triodia pungens* and *Triodia wiseana* and some Mulga (*Acacia aneura*) occur within valley areas and short grass plains occur on alluvia.

The original vegetation mapping was undertaken by Beard (1975) and refined by Shepherd *et al.* (2002). There was two vegetation associations described from the study area (Figure 3). While the Pre-European extent for each vegetation association is 100 percent, less than 10 percent of each association occurs within formal or informal reserves (Table 1).

Table 1 Pre-European extent of vegetation associations occurring within the study area (Shepherd *et al.* 2002).

Vegetation Sub-Association	Description	Pre-Euro. Extent Remaining	Remaining area in IUCN Class I-IV Reserves	% remaining Other Reserves	% remaining DPaW Managed PL
Fortescue - Valley 82	Hummock grasslands, low tree steppe; Snappy gum over *Triodia wiseana*	2,290,910 ha (100 %)	8.9 ha	0.2	1.0
Fortescue - Valley 216	Low woodland; mulga (with spinifex) on rises	298,549 ha (100 %)	0.0 ha	0.0	0.0
Fortescue Valley 111	Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex	814,103 ha (100%)	2.9 ha	0.0	0.0

1.11 Land Systems

The Department of Agriculture (now the Department of Agriculture and Food) has conducted inventory and condition surveys of the Pilbara (van Vreeswyk *et al.* 2004) using an integrated survey method involving the land system approach to rangeland description evaluation. The primary objective of the surveys was to provide comprehensive descriptions and mapping of the biophysical resources of the region, as well as an evaluation on the condition of soils and vegetation. The mapping is based on patterns in topography, soils and vegetation.

A total of 102 land systems were defined in the Pilbara at a scale of 1: 250,000 (van Vreeswyk et al. 2004). There were five land systems represented within the

study area; Boolgeeda, Newman, Divide, River and Fortescue Land Systems (**Table**, Figure 4). The creekline is mostly comprised of the River Land System and the surrounding plains are part of the Divide Land System. The Boolgeeda and Newman Land Systems occur in southern parts of the study area. The Fortescue Land System occurs on the far northern boundary of the study area (Figure 4).

Table 2 Land Systems occurring within the study area (descriptions from van Vreeswyk et al. 2004).

Land System	Land System	Representation in the Pilbara	Description
RGEBGD	Boolgeeda	7,748 km^2 or 4.3 %	Stony plains with hard Spinifex grasslands or Mulga shrublands. The geology is quaternary colluvium.
RGENEW	Newman	14,580 km^2 or 8.0 %	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.
RGEDIV	Divide	5,293km^2 2.9%	Sandplains and occasional dunes supporting shrubby hard spinifex grasslands.
RGEFTC	Fortescue	504 km^2 or 0.3%	Alluvial plains and flood plains supporting patchy grassy woodlands and shrublands and tussock grassland.
RGERIV	River	4,088 km^2 or 2.3%	Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands

1.12 Riparian Vegetation

The riparian zones of the Pilbara are generally ephemeral and comprise an incised drainage channel surrounded by levee banks and floodplains. Surface water is rare but does occur at localised points such as Innawally Pool along Jimblebar Creek (4km south of the study area). Dominant tree species of the riparian zone are *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea. Eucalyptus camaldulensis* and *Eucalyptus victrix* are facultative phreatophytes that draw on groundwater in times of drought but also utilise surface water. *Melaleuca argentea* is an obligate phreatophyte associated with shallow groundwater and/or permanent pools of surface water along the major creeklines.

205000 210000 215000 220000

7440000 7435000 7430000 7425000 7420000 7415000

FORTESCUE VALLEY,166
FORTESCUE VALLEY,166
FORTESCUE VALLEY,111
FORTESCUE VALLEY,82
FORTESCUE VALLEY,29
FORTESCUE VALLEY,216
FORTESCUE VALLEY,82
FORTESCUE VALLEY,29
FORTESCUE VALLEY,82
FORTESCUE VALLEY,82

205000 210000 215000 220000

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JIMBLEBAR CREEK

Beard (1975) vegetation complexes represented within the study area

0 1 2 3 4 5
Kilometers
1:75,000
Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

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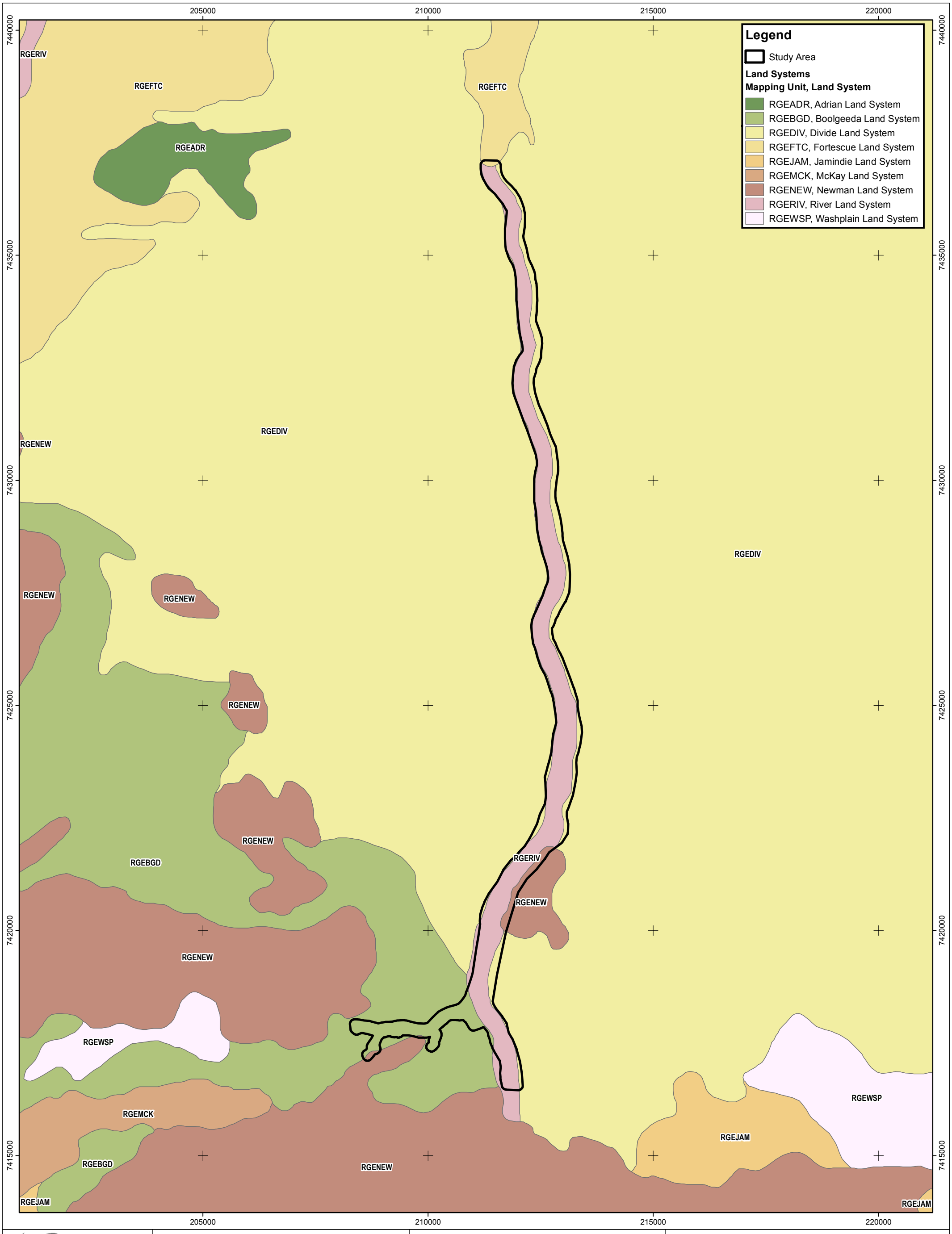
Legend

Study Area

Pre-European Vegetation (Beard 1975) System, Vegetation Association

- FORTESCUE VALLEY, 111
- FORTESCUE VALLEY, 166
- FORTESCUE VALLEY, 216
- FORTESCUE VALLEY, 29
- FORTESCUE VALLEY, 82

N



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JIMBLEBAR CREEK

Land Systems represented within the study area
(as mapped by Van Vreeswyk et al. 2004)

0 1 2 3 4 5
Kilometers

1:75,000

Datum: GDA94
Projection: MGA Zone 51

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2.0 METHODOLOGY

2.1 Legislation and Guidance Statements

The flora and vegetation survey was carried out in a manner that was compliant with Environmental Protection Authority (EPA) requirements for the environmental surveying and reporting of flora and vegetation in Western Australia:

- Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No. 2 (EPA 2000);
- Terrestrial Biological Surveys as an Element of Environmental Protection. Position Statement No. 3 (EPA 2002); and
- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004).

The survey was also conducted in accordance with BHP Billiton Iron Ore's Guidance for Flora and Vegetation Surveys in the Pilbara (BHP Billiton Iron Ore 2010).

2.2 Desktop Searches

Desktop searches of three databases were completed for information relating to rare flora (DPaW 2014a), TECs and PECs (DPaW 2014b) previously collected or described within, or in close proximity to, the study area. For this report a database search covering the entire study area was completed. The search was extended beyond the immediate survey limits to place flora values into a local and regional context. The search co-ordinate used was a 50 km radius around the central point of the study area which includes the length of Jimblebar Creek surveyed; 193000mE 7417000mN (Zone 51 GDA94). The State database search investigated three DPaW databases:

- The DPaW Threatened Flora Database (DPaW 2014a);
- The DPaW Threatened and Priority Flora List (DPaW 2014b); and
- The Western Australian Herbarium Specimen Database for priority species opportunistically collected in the area of interest.

A search of the EPBC Act Protected Matters database was undertaken (DOE 2014), as well as a search of the International Union for Conservation of Nature (IUCN) database (IUCN 2014). A comprehensive literature review of surveys previously completed within or in close proximity to the study area was also completed.

2.3 Baseline Survey Methodology

2.3.1 Timing and Personnel

The flora and vegetation survey was completed by Principal Botanist Dr Jerome Bull and Field Botanist Mr Daniel Roberts working over a five day period between the 8th and 12th September 2014.

2.3.2 Sampling of Study Sites

The field survey involved systematic sampling using quadrats (referred to as study sites). Relevé vegetation descriptions were made to increase the accuracy of vegetation mapping and targeted searches were completed in habitats where it was anticipated significant flora may occur.

Quadrats were 50 m by 50 m in dimension, with this area being standard for the Pilbara bioregion. The number of study sites sampled was determined by the size and heterogeneity of the study area, with 13 quadrats formally assessed along the approximately 20 km length of Jimblebar Creek. An additional 81 relevé sites were assessed. The locations of all quadrats sampled are provided in Figure 5.

The sampling sites were assessed to provide a list of the total flora occurring within the study area and a description of the vegetation structure. Data collected covered a range of environmental parameters including:

- Landform and habitat;
- Aspect;
- Soil colour and soil type;
- Rock type;
- Slope (angle);
- Percentage of bare ground, logs, twigs and leaves;
- Vegetation condition;
- Disturbance (caused by fire, clearing, grazing etc.);
- Age since fire;
- Broad floristic formation;
- Vegetation association description; and
- Height and percentage ground cover provided by individual plant taxa.

Other parameters recorded for each study site were:

- Study site number and date of assessment;
- Names of the botanists undertaking the assessment;
- Location description a waypoint – GPS coordinate (GDA94) using a handheld GPS; and
- Photograph number.

202500 204000 205500 207000 208500 210000 211500 213000 214500 216000 217500 219000 220500 222000

7438500 7437000 7435500 7434000 7432500 7431000 7429500 7428000 7426500 7425000 7423500 7422000 7420500 7419000 7417500 7416000 7414500

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JC01

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JIMBLEBAR CREEK

Sample Locations

0 1 2 3 4 5
Kilometers
1:75,000
Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

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Legend

- Study Area
- **Sample Location**
- 50m x 50m
- 20m x 20m

N

2.3.3 Targeted Surveys for Conservation Significant Species

Targeted searches were completed across the majority of the study area, noting that access to the northern 4 km section of Jimblebar Creek was restricted. The existing pastoral track aligned north-south and to the west of Jimblebar Creek was inaccessible from north of the main intersection (at around 210500E, 7428750N), where it became overgrown on a red sand plain.

Ground truthing provided an opportunity to record opportunistic locations for Threatened and Priority listed flora and under take closer examination of specific landforms where conservation significant flora may be expected to occur.

2.3.4 Weed Survey and Mapping

Introduced weed species were recorded from the 13 formal quadrats assessed within the study area. Opportunistic collections were also made while moving along the creekline with targeted weed searches were completed in high moisture habitats of the main drainage channel.

2.3.5 Vegetation Association Mapping

The vegetation mapping utilised high-resolution aerial photography of the entire study area at a scale of 1:10,000, with definition of vegetation polygons based on contrasting shading patterns. Ground-truthing of the study area was completed during the survey with vegetation descriptions made within selected vegetation polygons to confirm dominant structural layers and associated plant taxa.

The location of 13 quadrats (50 m x 50 m or 2,500 m^2 in equivalent area) and 81 relevé plots was overlaid on the aerial photography, and associated flora and vegetation data was used to provide vegetation association descriptions for individual polygons defined.

Description of vegetation structure follows the height, life form and density classes of Specht (1970) as modified by Alpin (1979) and Trudgen (2009) (see Appendix 1). This is largely a structural classification suitable for broader scale mapping, but taking all ecologically significant strata into account. Vegetation condition for each of the sampling sites was determined using a recognised rating scale (based on Keighery 1994, see Appendix 2).

2.3.6 Vouchering

At least one voucher specimen was taken for each species collected to verify identification. Taxonomy was completed by Dr Jerome Bull at the Western Australian Herbarium (WAH), with selected voucher specimens provided to the BHP Billiton Iron Ore sponsored botanist, Mr Steve Dillon. Use was made of the WAH for confirmation of species identification.

2.3.7 Field Survey Constraints

The EPA Guidance Statement for Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004) list twelve potential constraints that field surveys may encounter. These constraints are addressed in Table 3.

Table 3 Relevance of constraints, as identified by EPA (2004), to the flora and vegetation survey.

Constraint	Relevance
Scope	The scope was established by BHP Billiton Iron Ore in compliance with relevant EPA Guidance Statements.
Proportion of flora collected and identified	It is likely that a large proportion of the flora occurring within the study area has been collected, given the intensity of the 2014 survey effort by Onshore Environmental. The low rainfall over the six months prior to field work would have reduced the annual flora component, although a number of ephemeral taxa were recorded.
Sources of information	Onshore Environmental has recently completed a comprehensive Level 2 flora and vegetation survey of the adjacent OB31 study area. There has been additional high intensity sampling from at least 33 neighbouring BHP Billiton Iron Ore tenements (25 km radius around the study area), providing an extensive local database. This is confirmed by the intensity of records for the area on Florabase.
The proportion of the task achieved and further work which might be needed	All allocated tasks detailed in the scope of works were achieved during the 2014 survey and no further work is required at this site.
Timing / weather / season / cycle	The survey was completed in September 2014 under relatively dry seasonal conditions. There was significant summer rainfall recorded during January 2014, but rainfall totals for seven of the subsequent eight months was below the long term monthly average.
Disturbances, e.g. fire, flood	Disturbances within the study area include introduced species, grazing of vegetation and damage to the creekline by domestic stock (cattle), and fire (mosaic of burn ages recorded). The riparian habitats are preferentially used by domestic stock and which may lead to erosion and increased weed infestation compared to other habitats.
Intensity	A total of 13 quadrats and 81 releve plots were assessed along the 20km length of the creekline by Onshore Environmental during 2014.
Completeness	Given the narrow width of the study area and the intensive ground coverage along the entire 20 km length it is considered the area has been adequately surveyed.
Resources	Appropriate resources were applied to surveying the study area.
Access problems	The entire study area could be accessed by vehicle and on foot, noting that vegetation mapping was facilitated by high-resolution aerial photography.
Availability of contextual information	More than 33 flora and vegetation surveys have been undertaken within a 25 km radius of the study area, providing an extensive local database.
Experience levels	The Principal Botanist working on the survey has over ten years Pilbara experience, and the accompanying Field Botanist has in excess of three years Pilbara experience. Together the group has completed numerous surveys in close proximity to the study area over recent years.

2.3.8 Assessment of Conservation Significance

The conservation significance of flora and ecological communities are classified on a Commonwealth, State and Local level on the basis of various Acts and Agreements (EPA Guidance Statement No. 51, EPA 2004), including:

Commonwealth Level:

- EPBC Act: The Department of Environment (DoE) lists Threatened Flora and Ecological Communities, which are determined by the Western Australian Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 3).

State Level:

- WC Act: At a State level native flora species are protected under the WC Act – Wildlife Conservation (Rare Flora) Notice. A number of plant species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations. Species of the highest conservation significance are gazetted Threatened Flora (T) under subsection 2 of section 23F of the Act. It is an offence to take or damage Threatened flora without Ministerial approval. Section 23F of the Act defines 'to take' as "to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means".
- DPaW Priority list: DPaW produces a list of Priority species and ecological communities (PECs) that have not been assigned statutory protection under the WC Act. Priority Flora are under consideration for declaration as 'Rare Flora', classified as in urgent need of further survey (Priority One to Three), require monitoring every 5-10 years (Priority Four) or require a specific conservation program to prevent the taxon becoming threatened within five years (Priority 5), see Appendix 4. The list of PECs identifies those that need further investigation before nomination for TEC status.

Local Level:

- Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.

2.4 Vegetation Monitoring Methodology

The potential impact on flora and vegetation resulting from surface discharge of surplus water from the proposed OB31 Mine situated adjacent to Jimblebar Creek, can be assessed by establishing permanent monitoring plots and quantitatively recording plant biodiversity parameters. Undertaking a baseline assessment prior to the commencement of discharge is critical in obtaining *in situ* data from which future comparisons can assessed.

The monitoring strategy for the study area reflects the objectives of the site and allows for accurate assessment of the understorey and overstorey vegetation components. A total of five permanent monitoring points were established along the length of Jimblebar Creek, at increasing distances downstream from the proposed discharge point. Monitoring of these transects will allow identification of changes in vegetation health that may potentially occur as a result of discharge activities from the proposed OB31 Mine. Separate monitoring procedures were used to assess the understory and overstorey strata.

2.4.1 Quantitative assessment of understory vegetation

Twenty metre by one metre permanent belt transects were established to sample plant density, percent ground cover, and maximum plant height for all plant taxa present. Permanent belt transects of twenty continguous 1m by 1m quadrats were established along the western boundary of a larger 20m by 20m plot used to quantitatively assess trees (see Section 2.4.2 below) (Figure 6).

The twenty contiguous $1m^2$ quadrats were assessed individually. For each species within a quadrat the number present, percentage ground cover, and maximum plant height was recorded. Summarised data gave mean density values (no. plants m^{-2}), mean percentage ground cover, and mean maximum plant height for each of the five transects. An importance value index (IVI, Mueller-Dombois and Ellenberg 1974) which considers frequency, density, and cover was calculated for each species recorded along a transect line. The total IVI value for all species within the transect is 300; the greater the dominance of a particular species within the transect the larger the individual species' IVI. A diversity index, Shannon-Wiener (H), and an evenness value (J) were also calculated. The evenness index has a maximum value of one which represents an even spread of individuals among species (Magurran 1988).

2.4.2 Quantitative assessment of trees

Permanent 20 m x 20 m plots were established to monitor the health and density of tree species along Jimblebar Creek (Figure 6). The western boundary of each plot aligned with the 20m by 1m belt transects described in Section 2.4.1 above. Within each plot the height, stem diameter (at breast height) and condition of each tree present was recorded.

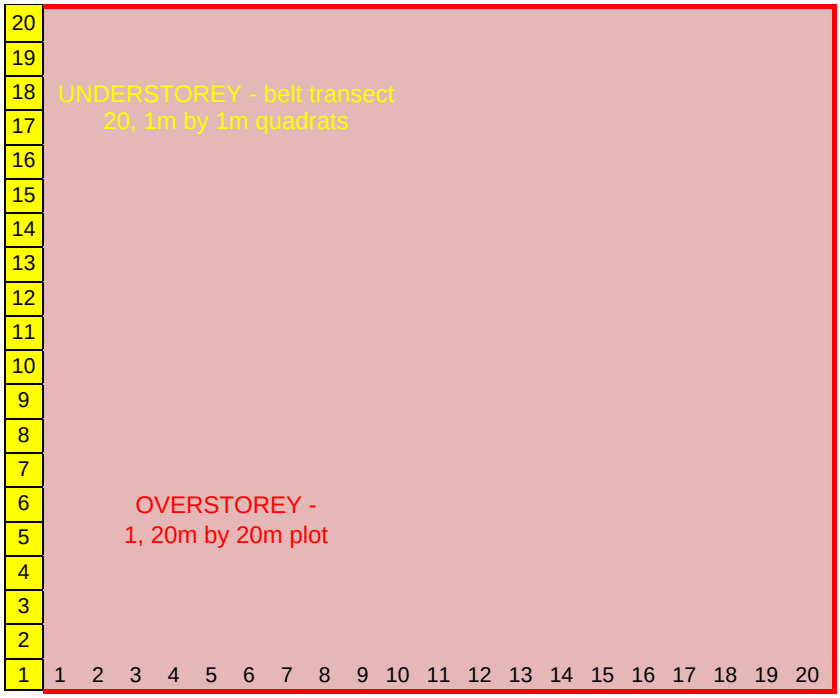

Figure 6 **Layout of permanent understorey belt transect (20, 1m by 1m quadrats) and overstorey plots (20m by 20m), established as part of the monitoring program.**

2.4.3 Vegetation Health

Vegetation health was assessed along transects established at each of the five pre-determined sites. A score ranging between 0 and 5 (Table 4) was applied on the basis of visual evidence of plant stress or deaths. Scores will be compared over time to determine whether there is any significant change in vegetation health.

Table 4 **Vegetation health rating table.**

Score	Observation
5	No evidence of stress
4	Odd plant showing signs of stress
3	One or Two stressed plants, usually under severe stress, near death
2	Scattered stressed and dead plants around plot
1	Susceptible plants dead or dying
0	Graveyard death, most plants dead

3.0 RESULTS: BASELINE SURVEY

3.1 Desktop Review

3.1.1 Previous Baseline Flora Surveys

There was a total of 33 previous flora and vegetation surveys within a 25 km radius of the study area that were reviewed to determine existing values within the region. Table 5 summarises findings of the literature review, tabulating methodology, main findings including conservation significant flora, and current status of significant flora (i.e. change of conservation ranking since survey).

Table 5 Summary of results from previous flora and vegetation surveys within, or in close proximity to, the study area.

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Onshore Environmental (2014a) Level 2 Flora and Vegetation Assessment Orebody 31	Situated on the eastern side of Jimblebar Creek	1- 14 October 2013 45 quadrats and 146 releve	35 vegetation associations within 15 broad floristics formations	280 plant taxa from 35 families and 110 genera. The most commonly recorded families were *Fabaceae, Poaceae, Malvaceae, Chenopodiaceae, Asteraceae, Amaranthaceae, Scrophulariaceae Myrtaceae* and *Goodeniaceae.* The dominant genus was *Acacia* (40 taxa), followed by *Senna* (11 taxa), *Sida* (11 taxa) and *Eremophila* (10 taxa). There were two introduced species recorded; **Cenchrus ciliaris* (Buffel Grass) and **Malvastrum americanum* (Spiked Malvastrum).	No Threatened Flora. One Priority flora taxa; *Rhagodia* sp. Hamersley (M. Trudgen 12739) (P3). Two taxa of interest: *Acacia* sp. nov (reticulate/anastomosing) and *Triodia* ?sp. Mt Ella (M.E. Trudgen 12739)[1] Range extensions: *Rhagodia* sp. Hamersley (M. Trudgen 12739), *Acacia clelandii* and *Eremophila demissa*

[1] Since confirmed to be *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (Priority 3)

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Onshore Environmental (2014b) OB 31 / Wheelarra Hill North Targeted Significant Flora Survey	Situated to the east of Jimblebar Creek	24-30 April 2014	Not recorded	Not recorded	No Threatened Flora Three Priority flora taxa; *Rhagodia* sp. Hamersley (M. Trudgen 12739) (P3), *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3) and *Goodenia nuda* (P4) One taxon of interest: *Acacia* sp. nov (reticulate/anastomosing) One significant range extension: *Acacia clelandii*
Onshore Environmental (2014c) OB18 to OB31 Infrastructure Corridor Targeted Flora Survey	Situated between OB18 and OB31, and to the east of Jimblebar Creek	13-14 September 2014	Not recorded	Not recorded	No Threatened Flora Two Priority flora taxa; *Triodia* sp. Mt Ella (M.E. Trudgen 12739) (P3) and *Goodenia nuda* (P4)
Onshore Environmental (2013) Orebody 17/18 Derived Vegetation Association Mapping Report	Small area of OB 17/18 located in the Eastern Pilbara, west of the Jimblebar Mine. It is located approx. 10km west of the southern end of the study area.	Desktop survey	Five of the 27 vegetation associations described by ENV (2007)	N/A	No Threatened or Priority Flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Syrinx (2012) South West Jimblebar Flora and Vegetation Survey	South West Jimblebar is located 40 km east of Newman, and is adjacent to the existing Jimblebar Mine. It is approximately 10 km south-west of the study area.	14-8 March 2011 19 quadrats and four relevés.	17 vegetation associations within ten broad floristic formations	202 plant taxa from 33 families and 93 genera. Most commonly recorded families were Poaceae (42 taxa), Fabaceae (38 taxa) and Malvaceae (14 taxa). The dominant genus was Acacia (23 taxa) followed by Eremophila (10 taxa) and Ptilotus (9 taxa). There were four introduced species recorded; **Bidens bipinnata, *Cenchrus ciliaris, *Cucumis melo, *Portulaca oleracea*	No Threatened Flora Two Priority flora taxa; *Aristida ?jerichoensis* var. *subspinulifera* (P1), *Goodenia ?nuda* (P4) Five range extensions: *Alloteropsis cimicina, Brachyscome ciliaris* var. *ciliaris, Evolvulus alsinoides* var. *decumbens, Tephrosia sphaerospora* and *Tribulopis angustifolia*

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Syrinx (2012) Wheelarra Hill North Level 2 Flora and Vegetation Assessment	Situated to the south of the study area	Two season survey. First season from 17-29 May 2011 and second season from 4-12 October 2011 83 quadrats and 19 relevés	25 vegetation associations were recorded within nine broad floristic formations	411 taxa from 49 families and 145 genera. The most commonly recorded families were Fabaceae (78 taxa), Poaceae (58 taxa) and Malvaceae (47 taxa). The dominant genera were *Acacia* (40 taxa), *Ptilotus* (16 taxa) and *Senna* (15 taxa). Four introduced species; **Bidens bipinnata*, **Cenchrus ciliaris*, **Malvastrum americanum*, **Portulaca oleracea*	No Threatened Flora One Priority 1 flora *Aristida ?jerichoensis* var. *subspinulifera*[2] Nine range extensions: *Sclerolaena minuta*, *Eragrostis olida*, *Oldenlandia galioides*, *Evolvulus alsinoides* var. *decumbens*, *Phyllanthus erwinii*, *Phyllanthus maderaspatensis*, *Santalum spicatum*, *Cyperus ixiocarpus*, *Abultilon cunninghamii*, and two possible range extensions; *Tephrosia* aff. *sphaerospora*, *Hibiscus* aff. *apodus*

[2] Targeted searches by Onshore Environmental (2014b) confirmed this taxon to be *Aristida inaequiglumis* (not Threatened or Priority flora).

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Astron (2012) Eastern Mines Weed Survey, Jimblebar	Situated to the south of the study area	22-30 May 2012 25 project monitoring sites and 6 reference monitoring sites	N/A	13 weed species; **Acetosa vesicaria, *Aerva javanica, *Bidens bipinnata, *Cenchrus ciliaris, *Chloris barbata, *Chloris virgata, *Citrullus colocynthis, *Cynodon dactylon, *Malvastrum americanum, *Portulaca oleracea, *Solanum nigrum, *Sonchus asper, *Vachellia farnesiana*	N/A
Eco Logical (2012) Level 1 flora and fauna surveys along the Great Northern Highway for Jimblebar mine module transport.	Boodarie Staging Yard in Port Hedland south to Jimblebar Mine along the Great Northern Highway near Newman. Site 1: Located 3.8 km south-east of Newman townsite Site 2: Located 9 km north-west of Newman Site 3: Located 98 km north-west of Newman At any point the Great Northern Highway is at least 15 km west or north-west of the study area	18-19 August 2011 Three quadrats	seven vegetation associations	52 flora taxa comprising 14 families; the most commonly occurring families were: Poaceae, (12 taxa), Fabaceae (12 taxa), Amaranthaceae (8 taxa) and Myrtaceae (5 taxa). One introduced weed species, **Cenchrus ciliaris*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Syrinx (2011) OB 31 Flora and Vegetation Assessment	Situated to the south of the study area	10-15 February and 9-13 March 2011 29 quadrats	21 vegetation associations classified into 12 broad floristic formations	206 plant taxa from 36 families and 93 genera, with dominant families being the Fabaceae (10 taxa), Malvaceae (20 taxa) and Chenopodiaceae (12 taxa). Four introduced weed species; **Bidens bipinnata, *Cenchrus ciliaris, *Malvastrum americanum, *Portulaca oleracea*	No Threatened or Priority flora
ENV (2010) RGP6 Jimblebar Hub (Water Pipeline) Flora and Vegetation Assessment	Situated to the south of the study area	November 2009 16 quadrats and seven relevés	14 vegetation associations	166 plant taxa comprising 33 families and 81 genera. The most common families were Poaceae (29 taxa), Mimosaceae (25 taxa) and Malvaceae (15 taxa). The common genera were *Acacia* (25 taxa), *Senna* (10 taxa) and *Ptilotus* (8 taxa). Two introduced flora species were recorded; **Cenchrus ciliaris, *Malvastrum americanum*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV (2010) Jimblebar Wye Targeted Declared Rare Flora and Priority Listed Flora Assessment	Situated approximately 20 km south west of the study area.	3-5 March 2010 and 8-11 June 2010 Transects in habitats known to support targeted flora	N/A	N/A	No Threatened flora One Priority flora; *Gymnanthera cunninghamii* (P3)
ENV (2009) Ammonium Nitrate Storage Facility Flora and Vegetation Assessment	Situated approximately 15 km to the southeast of the study area	17 September 2009 seven quadrats and one relevé	Eight vegetation associations	123 taxa comprising 34 families and 70 genera. Common families were Poaceae (23 taxa), Mimosaceae (16 taxa), Malvaceae (10 taxa). The most common genera were *Acacia* (16 taxa), *Ptilotus* (7 taxa) and *Senna* (6 taxa). Two introduced flora species; **Cenchrus ciliaris, *Portulaca oleracea*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV (2009) Construction Water Supply Pipeline and Ammonium Nitrate Storage Facility Flora and Vegetation Assessment	Situated approximately 15 km south-east of the study area	17 September and 4-6 November 2009 23 quadrats and 8 relevés	19 vegetation associations	213 taxa comprising 38 families and 91 genera The most common families were Poaceae (38 taxa), Mimosaceae (32 taxa) and Malvaceae (20 taxa). The most common genera were *Acacia* (32 taxa), *Senna* (11 taxa) and *Ptilotus* (10 taxa). Three introduced flora species were recorded; **Cenchrus ciliaris, *Malvastrum americanum, *Portulaca oleracea*	No Threatened Flora One current Priority flora *Goodenia nuda* (P4)
Outback Ecology (2009) Eastern Pilbara Accommodation Camp Flora and Fauna Assessment	Situated approximately 15 km south-east of the study area.	30 October – 4 November 2008 15 quadrats	16 vegetation associations	115 taxa from 23 families and 44 genera; dominant families were: Mimosaceae (23 taxa), Poaceae (17 taxa), Caesalpinaceae (13 taxa), Myrtaceae (9 taxa), Papilionaceae (7 taxa), Myoporaceae (8 taxa) and Chenopodiaceae (7 taxa); dominant genera were *Acacia* (23 taxa), *Senna* (12 taxa) and *Eremophila* (8 taxa); no weed species	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Outback Ecology (2009) Wheelarra Hill Iron Ore Mine Modification Flora and Fauna Assessment	Situated approximately 8 km south-east of the study area.	This report documents the results of supplementary flora and vegetation surveys conducted in October and November 2008 and January 2009. 22 quadrats	Five broad vegetation associations	146 plant taxa from 29 families and 62 genera; one introduced weed, **Cenchrus ciliaris*	No Threatened Flora One current Priority 4 flora, *Goodenia nuda*, recorded from one location

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV (2008) Rapid Growth Project 5: Repeater 9 Access Road Flora and Vegetation Assessment	Situated approximately 20 km directly west of the study area	12-13 June 2008 Six quadrats and one relevé	Six broad vegetation communities were mapped	163 taxa comprising 95 genera; most common families were Poaceae (28 taxa), Mimosaceae (14 taxa), Amaranthaceae (11 taxa) and Malvaceae (11 taxa); the most common genera were Acacia (13 taxa), Eremophila (9 taxa) and Senna (7 taxa); 14 introduced species were recorded: **Acetosa vesicaria, *Aerva javanica, *Brassica tournefortii, *Cenchrus ciliaris, *Citrullus lanatus, *Cucumis melo* subsp. *agrestis, *Cynodon dactylon, *Datura leichhardtii, *Malvastrum americanum, *Portulaca oleracea, *Setaria verticillata, *Sonchus asper, *Sonchus oleraceus* and **Vachellia farnesiana*	No Threatened Flora recorded One current Priority flora species, *Rostellularia adscendens* var. *latifolia* (P3) A second Priority 1 flora recorded *Eremophila* sp. Ophthalmia Range (D. Brearley s.n. 20/3/2004) has since been renamed *Eremophila margarethae* (not Threatened or Priority listed)

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
GHD (2008) Draft Report for Wheelarra Hill (Jimblebar Mine Site) Priority Species Verification – Goodenia hartiana Species Verification	Situated to the south of the study area	25-26 September 2007 12 quadrats	N/A	N/A	No Threatened or Priority flora
ENV (2008) Jimblebar Access Road Flora and Vegetation Assessment	Situated 15 km south-west of the study area	20-23 May 2007 22 quadrats	Ten distinct vegetation communities were described	112 taxa were recorded from 28 families; three introduced weed species were **Cenchrus ciliaris*, **Aerva javanica* and **Citrullus lanatus*	No Threatened or Priority flora
GHD (2008) Mesa Gap Biological Survey	Situated between OB 18 and Jimblebar Mines, south of the study area	October 2007 40 quadrats	Eight vegetation associations from 7 landforms	133 plant taxa from 32 families with dominant families being the *Fabaceae* (15 species), *Poaceae* (9 species) and *Myrtaceae* (6 species); there were no introduced weed species	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Pilbara Flora (2008) OB17 Flora and Vegetation Survey	Situated approximately 5 km south-west of the study area	October 2008	Six vegetation associations from four landforms	61 plant taxa from 39 genera and 23 families, with dominant families being the *Fabaceae* (35 species), *Poaceae* (20 species) and *Myrtaceae* (8 species). There were no introduced weed species	No Threatened or Priority flora
ENV (2007) West Jimblebar Exploration Lease Flora and Vegetation Assessment – Management Recommendations	Situated approximately 15 km south-east of the study area	14-18 May 2007 29 quadrats	N/A	318 taxa were recorded from 113 genera and 44 families. Most frequently represented families were Poaceae, Mimosaceae and Malvaceae Three introduced weeds were recorded	No Threatened flora One current Priority flora species, *Goodenia nuda* (P4) One range extension was recorded, *Thyridolepis xerophila*
ENV (2007) OB 18 Flora and Vegetation Assessment Phase II	Situated to the south-east of the study area	July and August 2006 71 quadrats and relevés	A total of 27 vegetation associations classified into six broad landforms - Hill crests, Hill slopes, Gorges and Gullies, Drainage lines, Footslopes and Flood plains.	276 plant taxa including 46 families; dominant families were Poaceae (41 taxa), Mimosaceae (30 taxa), Amaranthaceae (19 taxa) and Malvaceae (18 taxa); two weed species were recorded, **Acetosa vesicaria* and **Cenchrus ciliaris*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Ecologia (2007) Hashimoto Exploration Project Biological Survey: Flora and Vegetation	Situated to the south-east of the study area	August/September 2005 and February 2006 44 quadrats	Described as nine vegetation/landform associations: Range crest vegetation; Rocky range slope vegetation; Acacia aneura (mulga) woodland; Valley plain vegetation; Scattered Corymbia deserticola and Eucalyptus gamophylla and shrubs over Triodia basedowii; Range slope vegetation; Gorge and Gully vegetation; Minor drainage channel vegetation; and Minor creek line vegetation.	372 species, representing 42 families and 129 genera were recorded. Thirty eight (38) collections could not be identified beyond family level. The most commonly recorded genera were *Acacia* (26 species), *Ptilotus* (20 species), *Eremophila* (16 species), and *Sida* (15 species). Three introduced species were recorded: **Cenchrus ciliaris, *Bidens bipinnata* and **Sonchus oleraceus.*	No Threatened Flora One current Priority 4 flora, *Goodenia nuda*. A Priority 2 flora taxon *Goodenia hartiana* has since been split into a number of new entities and now determined to be *Goodenia* sp. Sandy Creek (R.D. Royce 1653) (not Threatened or Priority listed).
ENV (2007) Jimblebar Stage 2, Levee Banks and Communications Tower Redevelopment Flora and Vegetation Assessments	Situated to the south of the study area	April – June 2007 Four quadrats	Six vegetation associations	103 plant taxa from 24 families; most common families were Poaceae (30 taxa), Mimosaceae (17 taxa) and Papilionaceae (8 taxa)' five weed species were **Cenchrus ciliaris, *Cenchrus setiger, *Citrullus lanatus, *Bidens bipinnata* and **Cynodon dactylon*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
ENV (2007) RGP4 Jimblebar Rail Loop Flora and Vegetation Assessment	Situated approximately 5 km south of the study area	27 November – 1 December 2006 Four quadrats	Four vegetation associations classified into three landform types; creekline, floodplain and plain.	65 plant taxa (44 genera) with most common families being Poaceae (14 taxa), Mimosaceae (11 taxa) and Malvaceae (5 taxa); two introduced weeds were **Bidens bipinnata* and **Cenchrus ciliaris*	No Threatened or Priority flora
Ecologia (2006) Jimblebar Marra Mamba Exploration Biological Survey	Situated approximately 5 km south of the study area	22-28 May 2006 105 quadrats	Four vegetation types	267 plant taxa with most common families being Poaceae (33 species) and Malvaceae (22 species); two introduced weeds were **Acetosa vesicaria* and **Cenchrus ciliaris*	No Threatened Flora recorded. One current Priority 4 flora *Goodenia nuda*. A second Priority 3 flora recorded, *Triumfetta leptacantha* is no longer Threatened or Priority listed

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Ecologia (2005) Jimblebar East Exploration Project Biological Survey	Situated approximately 15 km south-east of the study area	8-14 Feb 2005 26 sampling sites (50 m x 50 m in size)	Seven vegetation types were recorded relating to specific landforms: (i) undulating fine to coarse gravelly plains; (ii) flat to slightly undulating fine gravelly to sandy plains; (iii) fine gravelly to clayey sand undulating or flat plains; (iv) fine gravelly gentle lower slopes / low rises and undulating plains; (v) flat red clayey sandplains with areas of loose soil; (vi) flat clayey sandplains often with loose soil; (vii) flat red, sandy clay plains, with areas of soil surface crust and loose soil	155 plant taxa with most common families being Poaceae (27 taxa), Caesalpiniaceae (13 taxa) and Mimosaceae (12 taxa); one weed species was **Cenchrus ciliaris.*	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Ecologia (2004) OB 18 Flora and Fauna Review	Situated directly south-west of the study area	Targeted searches in July 2004	As above	As above	No Threatened Flora One Priority 2 Flora *Rhodanthe frenchii* identified from one gorge site[3].
Ecologia (2004) Jimblebar-Wheelarra Hill Expansion Biological Study	Situated approximately 10 km directly south of the study area	9 Feb – 4 March 2004. A total of 44 quadrats were sampled, each measuring 100 x 100 m.	Nine vegetation associations were recorded.	181 plant species from 47 families and 80 genera; dominant genera were *Acacia* (30 species), *Senna* (10 species) and *Eremophila* (7 species); one weed species, **Cenchrus ciliaris.*	No Threatened or Priority flora *Goodenia hartiana* (P2) recorded but this taxon later split and now determined to be *Goodenia* sp. Sandy Creek (R. D. Royce 1653) (not Threatened or Priority listed).

[3] It is noted that the original identification was not confirmed through the WAH and the collection represents a 300 km range extension to the east. It has not been recorded locally during numerous surveys over a 17 year period since the original record.

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
Biota (2004) Jimblebar – Wheelarra Hill 3 Flora and Fauna Assessment	Situated approximately 10 km directly south of the study area	August 2003. The survey was conducted to review and update existing botanical information and recording supplementary floristic data.	Six vegetation types described were based on the Ecologia (1999) flora survey of the area. Vegetation was confined to the following landforms: Range Crests, Range Slopes, Rocky Range Slopes, Lower Footslopes, Gorges and Gullies and Numerous minor creek channels.	227 taxa from 42 families and 99 genera; dominant genera were *Acacia* (29 taxa), *Senna* (15 taxa) and *Ptilotus* (9 taxa); one weed species was **Acetosa vesicaria*.	No Threatened or Priority flora One Priority species, *Tephrosia* sp. Pilbara Ranges (P3). This species has been re-named *Tephrosia* sp. Cathedral Gorge (F.H. Molleman 2420) and is no longer Threatened or Priority listed
Ecologia (1996) Jimblebar Rail Spur Biological Assessment Survey	Situated approximately 5 km directly south of the study area.	6-8 June 1995 Two detailed floristic survey sites were assessed (100 m x 100 m in size) with additional opportunistic vegetation sampling.	The survey area encompassed the breadth of a creekline, but did not extend to surrounding hills. Two vegetation types were recorded: (i) Vegetation type associated with the creek banks (ii) Vegetation type associated with the creek bed	106 taxa from 32 families and 71 genera; common families were Poaceae (13 taxa), Mimosaceae and Chenopdiaceae (9 taxa each) and Caesalpiniaceae and Malvaceae (7 taxa each); common genera were *Acacia* (9 taxa), *Senna* (6 taxa), *Eucalyptus* (5 taxa) and *Ptilotus* (4 taxa); four weed species were **Cenchrus ciliaris, *Acetosa vesicaria, *Malvastrum americanum* and **Sonchus oleraceus*.	No Threatened or Priority flora

Report	Proximity to Study Area	Survey Timing & Intensity	Vegetation Associations & Landform	Floristics	Significant Flora
BHP IO (1994) Jimblebar Mine Site Biological Survey	Situated approximately 5 km directly south of the study area.	11-22 June 1994 22 plotless sampling areas (covering approx. 100m^2 each)	Five broad vegetation assemblages recognised including Tall Shrubland (Minor Drainage Lines), Sparse Tree Steppe, Shrub Steppe, Open Mixed Shrubland and Mixed Communities (Gorges)	132 species, representing 30 families; dominant families were Mimosaceae (19 taxa), Poaceae (10 taxa), Myrtaceae (9 taxa) and Caesalpiniaceae (8 taxa); dominant genera were *Triodia, Acacia, Senna* and *Eremophila.* One weed species, **Rumex vesicarius* (now **Acetosa vesicaria)*	No Threatened Flora One Priority 3 taxon, *Crypt*and*ra* sp. Mt Meharry (S. van Leeuwen 682). This is now known as *Crypt*and*ra monticola* and no longer considered to be Threatened or Priority listed.
Dames and Moore (1993) Ecological Observations Jimblebar Railway Line	Situated approximately 5 km directly south of the study area.	19 - 22 November 1992 39 borrow pits and 2 control areas	The report assessed disturbed borrow pit areas the vegetation data provided is not applicable.	NR	No Threatened or Priority Flora

3.1.2 Previous Riparian Monitoring Surveys

In 2011 Astron Environmental developed a monitoring program to assess the potential effects of groundwater drawdown from dewatering activities on riparian vegetation at the Jimblebar Iron Ore Mine. Astron Environmental conducts monitoring and reporting for established sites on an annual basis. The previous three annual reports are listed and summarised below:

- Astron Environmental (2012) Jimblebar Creek (Wheelarra Hill) Riparian Vegetation Monitoring Program Annual Report July 2011-June 2012;
- Astron Environmental (2013) Jimblebar Creek (Wheelarra Hill) Riparian Vegetation Monitoring Program Annual Report July 2012-June 2013; and
- Astron Environmental (2014) Jimblebar Creek Riparian Vegetation Monitoring Program – Survey 3 – Letter Report, June 2014.

A total of seven monitoring locations have been established along Jimblebar Creek and Carramulla Creek between 2011 and 2014. The previous monitoring along Jimblebar Creek has occurred upsteam from the current study area and in closer proximity to the Jimblebar Iron Ore Mine. Six of these monitoring points were to assess impacts from potential groundwater drawdown from the dewatering activities at the Jimblebar Iron Ore Mine. The monitoring includes two reference sites situated outside of the predicted drawdown area (one at Carramulla Creek and one at Jimblebar Creek). An additional site was established in 2013 to assess the impacts of surplus water discharge into Jimblebar Creek.

Monitoring was conducted on both *Eucalyptus camaldulensis* and *Eucalyptus victrix* trees and included measures of leaf water potential, projected foliar cover and stem diameter. In addition visual assessments of tree health, counts of seedlings and saplings and an assessment of the understory vegetation were carried out. Results from the previous three years of monitoring suggest that vegetation health is generally stable with similar trends occurring at reference and potentially impacted sites. Monitoring also indicated that the condition of the riparian vegetation was closely related to seasonal conditions (Astron Environmental 2012, 2013, 2014).

3.1.3 Threatened Flora listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken (DoE 2014) within a 50 km buffer of the study area (DoE 2014). The database search listed two Threatened Flora or their habitat as likely to occur within the study area; *Lepidium catapycnon* (Hamersley Lepidium) and *Pityrodia augustensis* (Mt Augustus Foxglove). No Threatened Ecological Communities (TECs) were recorded during the search.

3.1.4 Threatened Flora listed under the IUCN Red List

A search of the International Union for Conservation of Nature (IUCN) database was conducted (IUCN 2014). No Threatened Flora was listed as likely to occur within the study area from this search.

3.1.5 Threatened Flora listed under the WA Wildlife Conservation (Rare Flora) Notice 2014

The DPaW search identified one Threatened Flora taxon as occurring within a 50km radius of the study area; *Lepidium catapycnon.*

3.1.6 Priority Flora recognised by the DPaW

The DPaW rare flora database search (DPaW 2013a) identified 88 Priority flora taxa as potentially occurring within a 50 km radius of the study area (Table 6).

Table 6 Significant flora previously recorded from a 50 km search radius of the study area (DPaW 2014). SCC - State Conservation Code (WC Act) and DPaW (2013), FCC - Federal Conservation Code (EPBC Act).

Species	SCC	FCC
Acacia bromilowiana	4	
Acacia daweana	3	
Acacia effusa	3	
Acacia subtiliformis	3	
Adiantum capillus-veneris	2	
Amaranthus centralis	3	
Aristida jerichoensis var. *subspinulifera*	1	
Astrebla lappacea	3	
Atriplex flabelliformis	3	
Atriplex lindleyi subsp. *conduplicata*	3	
Barbula ehrenbergii	1	
Bothriochloa decipiens var. *cloncurrensis*	1	
Brachyscome sp. Wanna Munna Flats (S. van Leeuwen 4662)	1	
Brunonia sp. long hairs (D.E. Symon 2440)	1	
Calotis latiuscula	3	
Calotis squamigera	1	
Cochlospermum macnamarae	1	
Crotalaria smithiana	3	
Dampiera anonyma	3	
Dampiera metallorum	3	
Dicladanthera glabra	2	
Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)	1	
Eremophila appressa	1	
Eremophila forrestii subsp. Pingandy (M.E. Trudgen 2662)	2	
Eremophila magnifica subsp. *magnifica*	4	
Eremophila magnifica subsp. *velutina*	3	
Eremophila pilosa	1	
Eremophila rigida	3	
Eremophila sp. Hamersley Range (K. Walker KW 136) PN	1	
Eremophila sp. Rudall River (P.G. Wilson 10512) PN	2	
Eremophila sp. Snowy Mountain (S. van Leeuwen 3737)	1	
Eremophila sp. West Angelas (S. van Leeuwen 4068)	1	
Eucalyptus lucens	1	
Eucalyptus rowleyi	3	
Euphorbia parvicaruncula	1	
Fimbristylis sieberiana	3	
Geijera salicifolia	3	
Genus sp. Hamersley Range hilltops (S. van Leeuwen 4345)	1	
Glycine falcata	3	
Goodenia hartiana	2	
Goodenia lyrata	3	
Goodenia nuda	4	
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	3	

Species	SCC	FCC
Grevillea sp. Turee (J. Bull & G. Hopkinson ONS JJ 01.01) PN	1	
Gymnanthera cunninghamii	3	
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	2	
Hibiscus sp. Mt Brockman (E. Thoma ET 1354) PN	1	
Indigofera sp. Bungaroo Creek (S. van Leeuwen 4301)	3	
Indigofera sp. Gilesii (M.E. Trudgen 15869) PN	3	
Iotasperma sessilifolium	3	
Ipomoea racemigera	1	
Isotropis parviflora	2	
Lepidium catapycnon	T	V
Maireana prosthecochaeta	3	
Myriocephalus scalpellus	1	
Nicotiana heterantha	1	
Nicotiana umbratica	3	
*Oldenl*and*ia* sp. Hamersley Station (A.A. Mitchell PRP 1479)	3	
Olearia mucronata	3	
Oxalis sp. Pilbara (M.E. Trudgen 12725)	2	
Pentalepis trichodesmoides subsp*. hispida*	2	
Peplidium sp. fortescue marsh (S. van Leeuwen 4865)	1	
Pilbara trudgenii	2	
Polymeria distigma	3	
Ptilotus subspinescens	3	
Rhagodia sp. Hamersley (M. Trudgen 17794)	3	
Rhynchosia bungarensis	4	
Rostellularia adscendens var. *latifolia*	3	
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	2	
Sida sp. Barlee Range (S. van Leeuwen 1642)	3	
Sida sp. Hamersley Range (K. Newbey 10692)	1	
Solanum albostellatum	3	
Solanum sp. Gurinbiddy Range (M.E. Trudgen & M. Trudgen MET 12775) PN	3	
Spartothamnella puberula	2	
Stemodia sp. Battle Hill (A.L. Payne 1006*)*	1	
Swainsona thompsoniana	3	
Tecticornia medusa	3	
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	1	
Tetratheca fordiana	1	
Teucrium pilbaranum	1	
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	3	
Thryptomene wittweri	T	V
Triodia sp. Karijini (S. van Leeuwen 4111) PN	1	
Triodia sp. Mt Ella (M.E. Trudgen 12739)	3	
Triodia sp. Robe River (M.E. Trudgen et al. MET 12367)	3	
Triodia triticoides	1	
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	1	
Whiteochloa capillipes	3	

3.1.7 TECs listed under State and Federal Legislation

A search of the EPBC Act Protected Matters database (DoE 2014) confirmed there were no Federal listed TECs previously recorded within, or adjacent to, the study area. Similarly, a search of the State database by DPaW (2014b) confirmed there were no currently listed TEC records for the immediate study area. The nearest known TEC is the Endangered Ethel Gorge aquifer stygobiont community located approximately 40 km west of the study area.

3.1.8 PECs recognised by DPaW

A search of the State database (DPaW 2014b) confirmed there were no PECs within a 50 km radius of the study area.

3.2 Flora Species

A total number of 167 plant taxa (including varieties and subspecies) from 39 families and 97 genera were recorded from the study area (Table 7, Appendix 5). Species representation was greatest among the Poaceae (34 taxa), Fabaceae (31 taxa), and Malvaceae (16 taxa) families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (15 taxa), followed by *Senna* (8 taxa), *Eragrostis* (5 taxa) and *Eremophila* (5 taxa).

Table 1 Statistics for total flora recorded from the study area

Overview	No. Taxa
Families	39
Genera	97
Taxa (species, subspecies, varieties)	167
Native Taxa	164
Introduced Taxa	3
Threatened Flora	0
Priority Flora	0
Range Extensions	3
Speciose Families	**No. Taxa**
POACEAE	33
FABACEAE	31
MALVACEAE	16
ASTERACEAE	8
AMARANTHACEAE	7
Speciose Genera	**No. Taxa**
Acacia (Fabaceae)	15
Senna (Fabaceae)	8
Eremophila (Scrophulariaceae)	5
Eragrostis (Poaceae)	5

3.3 Significant Flora

3.3.1 Threatened Flora listed under the WC Act and EPBC Act

There was no plant taxon gazetted as Threatened Flora (T) pursuant to subsection (2) of Section 23F of the WC Act or listed under the EPBC Act recorded from the study area.

3.3.2 Significant Flora

No Priority flora taxa as defined by DPaW were recorded from the study area.

3.3.3 Range Extensions

Three species recorded within the study area are considered to be range extensions based on the current known distribution of these species.

Chamaecrista symonii

An erect or spreading shrub reaching approximately 1 m in height and producing yellow flowers between February and August. This species grows on red sand on sand dunes and hills. It has been recorded from the Kimberley extending south in to the Great Sandy Desert and on the border of the Pilbara, Little Sandy Desert and Great Sandy Desert. The nearest record for this species is approximately 200 km north-east of the study area.

Eragrostis speciosa

Eragrostis speciosa is a tussock-forming grass reaching 1.4 m in height. It grows in red sand, clay, loam and alluvium along watercourses, floodplains and seasonally wet areas. This species has been recorded in the Kimberley and Great Sandy Desert, and several records occur further north in the Pilbara. The distribution extends in to the Gascoyne and an isolated record also occurs in the far east within the Central Ranges Bioregion. The closest record for this species is the western Fortescue Marsh approximately 100 km to the north-west. An additional record occurs approximately 200 km to the south-east.

Halgania erecta

Halgania erecta is a low shrub reaching 0.3 m in height and producing blue flowers between March and April. It grows in red sand on plains. This species has only been recorded from the far south-eastern corner of the Pilbara, but is commonly recorded within the Little Sandy Desert and extending south to the border of the South-West Provence. The nearest record for this species occurs approximately 60 km east south-east of the study area.

3.4 Introduced Flora

There were three introduced (weed) species recorded from the study area; **Cenchrus ciliaris* (Buffel Grass), **Cenchrus setiger* (Birdwood Grass) and **Bidens bipinnata* (Beggers Ticks) (Table 8, Figure 7, Appendix 6). None of these taxa are listed as a Declared Pest under the BAM Act.

Table 8 Introduced weed species recorded from the study area.

Taxon (Common Name)	Photograph	Description	Occurrence in study area
**Cenchrus ciliaris* (Buffel Grass)		Tufted perennial grass originating from the Middle East as a fodder species by pastoralists. It grows in dense tussocks up to 1 m tall and typically occurs in monospecific stands on loamy plains and creekline levee banks. It is an aggressive colonizing species that has become well established throughout the Pilbara, Gascoyne and Murchison regions of Western Australia, and is continuing to spread in the south west (Hussey *et al.* 1997).	This species was widespread along the length of the study area. It was recorded from 12 of 13 quadrats formally assessed and a further 24 releve locations. It was generally recorded as a Tussock Grassland (30-50 percent ground cover). It was the dominant species in three of the vegetation associations. This species was most dominant on levee banks, however it was also present within the main drainage channels and on slopes, plains and floodplains surrounding the creek line.
**Bidens bipinnata* (Bipinnate Beggars Tick)		Erect annual herb that grows up to 1m in height. This species is widespread in the northern parts of WA from Shark Bay up to the Northern Territory Border. It has three pronged barbs on its seeds so it is easily spread by livestock and other animals. In the Pilbara it is common in moist habitats such as drainage lines, flood plains and gorges, and responds vigorously following rainfall.	This species was recorded from two locations within the study area. Scattered individuals were recorded at both locations with ground coverage of less that 2 percent.

Taxon (Common Name)	Photograph	Description	Occurrence in study area
**Cenchrus setiger* (Birdwood Grass)		An erect tussocky stoloniferous perennial grass up to 0.5m in height. Flowers are cream or purple and flowering occurs between April and May. It occurs on brown sands, red loams and pindan soils on sand dunes, plains, rangelands, stony hillsides and floodplains. It has been recorded across the north of western Australia from Geraldton to the Northern Territory border.	Was recorded at three locations within the study area. It was recorded as a Tussock Grassland (30-50 percent ground cover) in combination with **Cenchrus ciliaris.*

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JIMBLEBAR CREEK

Introduced Flora

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Kilometers
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Datum: GDA94
Projection: MGA Zone 51

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Figure:	7	Date:	26/11/2014
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Legend

- Study Area

Introduced Flora

- *Bidens bipinnata (B.p)*
- *Cenchrus ciliaris (C.c)*
- *Cenchrus setiger (C.s)*

N

3.5 Threatened Ecological Communities

No TECs occur within or adjacent to the study area. The nearest known TEC is the endangered Ethel Gorge aquifer stygobiont community located approximately 40km west of the study area.

3.6 Priority Ecological Communities

None of the vegetation associations described and mapped from the study area were found to have affiliations with any PECs documented from the Pilbara.

3.7 Vegetation

A total of 19 vegetation associations were described and mapped within the study area (Figure 8). The vegetation associations have been classified into seven Broad Floristic Formations on the basis of the dominant vegetation stratum (Table 9). All site data collected is presented in Appendix 7.

Table 9 Vegetation descriptions for 19 vegetation associations mapped within the study area.

Code	Broad Floristic Formation	Vegetation Association	Characteristics	Condition
1	*Eucalyptus* Woodland	Woodland (to Open Woodland) of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata, Acacia citrinoviridis* and *Acacia pyrifolia* var. *pyrifolia* along major drainage lines	Major drainage line with both *Eucalyptus camaldulensis* and *Eucalyptus victrix*	Very Good
2a	*Acacia* Low Open Forest	Low Open Forest of *Acacia aneura* over High Open Shrubland of *Eremophila fraseri* over Very Open Hummock Grassland of *Triodia basedowii* on bare plains	Characterised by Mulga groves and bare plains with patches of *Triodia basedowii*	Very Good
2b	*Acacia* Low Open Forest	Low Open Forest of *Acacia aptaneura* and *Acacia paraneura* over Open Shrubland of *Acacia wanyu, Eremophila fraseri* and *Senna glutinosa* subsp. *luerssenii* over Very Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835) on floodplains	Dense Mulga forest	Very Good
2c	*Acacia* Low Open Forest	Low Open Forest of *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* and *Melaleuca glomerata* with Scattered Trees of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* on major drainage lines	Major drainage line with scattered *Eucalyptus* trees	Good
3a	*Acacia* Low Open Woodland	Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Acacia paraneura* over Open Shrubland of *Eremophila fraseri, Acacia tetragonophylla* and *Acacia wanyu* over Low Open Shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* on raised stony plains	Characterised by the presence of *Eremophila fraseri*	Very Good
3b	*Acacia* Low Open Woodland	Low Open Woodland of *Eucalyptus victrix* and *Acacia citrinoviridis* over High Open Shubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in medium drainage lines	Medium drainage line without *Eucalyptus camaldulensis* and with relatively open *Acacia citrinoviridis*	Very Good
4	*Acacia* High Shrubland	High Shrubland of *Acacia citrinoviridis, Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* over Low Shrubland of *Corchorus crozophorifolius* and *Tephroisa rosea* var. Fortescue Creeks (M.I.H. Brooker 2186) over Open Tussock Grassland of **Cenchrus ciliaris, Cymbopogon procerus* and *Eriachne pulchella* subsp. *dominii* on flood banks within major drainage channels	Flooded banks dominated by *Acacia pyrifolia* and *Gossypium robinsonii*	Good

Code	Broad Floristic Formation	Vegetation Association	Characteristics	Condition
5a	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with High Open Shrubland of *Acacia bivenosa* on stony plains	Dominated by *Acacia bivenosa*	Excellent
5b	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii* and *Acacia citrinoviridis* and Low Open Woodland of *Corymbia hamerselyana* on floodplains	Sandy floodplains dominated by *Acacia pyrifolia* and *Acacia citrinoviridis* with no *Eucalyptus* species	Very Good
5c	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Acacia pachyacra* and *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* and *Hakea lorea* subsp. *lorea* on stony sandplains	Sandy / stony plains with *Triodia basedowii*	Excellent
5d	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia angusta* and *Triodia pungens* with Shrubland of *Acacia bivenosa* and Low Open Mallee of *Eucalyptus socialis* subsp. *eucentrica* and *Eucalyptus gamophylla* on low calcrete hills and rises	Characterised by *Eucalyptus socialis* subsp. *eucentrica* mallee on calcrete	Very Good
5e	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Corymbia hamersleyana* and High Open Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia synchronicia* on eroded plains and slopes	Scrappy stony plains and slopes with various *Acacia* species	Excellent
5f	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with High Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia kempeana* and Scattered Low Trees of *Corymbia hamerselyana* on sandplains	This unit is characterised by denser *Acacia* shrublands with *Triodia basedowii*	Excellent
5g	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Open Shrubland of *Acacia ancistrocarpa, Acacia trudgeniana* and *Senna glutinosa* subsp. x *luerssenii* and Scattered Low Trees of *Acacia pruinocarpa* and *Corymbia hamerselyana* on footslopes and hillslopes	Characterised by *Triodia* sp. Shovelanna Hill on ironstone slopes	Excellent
5h	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* with Open Shrubland of *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* on undulating plains and floodplains	Dominated by *Acacia ancistrocarpa*	Very Good

Code	Broad Floristic Formation	Vegetation Association	Characteristics	Condition
6	*Triodia* Open Hummock Grassland	Open Hummock Grassland of *Triodia pungens* (and Open Tussock Grassland of **Cenchrus ciliaris*) with Low Open Woodland of *Corymbia hamersleyana* and *Acacia citrinoviridis* and High Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia pyrifolia* var. *pyrifolia* and *Acacia ancistrocarpa* on levee banks of major drainage lines	Levee banks dominated by *Corymbia hamersleyana* and *Acacia citrinoviridis*	Good
7a	**Cenchrus* Tussock Grassland	Tussock Grassland of **Cenchrus ciliaris* with Low Open Woodland of *Corymbia hamersleyana* and High Open Shrubland of *Acacia dictyophleba* and *Acacia sclerosperma* subsp. *sclerosperma* on raised levee banks of major drainage lines	Higher sandy banks not dominated by *Acacia citrinoviridis*	Good
7b	**Cenchrus* Tussock Grassland	Tussock Grassland of **Cenchrus ciliaris* and *Cymbopogon procerus* with Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* and Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* on levee banks of major drainage lines	Levee banks dominated by **Cenchrus ciliaris*	Good
7c	**Cenchrus* Tussock Grassland	Tussock Grassland of **Cenchrus ciliaris* with Low Woodland of *Acacia citrinoviridis* and Very Open Hummock Grassland of *Triodia pungens* on levee banks of major drainage lines	**Cenchrus ciliaris* dominant with *Acacia citrinoviridis* and *Acacia sclerosperma*	Good

211500 213000 214500

7437000 7435500 7434000 7432500 7431000

6 5f 5c 6 5c 5f 7c 5c 5c 7c 5f 5c 2c 5c 5c 7c 7c 5f 5c 6 6

211500 213000 214500

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JIMBLEBAR CREEK

Vegetation Associations
Map 1 of 3

0 250 500 750 1,000 1,250
Meters

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Figure:	8	Date:	06/01/2015
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Study Area

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211500 213000 214500

7429500 7428000 7426500 7425000 7423500

5f 5f 6 7c 5c 6 7a 5c 6 5c 6 5f 2c 7c 5c 7c 6 6 5f 5c 5c 6 6 5f 5c 6 7c 7a 5c 5f 7c 7a 5c

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JIMBLEBAR CREEK

Vegetation Associations
Map 2 of 3

0 250 500 750 1,000 1,250
Meters

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Projection: MGA Zone 51

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Figure:	8	Date:	06/01/2015
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Legend

Study Area

N

208500 210000 211500 213000

7422000 7420500 7419000 7417500

208500 210000 211500 213000

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JIMBLEBAR CREEK

Vegetation Associations
Map 3 of 3

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Meters
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Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

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Study Area

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Study Area

Vegetation Types

Eucalyptus Woodland

1 Woodland (to Open Woodland) of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata*, *Acacia citrinoviridis* and *Acacia pyrifolia* var. *pyrifolia* along major drainage lines

Acacia Low Open Forest

2a Low Open Forest of *Acacia aneura* over High Open Shrubland of *Eremophila fraseri* over Very Open Hummock Grassland of *Triodia basedowii* on bare plains

2b Low Open Forest of *Acacia aptaneura* and *Acacia paraneura* over Open Shrubland of *Acacia wanyu, Eremophila fraseri* and *Senna glutinosa* subsp. *luerssenii* over Very Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835) on floodplains

2c Low Open Forest of *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* and *Melaleuca glomerata* with Scattered Trees of *Eucalyptus camaldulensis* subsp. refulgens and*Eucalyptus victrix* on major drainage lines

Acacia Low Open Woodland

3a Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Acacia paraneura* over Open Shrubland of *Eremophila fraseri, Acacia tetragonophylla* and *Acacia wanyu* over Low Open Shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* on raised stony plains

3b Low Open Woodland of *Eucalyptus victrix* and *Acacia citrinoviridis* over High Open Shubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in medium drainage lines

Acacia High Shrubland

4 High Shrubland of *Acacia citrinoviridis, Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* over Low Shrubland of *Corchorus crozophorifolius* and *Tephroisa rosea* var. Fortescue Creeks (M.I.H. Brooker 2186) over Open Tussock Grassland of **Cenchrus cilaris, Cymbopogon procerus* and *Eriachne pulchella* subsp. dominii on flood banks within major drainage channels

Triodia Hummock Grassland

5a Hummock Grassland of *Triodia basedowii* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with High Open Shrubland of *Acacia bivenosa* on stony plains

5b Hummock Grassland of *Triodia pungens* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii* and *Acacia citrinoviridis* and Low Open Woodland of *Corymbia hamerselyana* on floodplains

5c Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Acacia pachyacra* and *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* and *Hakea lorea* subsp. *lorea* on stony sandplains

5d Hummock Grassland of *Triodia angusta* and *Triodia pungens* with Shrubland of *Acacia bivenosa* and Low Open Mallee of *Eucalyptus socialis* subsp. *eucentrica* and *Eucalyptus gamophylla* on low calcrete hills and rises

5e Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Corymbia hamersleyana* and High Open Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia synchronicia* on eroded plains and slopes

5f Hummock Grassland of *Triodia basedowii* with High Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia kempeana* and Scattered Low Trees of *Corymbia hamerselyana* on sandplains

5g Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Open Shrubland of *Acacia ancistrocarpa, Acacia trudgeniana* and *Senna glutinosa* subsp. *x luerssenii* and Scattered Low Trees of *Acacia pruinocarpa* and *Corymbia hamerselyana* on footslopes and hillslopes

5h Hummock Grassland of *Triodia pungens* with Open Shrubland of *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* on undulating plains and floodplains

Triodia Open Hummock Grassland

6 Open Hummock Grassland of *Triodia pungens* (and Open Tussock Grassland of **Cenchrus ciliaris*) with Low Open Woodland of *Corymbia hamersleyana* and *Acacia citrinoviridis* and High Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia pyrifolia* var. *pyrifolia* and *Acacia ancistrocarpa* on levee banks of major drainage lines

*Cenchrus Tussock Grassland

7a Tussock Grassland of **Cenchrus ciliaris* with Low Open Woodland of *Corymbia hamersleyana* and High Open Shrubland of *Acacia dictyophleba* and *Acacia sclerosperma* subsp. *sclerosperma* on raised levee banks of major drainage lines

7b Tussock Grassland of **Cenchrus ciliaris* and *Cymbopogon procerus* with Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* and Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* on levee banks of major drainage lines

7c Tussock Grassland of **Cenchrus ciliaris* with Low Woodland of *Acacia citrinoviridis* and Very Open Hummock Grassland of *Triodia pungens* on levee banks of major drainage lines

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JIMBLEBAR CREEK

Legend

ONSHORE ENVIRONMENTAL

Figure:	8	Date:	26/11/2014
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Broad Floristic Formation	1. *Eucalyptus* Woodland
Vegetation Association	Woodland (to Open Woodland) of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Melaleuca glomerata, Acacia citrinoviridis* and *Acacia pyrifolia* var. *pyrifolia* along major drainage line

Area Mapped	50.3 ha
Quadrats Sampled	JC01, JC03, Q71, JC07, Q31
Location	Southern parts of the study area
Leaf Litter Cover (%)	2-10%
Bare Ground (%)	30-75%
Soils and Geology	Brown sand with mixed riverine gravels, pebbles and cobbles
Land System	River
Land Form	Major drainage line
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Livestock, weeds, camels, flooding
Average Fire Age	Old (6+ yrs)
Characteristics	Major drainage line with both *Eucalyptus camaldulensis* and *Eucalyptus victrix*

Vegetation Structure & Floristics	
Trees 10-30m	*Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus victrix*
Trees <10m	*Acacia coriacea* subsp. *pendens, Acacia citrinoviridis*
Tall Shrubs >2m	*Melaleuca glomerata, Acacia citrinoviridis, Acacia pyrifolia* var. *pyrifolia*
Shrubs <1m	*Tephrosia rosea* var. Fortescue Creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius*
Tussock Grasses	**Cenchrus ciliaris, Cymbopogon procerus, Eulalia aurea, Aristida holathera* var. *holathera, Themeda triandra*

Broad Floristic Formation	2a. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia aneura* over High Open Shrubland of *Eremophila fraseri* over Very Open Hummock Grassland of *Triodia basedowii* on bare plains

Area Mapped	11.1 ha
Quadrats Sampled	Q61, Q60
Location	At the intersection of the two southern arms
Leaf Litter Cover (%)	10-30
Bare Ground (%)	10-30
Soils and Geology	Red brown loam/clay loam
Land System	Boolgeeda, River
Land Form	Bare plains
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Livestock
Average Fire Age	Old (6+ years)
Characteristics	Characterised by Mulga groves and bare plains with patches of *Triodia basedowii*
Vegetation Structure & Floristics	
Trees <10m	*Acacia aptaneura*
Tall Shrubs >2m	*Eremophila fraseri*
Shrubs <1m	*Solanum lasiophyllum*
Hummock Grasses	*Triodia basedowii*

Broad Floristic Formation	2b. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia aptaneura* and *Acacia paraneura* over Open Shrubland of *Acacia wanyu, Eremophila fraseri* and *Senna glutinosa* subsp. *luerssenii* over Very Open Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835) on flood plains

Area Mapped	15.6 ha
Quadrats Sampled	JC06, Q69
Location	Map 3
Leaf Litter Cover (%)	2-10
Bare Ground (%)	60%
Soils and Geology	Red sandy loam with ironstone and chert
Land System	River
Land Form	Flats/eroded slopes adjacent to drainage line
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Frequent fire, livestock, weeds
Average Fire Age	Moderate (3 – 5 years)
Characteristics	Dense Mulga forest
Vegetation Structure & Floristics	
Trees <10m	*Acacia aptaneura, Acacia paraneura*
Shrubs 1-2m	*Acacia wanyu, Eremophila fraseri, Senna glutinosa* subsp. *luerssenii*
Hummock Grasses	*Triodia basedowii, Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835)
Tussock Grasses	**Cenchrus ciliaris*

Broad Floristic Formation	2c. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* and *Melaleuca glomerata* with Scattered Trees of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* on major drainage lines

Area Mapped	206.3 ha
Quadrats Sampled	JC11, Q22, Q19
Location	Northern parts of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	30-70
Soils and Geology	Brown sand with mixed chert and ironstone cobbles and gravels
Land System	River, Fortescue
Land Form	Major drainage lines
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Good
Disturbances	Livestock, weeds, camels and flooding
Average Fire Age	Old (6+ yrs)
Characteristics	Major drainage line with scattered *Eucalyptus* trees

Vegetation Structure & Floristics	
Trees 10-30m	*Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus victrix*
Trees <10m	*Acacia citrinoviridis, Melaleuca glomerata*
Tall Shrubs >2m	*Melaleuca glomerata, Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii*
Shrubs <1m	*Tephrosia rosea* var. Fortescue Creeks (M.I.H. Brooker 2186)
Hummock Grasses	*Triodia pungens*
Tussock Grasses	**Cenchrus ciliaris, Eulalia aurea, Chrysopogon fallax, Themeda triandra, Cymbopogon procerus*
Sedges	*Cyperus ixiocarpus*
Herbs	*Goodenia lamprosperma*

Broad Floristic Formation	3a. *Acacia* Low Open Woodland
Vegetation Association	Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Acacia paraneura* over Open Shrubland of *Eremophila fraseri, Acacia tetragonophylla* and *Acacia wanyu* over Low Open Shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* on raised stony plains
	
Area Mapped	11.0 ha
Quadrats Sampled	Q62, Q63
Location	Situated at the start of the south-western arm of Jimblebar Creek
Leaf Litter Cover (%)	2-10
Bare Ground (%)	50-70
Soils and Geology	Red clay loam with scattered cobbles and pebbles
Land System	Boolgeeda, River
Land Form	Raised stony plain
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Fire, livestock
Average Fire Age	Old (6+ years)
Characteristics	Characterised by the presence of *Eremophila fraseri*
Vegetation Structure & Floristics	
Trees <10m	*Acacia aptanerura, Acacia paraneura, Acacia pruinocarpa*
Shrubs 1-2m	*Eremophila fraseri, Acacia tetragonophylla, Senna glutinosa* subsp. x *luerssenii*
Shrubs <1m	*Ptilotus obovatus, Solanum lasiophyllum*
Tussock Grasses	*Aristida contorta*

Broad Floristic Formation	3b. *Acacia* Low Open Woodland
Vegetation Association	Low Open Woodland of *Eucalyptus victrix* and *Acacia citrinoviridis* over High Open Shrubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in medium drainage lines

Area Mapped	18.3 ha
Quadrats Sampled	JC04, Q37, Q32
Location	South-western arm
Leaf Litter Cover (%)	2-10%
Bare Ground (%)	70%
Soils and Geology	Brown loamy sand with chert/ironstone cobbles and gravels
Land System	Boolgeeda
Land Form	Medium drainage lines
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Livestock, weeds, flooding
Average Fire Age	Old (6+ years)
Characteristics	Medium drainage lines without *Eucalyptus camaldulensis* subsp. *refulgens* and with relatively open *Acacia citrinoviridis*

Vegetation Structure & Floristics	
Trees <10m	*Eucalyptus victrix, Acacia citrinoviridis*
Tall Shrubs >2m	*Acacia pyrifolia* var. *pyrifolia, Acacia monticola*
Shrubs <1m	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Booker 2186)
Hummock Grasses	*Triodia pungens*
Tussock Grasses	*Eriachne tenuiculmis, Cymbopogon ambiguus, Cymbopogon procerus, Themedra triandra, Eriachne pulchella*

Broad Floristic Formation	4. *Acacia* High Shrubland
Vegetation Association	High Shrubland of *Acacia citrinoviridis, Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* over Low Shrubland of *Corchorus crozophorifolius* and *Tephroisa rosea* var. Fortescue creeks (M.I.H. Brooker 2186) over Open Tussock Grassland of **Cenchrus ciliaris, Cymbopogon procerus* and *Eriachne pulchella* subsp. *dominii* on flood banks within major drainage channels

Area Mapped	16.0 ha
Quadrats Sampled	Q70, Q20
Location	Southern parts of the study area
Leaf Litter Cover (%)	10-30
Bare Ground (%)	10-30
Soils and Geology	Loose gravels
Land System	River
Land Form	Flooded banks of major drainage line
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good to Good
Disturbances	Livestock, weeds, access tracks nearby
Average Fire Age	Moderate
Characteristics	Flooded banks dominated by *Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii*

Vegetation Structure & Floristics	
Trees <10m	*Acacia citrinoviridis*
Tall Shrubs >2m	*Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii, Acacia citrinoviridis*
Shrubs <1m	*Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)
Tussock Grasses	**Cenchrus ciliaris*

Broad Floristic Formation	5a. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with High Open Shrubland of *Acacia bivenosa* on stony plains

Area Mapped	6.8 ha
Quadrats Sampled	Q33
Location	Far west of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	30-50
Soils and Geology	Red sandy loam with ironstone/quartz cobbles and pebbles
Land System	Boolgeeda
Land Form	Stony plains/sandplains
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent
Disturbances	Fire, access tracks nearby
Average Fire Age	Old (5-10 years)
Characteristics	Dominated by *Acacia bivenosa*
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Acacia bivenosa, Acacia tenuissima, Acacia pachyacra*
Shrubs <1m	*Senna glutinosa* subsp. *pruinosa*
Hummock Grasses	*Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia basedowii*

Broad Floristic Formation	5b. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia pungens* with High Shrubland of *Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii* and *Acacia citrinoviridis* and Low Open Woodland of *Corymbia hamerselyana* on floodplains

Area Mapped	17.8 ha
Quadrats Sampled	Q39, Q35, Q45, Q47, Q36
Location	South-western arm of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	10-50
Soils and Geology	Red brown sands/sandy loam
Land System	Boolgeeda
Land Form	Floodplains
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Livestock, Weeds
Average Fire Age	Old (6+ years)
Characteristics	Sandy floodplains dominated by *Acacia pyrifolia* var. *pyrifolia* and *Acacia citrinoviridis* with no *Eucalyptus* species

Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamerselyana, Acacia aptaneura*
Tall Shrubs >2m	*Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii, Acacia ancistrocarpa, Acacia citrinoviridis, Hakea lorea* subsp. *lorea*
Shrubs 1-2m	*Senna artemisioides* subsp. *oligophylla*
Shrubs <1m	*Scaevola spinescens*
Hummock Grasses	*Triodia pungens*
Tussock Grasses	*Eragrositis eriopoda, *Cenchrus ciliaris*

Broad Floristic Formation	5c. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Acacia pachyacra* and *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* and *Hakea lorea* subsp. *lorea* on stony sandplains

Area Mapped	157.6 ha
Quadrats Sampled	JC08, JC12, Q4, Q80, Q11, Q34, Q42,Q43,Q44,
Location	Plains on the edges of the study area
Leaf Litter Cover (%)	<2
Bare Ground (%)	30-40%
Soils and Geology	Red/orange loamy sand with ironstone and quartz pebbles
Land System	Divide
Land Form	Sandplain/stony sandplain
Priority Ecological Community	None
Rare Flora	*Acacia clelandii* (Range extension)
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Excellent
Disturbances	Camels, cattle grazing
Average Fire Age	Old (6+ yrs)
Characteristics	Sandy/stony plains with *Triodia basedowii*

Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana, Hakea lorea* subsp. *lorea, Acacia pruinocarpa*
Tall Shrubs >2m	*Acacia ancistrocarpa, Acacia bivenosa, Acacia wanyu, Acacia pachyacra, Hakea lorea* subsp. *lorea, Acacia kempeana, Acacia sclerosperma* subsp. *sclerosperma, Acacia aptaneura*
Shrubs <1m	*Solanum elatius, Eremophila forrestii* subsp. *forrestii, Acacia melleodora*
Hummock Grasses	*Triodia basedowii, Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835)
Tussock Grasses	*Paraneurachne muelleri, *Cenchrus ciliaris, Aristida inaequiglumis*

Broad Floristic Formation	5d. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia angusta* and *Triodia pungens* with Shrubland of *Acacia bivenosa* and Low Open Mallee of *Eucalyptus socialis* subsp. *eucentrica* and *Eucalyptus gamophylla* on low calcrete hills and rises

Area Mapped	1.3 ha
Quadrats Sampled	None within previously surveyed OB31 area
Location	South-west of the study area
Leaf Litter Cover (%)	<2
Bare Ground (%)	65
Soils and Geology	Calcrete
Land System	Newman
Land Form	Low calcrete hill/rise
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	None
Average Fire Age	Moderate
Characteristics	Characterised by *Eucalyptus socialis* subsp. *eucentrica* mallee on calcrete
Vegetation Structure & Floristics	
Trees <10m	*Hakea lorea* subsp. *lorea*
Mallee	*Eucalyptus socialis* subsp. *eucentrica, Eucalyptus gamophylla*
Shrubs 1-2m	*Acacia bivenosa*
Shrubs <1m	*Scaevola ambylanthera, Ptilotus obovatus,* Senna sp. Meekatharra
Hummock Grasses	*Triodia angusta, Triodia pungens*

Broad Floristic Formation	5e. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia pungens* and *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Low Open Woodland of *Acacia aptaneura, Acacia pruinocarpa* and *Corymbia hamersleyana* and High Open Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia synchronicia* on eroded plains and slopes

Area Mapped	29.1 ha
Quadrats Sampled	Q50, Q41, Q51, Q46, Q67
Location	South-western arm of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	30-50
Soils and Geology	Red brown sandy loam with ironstone cobbles and pebbles, pisolitic ironstone
Land System	Boolgeeda
Land Form	Eroded stonyplains/hillslopes
Priority Ecological Community	No
Rare Flora	*Acacia clelandii* (Range extention)
Introduced (Weed) Species	None
Vegetation Condition	Excellent- Very Good
Disturbances	Fire
Average Fire Age	Moderate (2-5 years)
Characteristics	Scrappy stony plains and slopes with various *Acacia* species

Vegetation Structure & Floristics	
Trees <10m	*Acacia aptaneura, Acacia pruinocarpa, Corymbia hamerselyana*
Tall Shrubs >2m	*Acacia wanyu, Acacia ancistrocarpa, Acacia synchronicia, Acacia clelandii, Acacia pachyacra, Acacia tetragonophylla*
Shrubs 1-2m	*Eremophila fraseri, Acacia tetragonophylla, Acacia wanyu, Acacia clelandii, Senna glutinosa* subsp. *x luerssenii, Eremophila fraseri*
Shrubs <1m	*Ptilotus obovatus, Senna artemisioides* subsp. *helmsii x oligophylla, Eremophila cuneifolia, Senna stricta*
Hummock Grasses	*Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia pungens, Triodia basedowii, Triodia angusta*

Broad Floristic Formation	5f. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* with High Shrubland of *Acacia ancistrocarpa, Acacia wanyu* and *Acacia kempeana* and Scattered Low Trees of *Corymbia hamersleyana* on sandplains

Area Mapped	222.8 ha
Quadrats Sampled	Q56, Q57, Q3, Q12, Q28
Location	Situated along the edges of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	10-50
Soils and Geology	Quartz/ironstone/chert cobbles with red brown loamy sand
Land System	Divide, Newman, Fortescue
Land Form	Eroded sand plains and slopes
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Excellent
Disturbances	Erosion, livestock, weeds
Average Fire Age	Old (6+ years)
Characteristics	This unit is characterised by denser *Acacia* shrublands with *Triodia basedowii*

Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana, Acacia aneura, Acacia aptaneura*
Tall Shrubs >2m	*Acacia ancistrocarpa, Acacia wanyu, Acacia kempeana*
Shrubs <1m	*Eremophila demissa, Senna stricta, Eremophila platycalyx, Senna helmsii, Eremophila forrestii* subsp. *forrestii, Solanum lasiophyllum*
Hummock Grasses	*Triodia basedowii*

Broad Floristic Formation	5g. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) with Open Shrubland of *Acacia ancistrocarpa, Acacia trudgeniana* and *Senna glutinosa* subsp. x *luerssenii* and Scattered Low Trees of *Acacia pruinocarpa* and *Corymbia hamersleyana* on footslopes and hillslopes

Area Mapped	15.7 ha
Quadrats Sampled	Q68, Q73
Location	Southern parts of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	40
Soils and Geology	Ironstone
Land System	River, Divide
Land Form	Footslopes/hillslopes
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent
Disturbances	Access tracks, fire
Average Fire Age	Moderate (2-5 years)
Characteristics	Characterised by *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835) on ironstone slopes
Vegetation Structure & Floristics	
Trees <10m	*Acacia pruinocarpa, Corymbia hamerselyana*
Tall Shrubs >2m	*Acacia ancistrocarpa, Acacia trudgeniana, Grevillea wickhamii, Acacia adsurgens*
Shrubs 1-2m	*Senna glutinosa* subsp. *x luerssenii*
Hummock Grasses	*Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835)
Tussock Grasses	*Amphipogon sericeus*

Broad Floristic Formation	5h. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia pungens* with Open Shrubland of *Acacia ancistrocarpa* and Scattered Low Trees of *Corymbia hamersleyana* on undulating plains and flood plains

Area Mapped	6.0 ha
Quadrats Sampled	Q25, Q23
Location	Southern parts of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	30-50
Soils and Geology	Red/brown gravelly sand with hard loam and pavement rock
Land System	River
Land Form	Undulating plains/floodplains
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent-Very Good
Disturbances	Livestock
Average Fire Age	Old (6+ years)
Characteristics	Dominated by *Acacia ancistrocarpa*
Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia ancistrocarpa*
Hummock Grasses	*Triodia pungens*

Broad Floristic Formation	6. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland of *Triodia pungens* (and Open Tussock Grassland of **Cenchrus ciliaris*) with Low Open Woodland of *Corymbia hamersleyana* and *Acacia citrinoviridis* and High Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia pyrifolia* var. *pyrifolia* and *Acacia ancistrocarpa* on levee banks of major drainage lines

Area Mapped	136.8 ha
Quadrats Sampled	JC09, JC05, Q52, Q53, Q54, Q58, Q59, Q1, Q8
Location	Occurs along the length of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	20
Soils and Geology	Red/brown sandy loam
Land System	Fortescue, River, Boolgeeda
Land Form	Levee bank
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger*
Vegetation Condition	Degraded to Very Good
Disturbances	Weeds, livestock, frequent fire
Average Fire Age	Old (6+ yrs)
Characteristics	Levee banks dominated by *Corymbia hamersleyana* and *Acacia citrinoviridis*

Vegetation Structure & Floristics	
Trees <10m	*Acacia citrinoviridis, Corymbia hamersleyana, Acacia aptaneura*
Tall Shrubs >2m	*Acacia sclerosperma* subsp. *sclerosperma, Acacia ancistrocarpa, Acacia pyrifolia* var. *pyrifolia, Gossypium robinsonii, Hakea lorea* subsp. *lorea, Acacia dictyophleba*
Shrubs <1m	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)
Hummock Grasses	*Triodia pungens, Triodia basedowii*
Tussock Grasses	**Cenchrus ciliaris, *Cenchrus setiger, Chrysopogon fallax*

Broad Floristic Formation	7a. **Cenchrus* Tussock Grassland
Vegetation Association	Tussock Grassland of **Cenchrus ciliaris* with Low Open Woodland of *Corymbia hamersleyana* and High Open Shrubland of *Acacia dictyophleba* and *Acacia sclerosperma* subsp. *sclerosperma* on raised levee banks of major drainage lines

Area Mapped	30.7 ha
Quadrats Sampled	Q65, Q15, Q14, JC10
Location	Southern half of the study area
Leaf Litter Cover (%)	2-10
Bare Ground (%)	20-70
Soils and Geology	Brown loamy sand
Land System	River
Land Form	Raised levee
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger*
Vegetation Condition	Good
Disturbances	Livestock, weeds
Average Fire Age	Old (6+ years)
Characteristics	Higher sandy banks not dominated by *Acacia citrinoviridis*

Vegetation Structure & Floristics	
Trees 10-30m	*Eucalyptus victrix*
Trees <10m	*Corymbia hamersleyana, Acacia citrinoviridis*
Tall Shrubs >2m	*Acacia dictyophleba, Acacia sclerosperma* subsp. *sclerosperma, Cullen leucochaites*
Shrubs <1m	*Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Scaevola spinescens*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	**Cenchrus ciliaris, Cymbopogon procerus, Chrysopogon fallax*

Broad Floristic Formation	7b. **Cenchrus* Tussock Grassland
Vegetation Association	Tussock Grassland of **Cenchrus ciliaris* and *Cymbopogon procerus* with Woodland of *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* and Low Open Woodland of *Acacia citrinoviridis* and *Acacia coriacea* subsp. *pendens* on levee banks of major drainage lines

Area Mapped	30.0 ha
Quadrats Sampled	Q5, Q66, Q10
Location	Southern half of the study area
Leaf Litter Cover (%)	10-30
Bare Ground (%)	30-50
Soils and Geology	Red sand
Land System	River
Land Form	Undulating levee banks
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger*
Vegetation Condition	Good
Disturbances	Livestock, weeds
Average Fire Age	Old (6+ years)
Characteristics	Levee banks dominated by **Cenchrus ciliaris*

Vegetation Structure & Floristics	
Trees 10-30m	*Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus vixtrix*
Trees <10m	*Acacia citrinoviridis, Acacia coriacea, Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia sclerosperma* subsp. *sclerosperma, Acacia pyrifolia* var. *pyrifolia*
Shrubs <1m	*Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)
Tussock Grasses	**Cenchrus ciliaris, Cymbopogon procerus, *Cenchrus setiger*

Broad Floristic Formation	7c. *Cenchrus* Tussock Grassland
Vegetation Association	Tussock Grassland of **Cenchrus ciliaris* with Low Woodland of *Acacia citrinoviridis* and Very Open Hummock Grassland of *Triodia pungens* on levee banks of major drainage lines

Area Mapped	243.8 ha
Quadrats Sampled	JC02, JC13, Q64, Q72, Q30, Q77
Location	Levees along the main drainage channel
Leaf Litter Cover (%)	<2%
Bare Ground (%)	20%
Soils and Geology	Brown/red loamy sand
Land System	River
Land Form	Levee banks
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Good
Disturbances	Fire, livestock, weeds
Average Fire Age	Moderate (3 – 5 yrs)
Characteristics	**Cenchrus ciliaris* dominant with *Acacia citrinoviridis* and *Acacia sclerosperma* subsp. *sclerosperma*

Vegetation Structure & Floristics	
Trees <10m	*Acacia citrinoviridis, Acacia aptaneura*
Tall Shrubs >2m	*Acacia sclerosperma* subsp. *sclerosperma, Acacia citrinoviridis, Acacia aptaneura*
Shrubs <1m	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186), *Corchorus crozophorifolius, Senna artemisioides* subsp. *helmsii x oligophylla, Gossypium robinsonii*
Hummock Grasses	*Triodia pungens, Triodia basedowii*
Tussock Grasses	**Cenchrus ciliaris, Eriachne obtusa*

3.8 Vegetation Condition

Vegetation condition within the study area ranged from excellent (432 ha or 35 percent) and very good (131 ha or 11 percent), to good (664 ha or 54 percent). The northern two thirds of the study area comprised two distinctive vegetation condition classes; vegetation associations along the main drainage channel of Jimblebar Creek were rated as good, with fringing sandplain vegetation associations rated as excellent (Figure 9). Within the southern one third of the study area vegetation condition along the main drainage channel of Jimblebar Creek was rated as good and very good, with fringing sandplains again rated as excellent (Figure 9).

The major disturbances recorded within the study area were related to grazing by domestic cattle and camels, the introduction of introduced weeds [particularly the establishment of **Cenchrus ciliaris* (Buffel Grass) Tussock Grasslands], and fire.

211500 213000 214500

7437000 7435500 7434000 7432500 7431000

211500 213000 214500

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JIMBLEBAR CREEK

Vegetation Condition
Map 1 of 3

0 250 500 750 1,000 1,250
Meters

1:20,000

Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

Figure:	9	Date:	06/01/2015
Sheet Size:	A3	Status:	Draft
Drawn by GSM	Requested by DB	Internal Reference Jimblebar_creek_Veg_Cond	

Legend

Study Area

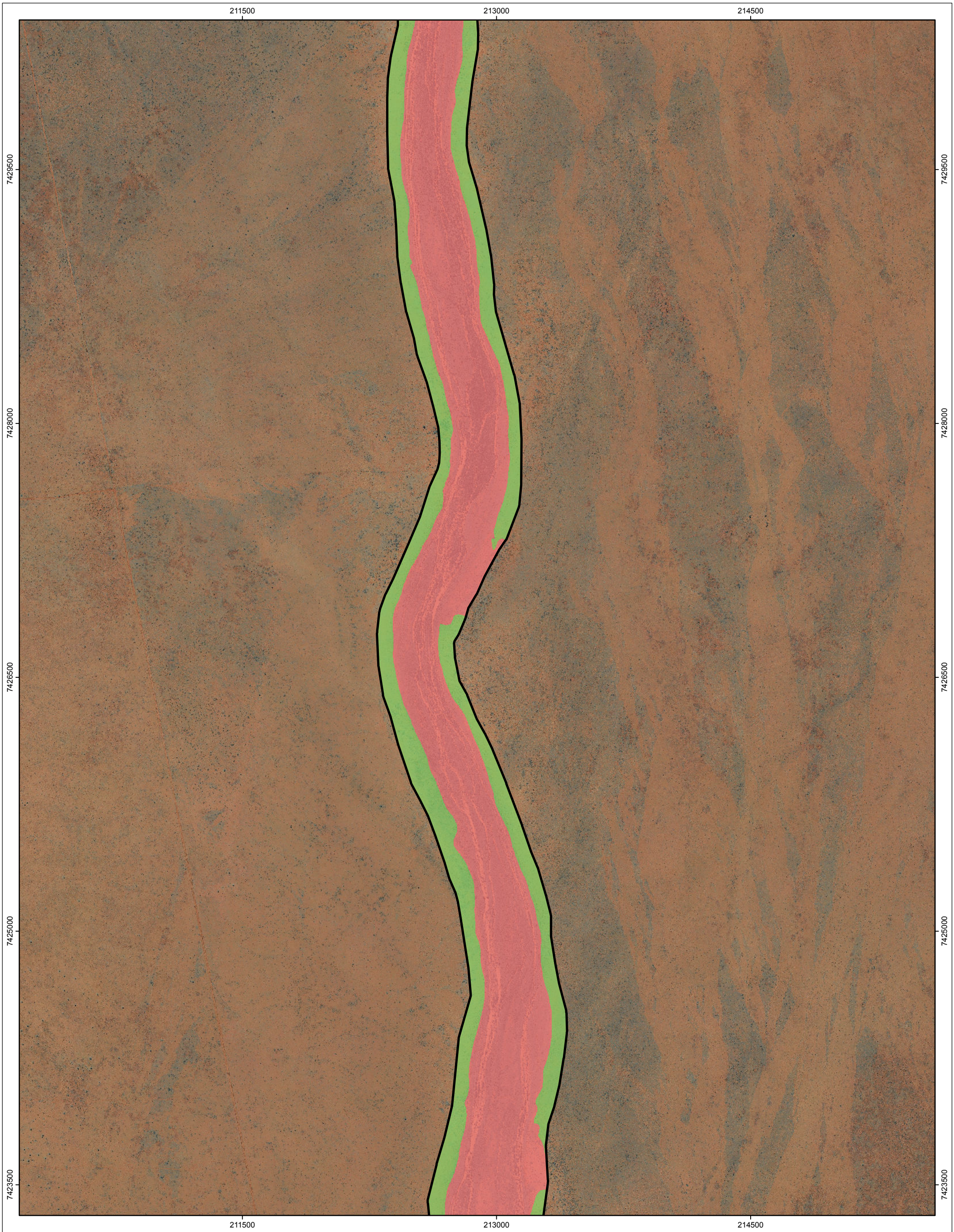
Vegetation Condition

Good
Very Good
Excellent

N

211500 213000 214500

7429500 7428000 7426500 7425000 7423500



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JIMBLEBAR CREEK

Vegetation Condition
Map 2 of 3

0 250 500 750 1,000 1,250
Meters

1:20,000

Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

Figure:	9	Date:	06/01/2015
Sheet Size:	A3	Status:	Draft
Drawn by GSM	Requested by DB	Internal Reference Jimblebar_creek_Veg_Cond	

Legend

Study Area

Vegetation Condition

Good
Very Good
Excellent

N

208500 210000 211500 213000

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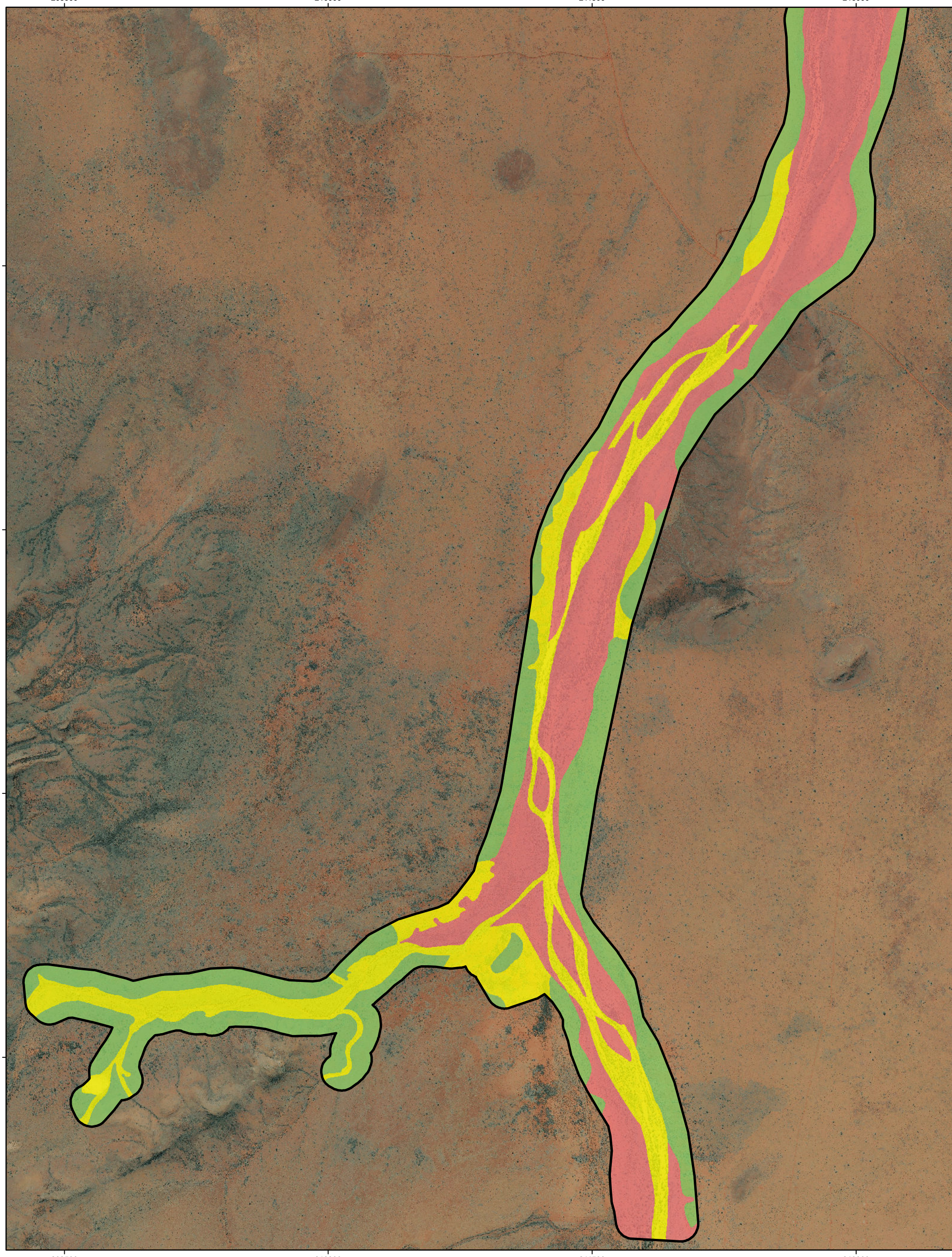

208500 210000 211500 213000

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JIMBLEBAR CREEK

Vegetation Condition
Map 3 of 3

0 250 500 750 1,000 1,250
Meters

1:20,000

Datum: GDA94
Projection: MGA Zone 51

ONSHORE ENVIRONMENTAL

Figure:	9	Date:	06/01/2015
Sheet Size:	A3	Status:	Draft
Drawn by GSM	Requested by DB	Internal Reference Jimblebar_creek_Veg_Cond	

Legend

Study Area

Vegetation Condition

- Good
- Very Good
- Excellent

N

4.0 RESULTS: Vegetation Monitoring

4.1 Plant Biodiversity Parameters

The establishment and assessment of plant biodiversity parameters along five permament belt transects provides baseline data against which data from future assessments can be directly compared.

The September 2014 assessment recorded a total of 29 plant taxa along the five belt transects, including 28 natives and one introduced weed species, **Cenchrus ciliaris* (Buffel Grass). Species richness for individual transects ranged from three to 18 taxa (Table 10). Perennial plant density averaged 1.27 plants m^{-2} (1,270 per ha equivalent) along the five transects, ranging from zero to 4.75 plants m^{-2}. Mean ground cover was 45.3 percent, with transects ranging from 24.7 percent to 69.6 percent (Table 10), reflecting the different vegetation structures. The dominant plant taxa recorded were *Acacia citrinoviridis, *Cenchrus ciliaris, Eriachne pulchella* and *Goodenia lamprosperma.* The mean Shannon-Wiener (H) and Evenness (J) values were 1.00 and 0.53 respectively.

Table 10 Species diversity and evenness indices for five monitoring transects at Jimblebar Creek.

Transect	Species Richness	Plant Density (no./m^2)	% Cover	SW-Diversity (H)	Evenness (J)
M1	18	4.75	24.70	0.96	0.44
M2	14	0.70	32.08	0.76	0.33
M3	3	0.20	47.55	0.56	0.51
M4	10	0.70	52.65	1.73	0.83
M5	5	0.00	69.65	no value[4]	no value[4]
Mean	10	1.27	45.33	1.00	0.53

4.2 Tree Plots

All tree species occurring within the five 20 m by 20 m plots were recorded. The tree species assessed included *Acacia citrinoviridis, Eucalyptus camaldulensis* and *Eucalyptus victrix.* The number of trees, average height, stem circumference and condition for each of the sites is presented in Table 11.

Tree density for the five plots assessed ranged from 175 to 425 trees per hectare, and averaged 320 trees per hectare. *Acacia citrinoviridis* was present at all five sites while *Eucalyptus victrix* was present within Plots 1 and 2 and *Eucalyptus camaldulensis* occurred at Plots 3, 4 and 5. The largest trees in terms of both height and circumference were *Eucalyptus camaldulensis* at Plot 3. *Acacia citrinoviridis* was the largest tree recorded at Plots 1, 2 and 5, with *Eucalyptus victrix* was the larger

[4] No value calculated for Plot 5 as there were no perennial plants rooted within the plot (foliage cover was overhanging).

tree at Plot 2. Tree condition was predominantly rated as excellent (score 5) with the exceptions being two *Eucalyptus camaldulensis* trees at Plot 5 (rated 3 and 4), and scattered *Acacia citrinoviridis* trees at Plots 3 and 4 (rated 3 and 4). All *Eucalyptus victrix* trees were given the highest score of 5.

Table 112 Summarised data for tree species recorded from five 20m by 20m plots established along Jimblebar Creek at September 2014.

Site	Species	Number Trees	Mean Tree Height (m)	Mean Condition Score	Mean Stem Circumference at Breast Height (cm)
M1	*Acacia citrinoviridis*	3	4.00	5.00	17.33
M2	*Acacia citrinoviridis*	12	3.67	5.00	11.50
M3	*Acacia citrinoviridis*	14	2.11	4.71	7.64
M4	*Acacia citrinoviridis*	4	6.50	4.75	15.25
M5	*Acacia citrinoviridis*	8	3.50	5.00	18.88
M3	*Eucalyptus camaldulensis*	2	14.50	5.00	125.00
M4	*Eucalyptus camaldulensis*	3	14.33	5.00	107.67
M5	*Eucalyptus camaldulensis*	2	9.00	3.50	57.50
M1	*Eucalyptus victrix*	14	6.18	5.00	35.29
M2	*Eucalyptus victrix*	2	8.00	5.00	56.00

4.0 SUMMARY

Onshore Environmental completed a Level 2 flora and vegetation survey of riparian vegetation along a 20 km stretch of Jimblebar Creek situated east of BHP Billiton Iron Ore's OB31 deposit between the 8th and 12th September 2014. In addition to the baseline survey, permanent monitoring sites were established along the main drainage channel downstream from the site of proposed surplus water discharge associated with development of the OB31 Mine. Plant biodiversity parameters were quantitatively assessed along belt transects, and trees were monitored within plots. This baseline monitoring data will allow for accurate determination of any change in flora and vegetation post-surface water discharge.

Level 2 Flora and Vegetation Assessment

A total number of 167 plant taxa (including varieties and subspecies) from 39 families and 97 genera were recorded from the study area at September 2014. Species representation was greatest among the Poaceae, Fabaceae, and Malvaceae families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (15 taxa), followed by *Senna* (8 taxa), *Eragrostis* (5 taxa) and *Eremophila* (5 taxa).

There were no plant taxa gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the WC Act, or listed under the EPBC Act recorded from the study area. In addition there were no Priority flora taxa recorded from the study area. Three of the plant taxa recorded were determined to represent range extensions based on the current known distribution of the total flora; *Chamaecrista symonii, Eragrostis speciosa* and *Halgania erecta.*

There were three introduced (weed) species recorded from the study area; **Cenchrus ciliaris, *Cenchrus setiger* and **Bidens bipinnata.* None of these taxa is listed as a Declared Pest under the BAM Act.

A total of 19 vegetation associations were described and mapped within the study area. Vegetation condition ranged from excellent to good, with the largest proportion of the study area rated as very good. The vegetation associations were classified into the following seven Broad Floristic Formations on the basis of dominant vegetation stratum:

8) *Eucalyptus* Woodland;
9) *Acacia* Low Open Forest;
10) *Acacia* Low Open Woodland;
11) *Acacia* High Shrubland;
12) *Triodia* Hummock Grassland;
13) *Triodia* Open Hummock Grassland; and
14) **Cenchrus* Tussock Grassland.

None of the vegetation associations within the study area had any affiliation with Federal or State listed TECs, or State listed PECs.

Riparian Vegetation Monitoring

At September 2014 a total number of 29 plant taxa was recorded along the five 20m by 1m belt transects assessed, including 28 natives and one introduced weed species, **Cenchrus ciliaris* (Buffel Grass). Species richness for individual transects ranged from three to 18 taxa and averaged ten taxa. Perennial plant density averaged 1.27 plants m^{-2} (1,270 per ha equivalent) and mean ground cover was 45.3 percent.

There three tree species occurring within the five 20 m by 20 m plots assessed were *Acacia citrinoviridis, Eucalyptus camaldulensis* and *Eucalyptus victrix.* Tree density ranged from 175 to 425 trees per hectare, averaging 320 trees per hectare. *Acacia citrinoviridis* was present at all five sites, while *Eucalyptus camaldulensis* was recorded from three sites and *Eucalyptus victrix* was present at two sites. The largest trees in terms of both height and stem circumference were *Eucalyptus camaldulensis* at Plot 3. Tree condition was predominantly rated as excellent (score 5) with the exceptions being two *Eucalyptus camaldulensis* trees at Plot 5 and scattered *Acacia citrinoviridis* trees at Plots 3 and 4. All *Eucalyptus victrix* trees were given the highest score of 5.

5.0 STUDY TEAM

The Level 2 flora and vegetation survey and monitoring program was planned, co-ordinated and executed by the following personnel:

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Ms Jessica Waters	BSc	Botanist
Mr Daniel Roberts	BSc	Botanist
Mrs Kerry Keenan		Data Analyst
Mr Todd Griffin		GIS Specialist

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APPENDIX 1

Conservation Codes for Western Australian Flora.

T: Threatened (Declared Rare) Flora - Extant Taxa

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

1: Priority One - Poorly Known Taxa

Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.

2: Priority Two - Poorly Known Taxa

Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

3: Priority Three - Poorly Known Taxa

Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

4: Priority Four - Rare, Near Threatened and other taxa in need of monitoring

(a) **Rare.** Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.
(b) **Near Threatened**. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
(c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

5: Priority Five - Conservation Dependent taxa

Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxa becoming threatened within five years.

APPENDIX 2

Conservation categories for flora described under the EPBC Act.

Category	Description
Extinct	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A species is categorised as extinct in the wild if it is only known to survive in cultivations, in captivity, or as a naturalised population well outside its past range; or if it has not been recorded in its known/expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	The species is facing an extremely high risk of extinction in the wild and in the immediate future.
Endangered	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival, or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Conservation Dependent	The species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

APPENDIX 3

Vegetation Classifications for the Pilbara based on Specht (1970), as modified by Aplin (1979) and Trudgen (2009).

Height Class	Canopy Cover				
	100 - 70%	70 - 30%	30 - 10%	10 - 2%	< 2%
Trees > 30 m	High Closed Forest	High Open Forest	High Woodland	High Open Woodland	Scattered Tall Trees
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland	Scattered Trees
Trees < 10 m	Low Closed Woodland	Low Open Forest	Low Woodland	Low Open Woodland	Scattered Low Trees
Mallee	Closed Mallee	Mallee	Open Mallee	Very Open Mallee	Scattered Mallees
Shrubs > 2 m	Closed Scrub	Open Scrub	High Shrubland	High Open Shrubland	Scattered Tall Shrubs
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland	Scattered Shrubs
Shrubs < 1 m	Low Closed Heath	Low Open Heath	Low Shrubland	Low Open Shrubland	Low Scattered Shrubs
Hummock Grass	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland	Scattered Hummock Grass
Tussock Grass	Closed Tussock Grassland	Tussock Grassland	Open Tussock Grassland	Very Open Tussock Grassland	Scattered Tussock Grass
Bunch Grass	Closed Bunch Grassland	Bunch Grassland	Open Bunch Grassland	Very Open Bunch Grassland	Scattered Bunch Grass
Sedges	Closed Sedges	Sedges	Open Sedges	Very Open Sedges	Scattered Sedges
Herbs	Closed Herbs	Herbs	Open Herbs	Very Open Herbs	Scattered Herbs

Source: S. Van Leeuwen (DPaW)

APPENDIX 4

Vegetation condition scale
(as developed by Keighery 1994)

Condition	Code	Description
Pristine	1	Pristine or nearly so, no obvious signs of disturbance.
Excellent	2	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	3	Vegetation structure altered; obvious signs of disturbance.
Good	4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
Degraded	5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching Very Good condition without intensive management.
Completely Degraded	6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

APPENDIX 5

Total flora list from the study area

Family	Genus	Species	subsp. / var.	
Acanthaceae	*Rostellularia*	*adscendens*	var.	*clementii*
Amaranthaceae	*Alternanthera*	*nana*		
Amaranthaceae	*Alternanthera*	*nodiflora*		
Amaranthaceae	*Amaranthus*	*undulatus*		
Amaranthaceae	*Ptilotus*	*aervoides*		
Amaranthaceae	*Ptilotus*	*astrolasius*		
Amaranthaceae	*Ptilotus*	*calostachyus*		
Amaranthaceae	*Ptilotus*	*obovatus*		
Apocynaceae	*Cynanchum*	*floribundum*		
Asteraceae	**Bidens*	*bipinnata*		
Asteraceae	*Blumea*	*tenella*		
Asteraceae	*Centipeda*	*minima*	subsp.	*macrocephala*
Asteraceae	*Helichrysum*	*luteoalbum*		
Asteraceae	*Pluchea*	*dentex*		
Asteraceae	*Pluchea*	*rubelliflora*		
Asteraceae	*Pterocaulon*	*sphacelatum*		
Asteraceae	*Streptoglossa*	*macrocephala*		
Boraginaceae	*Halgania*	*erecta*		
Boraginaceae	*Heliotropium*	*cunninghamii*		
Boraginaceae	*Trichodesma*	*zeylanicum*		
Campanulaceae	*Wahlenbergia*	*tumidifructa*		
Capparaceae	*Capparis*	*lasiantha*		
Caryophyllaceae	*Polycarpaea*	*corymbosa*		
Caryophyllaceae	*Polycarpaea*	*longiflora*		
Chenopodiaceae	*Dysphania*	*kalpari*		
Chenopodiaceae	*Maireana*	*villosa*		
Chenopodiaceae	*Rhagodia*	*eremaea*		
Chenopodiaceae	*Sclerolaena*	*cornishiana*		
Cleomaceae	*Cleome*	*viscosa*		
Convolvulaceae	*Bonamia*	*erecta*		
Convolvulaceae	*Bonamia*	sp. Dampier (A.A. Mitchell PRP 217)		
Convolvulaceae	*Duperreya*	*commixta*		
Convolvulaceae	*Ipomoea*	*muelleri*		
Convolvulaceae	*Ipomoea*	*polymorpha*		
Cucurbitaceae	*Cucumis*	*maderaspatanus*		
Cyperaceae	*Cyperus*	*ixiocarpus*		
Cyperaceae	*Cyperus*	*vaginatus*		
Cyperaceae	*Fimbristylis*	*dichotoma*		
Cyperaceae	*Fimbristylis*	*elegans*		
Elatinaceae	*Bergia*	*pedicellaris*		
Elatinaceae	*Bergia*	*perennis*	subsp.	*exigua*
Euphorbiaceae	*Adriana*	*tomentosa*	var.	*tomentosa*
Euphorbiaceae	*Euphorbia*	*australis*	var.	*subtomentosa*
Euphorbiaceae	*Euphorbia*	*biconvexa*		
Euphorbiaceae	*Euphorbia*	*tannensis*	subsp.	*eremophila*
Euphorbiaceae	*Evolvulus*	*alsinoides*	var.	*villosicalyx*
Fabaceae	*Acacia*	*adsurgens*		
Fabaceae	*Acacia*	*ancistrocarpa*		

Family	Genus	Species	subsp. / var.	
Fabaceae	*Acacia*	*aptaneura*		
Fabaceae	*Acacia*	*citrinoviridis*		
Fabaceae	*Acacia*	*coriacea*	subsp.	*pendens*
Fabaceae	*Acacia*	*maitlandii*		
Fabaceae	*Acacia*	*melleodora*		
Fabaceae	*Acacia*	*monticola*		
Fabaceae	*Acacia*	*pachyacra*		
Fabaceae	*Acacia*	*paraneura*		
Fabaceae	*Acacia*	*pruinocarpa*		
Fabaceae	*Acacia*	*pyrifolia*	var.	*pyrifolia*
Fabaceae	*Acacia*	*sclerosperma*	subsp.	*sclerosperma*
Fabaceae	*Acacia*	*synchronicia*		
Fabaceae	*Acacia*	*wanyu*		
Fabaceae	*Chamaecrista*	*symonii*		
Fabaceae	*Cullen*	*leucanthum*		
Fabaceae	*Glycine*	*canescens*		
Fabaceae	*Indigofera*	*georgei*		
Fabaceae	*Indigofera*	*monophylla*		
Fabaceae	*Isotropis*	*forrestii*		
Fabaceae	*Kennedia*	*prorepens*		
Fabaceae	*Senna*	*artemisioides*	subsp.	*helmsii*
Fabaceae	*Senna*	*artemisioides*	subsp.	*helmsii x oligophylla*
Fabaceae	*Senna*	*artemisioides*	subsp.	*oligophyllla*
Fabaceae	*Senna*	*artemisioides*		
Fabaceae	*Senna*	*glaucifolia*		
Fabaceae	*Senna*	*glutinosa*	subsp.	*glutinosa*
Fabaceae	*Senna*	*glutinosa*	subsp.	*luerssenii*
Fabaceae	*Tephrosia*	*rosea*	var.	Fortescue creeks (M.I.H. Brooker 2186)
Goodeniaceae	*Goodenia*	*lamprosperma*		
Goodeniaceae	*Scaevola*	*parvifolia*	subsp.	*pilbarae*
Goodeniaceae	*Scaevola*	*spinescens*		
Lamiaceae	*Clerodendrum*	*tomentosum*	var.	*lanceolatum*
Loganiaceae	*Mitrasacme*	*connata*		
Loranthaceae	*Amyema*	cf. *miquelii*		
Loranthaceae	*Amyema*	*fitzgeraldii*		
Lythraceae	*Ammannia*	*baccifera*		
Malvaceae	*Abutilon*	*amplum*		
Malvaceae	*Abutilon*	*otocarpum*		
Malvaceae	*Androcalva*	*luteiflora*		
Malvaceae	*Corchorus*	*crozophorifolius*		
Malvaceae	*Corchorus*	*sidoides*	subsp.	*sidoides*
Malvaceae	*Gossypium*	*robinsonii*		
Malvaceae	*Hibiscus*	sp. Gardneri (A.L. Payne PRP 1435)		
Malvaceae	*Hibiscus*	*sturtii*	var.	*platychlamys*
Malvaceae	*Hibiscus*	*sturtii*	var.	*truncatus*
Malvaceae	*Keraudrenia*	*velutina*	subsp.	*elliptica*

Family	Genus	Species	subsp. / var.	
Malvaceae	*Sida*	*arenicola*		
Malvaceae	*Sida*	*kingii*		
Malvaceae	*Sida*	sp. spiciform panicles (E. Leyland s.n. 14/8/90)		
Malvaceae	*Triumfetta*	aff. *chaetocarpa*		
Malvaceae	*Waltheria*	*indica*		
Malvaceae	*Waltheria*	*virgata*		
Myrtaceae	*Corymbia*	*hamersleyana*		
Myrtaceae	*Eucalyptus*	*camaldulensis*	subsp.	*obtusa*
Myrtaceae	*Eucalyptus*	*victrix*		
Myrtaceae	*Melaleuca*	*glomerata*		
Nyctaginaceae	*Boerhavia*	cf. *coccinea*		
Orabanchaceae	*Buchnera*	*linearis*		
Orobanchaceae	*Striga*	*squamigera*		
Phyllanthaceae	*Phyllanthus*	*maderaspatensis*		
Plantaginaceae	*Stemodia*	*grossa*		
Plantaginaceae	*Stemodia*	*viscosa*		
Poaceae	**Cenchrus*	*ciliaris*		
Poaceae	**Cenchrus*	*setiger*		
Poaceae	*Aristida*	*contorta*		
Poaceae	*Aristida*	*holathera*	var.	*holathera*
Poaceae	*Aristida*	*inaequiglumis*		
Poaceae	*Chrysopogon*	*fallax*		
Poaceae	*Cymbopogon*	*ambiguus*		
Poaceae	*Cymbopogon*	*obtectus*		
Poaceae	*Cymbopogon*	*procerus*		
Poaceae	*Digitaria*	*brownii*		
Poaceae	*Elytrophorus*	*spicatus*		
Poaceae	*Enneapogon*	*caerulescens*		
Poaceae	*Enneapogon*	*polyphyllus*		
Poaceae	*Enneapogon*	*robustissimus*		
Poaceae	*Eragrostis*	*cumingii*		
Poaceae	*Eragrostis*	*elongata*		
Poaceae	*Eragrostis*	*eriopoda*		
Poaceae	*Eragrostis*	*speciosa*		
Poaceae	*Eragrostis*	*tenellula*		
Poaceae	*Eriachne*	*obtusa*		
Poaceae	*Eriachne*	*pulchella*	subsp.	*dominii*
Poaceae	*Eriachne*	*tenuiculmis*		
Poaceae	*Eulalia*	*aurea*		
Poaceae	*Heteropogon*	*contortus*		
Poaceae	*Paraneurachne*	*muelleri*		
Poaceae	*Paspalidium*	*rarum*		
Poaceae	*Paspalidium*	*sp. indet*		
Poaceae	*Perotis*	*rara*		
Poaceae	*Setaria*	*surgens*		
Poaceae	*Themeda*	*avenacea*		
Poaceae	*Themeda*	*triandra*		
Poaceae	*Triodia*	*basedowii*		

Family	Genus	Species	subsp. / var.	
Poaceae	*Triodia*	*pungens*		
Poaceae	*Triodia*	sp. Shovelanna Hill (S. Van Leeuwen 3835)		
Portulacaceae	*Calandrinia*	*quadrivalvis*		
Portulacaceae	*Portulaca*	cf. *pilosa*		
Portulacaceae	*Portulaca*	*oleracea*		
Proteaceae	*Grevillea*	*juncifolia*	subsp.	*juncifolia*
Proteaceae	*Grevillea*	*wickhamii*		
Proteaceae	*Hakea*	*lorea*	subsp.	*lorea*
Pteridaceae	*Cheilanthes*	*sieberi*	subsp.	*sieberi*
Rhamnaceae	*Ventilago*	*viminalis*		
Rubiaceae	*Oldenlandia*	*galioides*		
Rubiaceae	*Psydrax*	*latifolia*		
Rubiaceae	*Synaptantha*	*tillaeacea*	subsp.	*tillaeacea*
Santalaceae	*Anthobolus*	*leptomerioides*		
Santalaceae	*Santalum*	*lanceolatum*		
Scrophulariaceae	*Eremophila*	*forrestii*	subsp.	*forrestii*
Scrophulariaceae	*Eremophila*	*fraseri*		
Scrophulariaceae	*Eremophila*	*latrobei*	subsp.	*filiformis*
Scrophulariaceae	*Eremophila*	*longifolia*		
Scrophulariaceae	*Eremophila*	*platycalyx*	subsp.	*pardalota*
Solanaceae	*Solanum*	*elatius*		
Solanaceae	*Solanum*	*lasiophyllum*		
Surianaceae	*Stylobasium*	*spathulatum*		
Violaceae	*Hybanthus*	*aurantiacus*		

APPENDIX 6

Records for introduced weed species recorded from the study area

MGA_EAST	MGA_NORTH	QUAD_NO	GENUS	SPECIES
212209.0000000000	7421553.0000000000	JC03	*Bidens	bipinnata
212553.0000000000	7430628.0000000000	JC11	*Bidens	bipinnata
211871.0000000000	7416753.0000000000	JC01	*Cenchrus	ciliaris
212969.0000000000	7423029.0000000000	JC02	*Cenchrus	ciliaris
212209.0000000000	7421553.0000000000	JC03	*Cenchrus	ciliaris
209115.0000000000	7417756.0000000000	JC04	*Cenchrus	ciliaris
210941.0000000000	7418457.0000000000	JC05	*Cenchrus	ciliaris
211217.0000000000	7420164.0000000000	JC06	*Cenchrus	ciliaris
211729.0000000000	7420943.0000000000	JC07	*Cenchrus	ciliaris
212320.0000000000	7426369.0000000000	JC08	*Cenchrus	ciliaris
212930.0000000000	7427750.0000000000	JC09	*Cenchrus	ciliaris
212609.0000000000	7429113.0000000000	JC10	*Cenchrus	ciliaris
212553.0000000000	7430628.0000000000	JC11	*Cenchrus	ciliaris
212354.0000000000	7432639.0000000000	JC13	*Cenchrus	ciliaris
211968.8827050000	7416762.6780900000	Q1	*Cenchrus	ciliaris
211968.8827050000	7416762.6780900000	Q1	*Cenchrus	setiger
211796.6421300000	7416672.4964300000	Q5	*Cenchrus	ciliaris
211753.8316070000	7416680.8982200000	Q7	*Cenchrus	ciliaris
212901.3328410000	7422512.9746300000	Q10	*Cenchrus	ciliaris
212901.3328410000	7422512.9746300000	Q10	*Cenchrus	setiger
213001.3577960000	7422370.8241200000	Q12	*Cenchrus	ciliaris
212983.0584280000	7422346.4549800000	Q13	*Cenchrus	ciliaris
212837.2373510000	7422386.1169500000	Q14	*Cenchrus	ciliaris
212837.2373510000	7422386.1169500000	Q14	*Cenchrus	setiger
212918.5633620000	7423121.0658100000	Q15	*Cenchrus	ciliaris
212690.3540870000	7422392.5057500000	Q20	*Cenchrus	ciliaris
212467.6602560000	7421996.5591500000	Q26	*Cenchrus	ciliaris
212147.2306250000	7421713.2409700000	Q29	*Cenchrus	ciliaris
212148.7737960000	7421633.8369800000	Q30	*Cenchrus	ciliaris
212399.0219190000	7421664.5606000000	Q31	*Cenchrus	ciliaris
209112.9753950000	7417815.1617500000	Q38	*Cenchrus	ciliaris
210743.0899530000	7418207.3689800000	Q53	*Cenchrus	ciliaris
211346.5130480000	7418496.2569500000	Q56	*Cenchrus	ciliaris
211350.6247560000	7419859.6590600000	Q64	*Cenchrus	ciliaris
211425.2025670000	7419885.1284500000	Q65	*Cenchrus	ciliaris
211518.8661340000	7419894.3437300000	Q66	*Cenchrus	ciliaris
211569.6757240000	7420789.4337300000	Q70	*Cenchrus	ciliaris
212508.5021160000	7426491.8068400000	Q74	*Cenchrus	ciliaris
212913.5841200000	7427258.8783200000	Q77	*Cenchrus	ciliaris
212694.2259820000	7427744.1640700000	Q80	*Cenchrus	ciliaris
212516.1887010000	7428740.0967600000	Q82	*Cenchrus	ciliaris

APPENDIX 7

Site sheets summarising raw data for quadrats within the study area

Site	Jimblebar Creek - Site JC01
Date	08/09/2014
Recorder	JB/DR
Photo	116-0499
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	211871
Northing	7416753
Habitat	Drainage Depression
Slope	Low
Soil	Sand - brown
Rock Type	Mixed Riverine Gravel (pebbles, cobbles)
% Leaves:Logs	2-10: <2
Bare Ground	74%
Vegetation Condition	Very Good
Disturbance Type	Livestock; Weeds
Fire Age	Old (6+yrs)
Vegetation	Open Woodland of *Eucalyptus camaldulensis* subsp. *refulgens*, *Eucalyptus victrix* over Low Open Woodland of *Acacia coriacea* subsp. *pendens, Acacia citrinoviridis* over High Open Shrubland of *Acacia pyrifolia* var. *pyrifolia, Melaleuca glomerata* over Very Open Tussock Grassland of **Cenchrus ciliaris, Cymbopogon procerus, Eulalia aurea*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		2 - 10	0.60
Acacia	*citrinoviridis*		2 - 10	7.00
Acacia	*coriacea*	subsp. *pendens*	2 - 10	7.50
Acacia	*monticola*		<2	2.00
Acacia	*pyrifolia*	var. *pyrifolia*	2 - 10	2.30
Alternanthera	*nana*		<2	0.10
Amyema		cf. *miquelii*	<2	
Androcalva	*luteiflora*		<2	0.40
Aristida	*holathera*	var. *holathera*	<2	0.60
Bonamia		sp. Dampier (A.A. Mitchell PRP 217)	<2	0.10
Centipeda	*minima*	subsp. *macrocephala*	<2	0.10
Chrysopogon	*fallax*		<2	1.00
Cleome	*viscosa*		<2	0.30
Corchorus	*crozophorifolius*		<2	0.75
Cymbopogon	*procerus*		<2	0.90
Cynanchum	*floribundum*		<2	0.35
Cyperus	*ixiocarpus*		<2	0.45
Cyperus	*vaginatus*		<2	0.60
Eragrostis	*cumingii*		<2	0.30
Eragrostis	*elongata*		<2	0.40
Eragrostis	*speciosa*			
Eragrostis	*tenellula*		<2	0.10
Eriachne	*obtusa*		<2	0.10
Eucalyptus	*camaldulensis*	subsp. *refulgens*	2 - 10	15.25
Eucalyptus	*victrix*		2 - 10	15.00
Eulalia	*aurea*		<2	0.50
Euphorbia	*australis*	subsp. *subtomentosa*	<2	
Euphorbia	*biconvexa*		<2	0.30

Genus	Species	subsp. / var.	% Cover	Height
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.10
Goodenia	*lamprosperma*		<2	0.30
Gossypium	*robinsonii*		<2	0.30
Grevillea	*wickhamii*		<2	1.50
Helichrysum	*luteoalbum*		<1	0.20
Ipomoea	*muelleri*		<2	0.20
Isotropis	*forrestii*		<2	0.50
Melaleuca	*glomerata*		<2	4.00
Mitrasacme	*connata*		<2	0.10
Phyllanthus	*maderaspatensis*		<2	0.25
Pluchea	*rubelliflora*		<2	0.10
Pterocaulon	*sphacelatum*		<2	0.20
Stemodia	*grossa*		<2	0.30
Stemodia	*viscosa*		<2	0.40
Striga	*squamigera*		<2	0.20
Synaptantha	*tillaeacea*	subsp. *tillaeacea*	<2	0.10
Tephrosia	*rosea*	var. Fortescue creeks (M.I.H. Brooker 2186)	2 – 10	0.50
Themeda	*triandra*		<2	0.50
Triumfetta	aff. *chaetocarpa*		<2	0.60
Wahlenbergia	*tumidifructa*		<2	0.40

Site	Jimblebar Creek - Site JC02
Date	09/09/2014
Recorder	JB/DR
Photo	116-0548
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212969
Northing	7423029
Habitat	Sandy Floodplain
Slope	Low
Soil	Loamy Sand – Brown
Rock Type	
% Leaves:Logs	<2: <2
Bare Ground	20%
Vegetation Condition	Good
Disturbance Type	Fire; Cattle; Weeds
Fire Age	Moderate (3-5yrs)
Vegetation	Tussock Grassland of **Cenchrus ciliaris, Eriachne obtusa* with High Open Shrubland *Acacia citrinoviridis* over Low Open Shrubland of *Corchorus crozophorifolius, Senna artemisioides* subsp. *helmsii x oligophylla*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		31 – 70	0.50
Acacia	*aptaneura*		<2	2.00
Acacia	*citrinoviridis*		2 – 10	4.00
Acacia	*pyrifolia*	var. *pyrifolia*	<2	2.50
Androcalva	*luteiflora*		<2	3.00
Aristida	*contorta*		<2	0.30
Aristida	*holathera*	var. *holathera*	<2	0.35
Aristida	*inaequiglumis*		<2	1.00
Bonamia	*erecta*		<2	0.30
Corchorus	*crozophorifolius*		2 – 10	1.00
Cullen	*leucanthum*		<2	1.50
Duperreya	*commixta*		<2	0.50
Enneapogon	*polyphyllus*		<2	0.30
Eragrostis	*eriopoda*		<2	0.20
Eremophila	*longifolia*		<2	2.50
Eriachne	*obtusa*		<2	0.50
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.10
Gossypium	*robinsonii*		<2	1.50
Hakea	*lorea*	subsp. *lorea*	<2	1.75
Indigofera	*georgei*		<2	1.00
Ptilotus	*obovatus*		<2	0.50
Senna	*artemisioides*	subsp. *helmsii x oligophylla*	<2	1.00
Senna	*artemisioides*	subsp. *helmsii*	<2	0.90
Sida		subsp. spiciform panicles (E. Leyland s.n. 14/8/90)	<2	0.30
Solanum	*lasiophyllum*		<2	0.50
Tephrosia	*rosea*	var. Fortescue creeks (M.I.H. Brooker 2186)	<2	0.60
Waltheria	*virgata*		<2	0.40

Site	Jimblebar Creek - Site JC03
Date	09/09/2014
Recorder	JB/DR
Photo	116-0555
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212209
Northing	7421553
Habitat	See Location Map 3 – North Central
Aspect	
Slope	Low
Soil	Loamy Sand – Brown
Rock Type	Riverine Gravels (pebbles, cobbles)
% Leaves:Logs	11-30: 2-10
Bare Ground	20%
Vegetation Condition	Very Good
Disturbance Type	Weeds; Cattle
Fire Age	Old (6+yrs)
Vegetation	Low Open Forest of *Acacia citrinoviridis, Acacia coriacea* subsp*. pendens* over Tussock Grassland of **Cenchrus ciliaris, Aristida holathera* var. *holathera* with High Open Shrubland of *Melaleuca glomerata, Acacia citrinoviridis*

Genus	Species	subsp. / var.	% Cover	Height
**Bidens*	*bipinnata*		<2	0.20
**Cenchrus*	*ciliaris*		31 – 70	0.65
Abutilon	*amplum*		<2	1.80
Abutilon	*otocarpum*		<2	0.10
Acacia	*aptaneura*		<2	2.00
Acacia	*citrinoviridis*		31 – 70	10.00
Acacia	*coriacea*	subsp. *pendens*	2 – 10	1.70
Acacia	*pyrifolia*	var. *pyrifolia*	<2	4.00
Ammannia	*multiflora*		<2	0.10
Aristida	*holathera*	var. *holathera*	2 – 10	0.30
Bonamia		sp. Dampier (A.A. Mitchell PRP 217)	<2	0.10
Buchnera	*linearis*		<2	0.10
Centipeda	*minima*	subsp. *macrocephala*	<2	0.10
Cheilanthes	*sieberi*	subsp. *sieberi*	<2	0.10
Chrysopogon	*fallax*		<2	0.80
Cleome	*viscosa*		<2	0.20
Corchorus	*crozophorifolius*		2 – 10	1.00
Cymbopogon	*procerus*		<2	0.80
Cynanchum	*floribundum*		<2	0.50
Duperreya	*commixta*		<2	0.50
Eragrostis	*cumingii*		<2	0.20
Eragrostis	*tenellula*		<2	0.30
Eucalyptus	*camaldulensis*	subsp. *refulgens*	2 – 10	12.00
Eulalia	*aurea*		<2	0.70
Euphorbia	*australis*	var. *subtomentosa*	<2	0.10
Euphorbia	*biconvexa*		<2	0.10
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.10
Heteropogon	*contortus*		<2	1.20

Genus	Species	subsp. / var.	% Cover	Height
Ipomoea	*polymorpha*		<2	0.20
Isotropis	*forrestii*		<2	0.20
Melaleuca	*glomerata*		2 – 10	4.50
Oldenlandia	*galioides*		<2	0.10
Phyllanthus	*maderaspatensis*		<2	0.30
Pluchea	*rubelliflora*		<2	0.20
Polycarpaea	*longiflora*		<2	0.10
Pterocaulon	*sphacelatum*		<2	0.05
Rostellularia	*adscendens*	var. *clementii*	<2	0.20
Stemodia	*viscosa*		<2	0.30
Tephrosia	*rosea*	var. Fortescue creeks (M.I.H. Brooker 2186)	<2	0.50
Themeda	*avanacea*		<2	1.50
Themeda	*triandra*		<2	1.00
Trichodesma	*zeylanicum*		<2	0.30
Triodia	*pungens*		<2	1.30
Waltheria	*virgata*		<2	0.20

Site	Jimblebar Creek - Site JC04
Date	10/09/2014
Recorder	JB/DR
Photo	116-0576
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	209115
Northing	7417756
Habitat	Drainage Depression
Slope	Low
Soil	Loamy Sand – Brown
Rock Type	Chert/ Ironstone (cobbles, gravels)
% Leaves:Logs	2-10: <2
Bare Ground	70%
Vegetation Condition	Very Good
Disturbance Type	Livestock; Weeds; Flooding
Fire Age	Old (6+yrs)
Vegetation	Low Open Woodland of *Eucalyptus victrix, Acacia citrinoviridis* over Low Open Shrubland of *Tephrosia rosea* var. Fortescue creeks (M.I.H. Booker 2186) over Very Open Tussock Grassland of *Eriachne tenuiculmis, Cymbopogon ambiguus, Cymbopogon procerus* over Very Open Hummock Grassland of *Triodia pungens*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		<2	0.50
Acacia	*ancistrocarpa*		<2	2.50
Acacia	*aptaneura*		<2	4.00
Acacia	*citrinoviridis*		2 – 10	6.00
Acacia	*maitlandii*		<2	0.80
Acacia	*monticola*		2 – 10	3.00
Acacia	*pyrifolia*	var. *pyrifolia*	2 – 10	2.00
Acacia	*wanyu*		<2	1.50
Androcalva	*luteiflora*		<2	2.50
Aristida	*holathera*	var. *holathera*	<2	0.40
Chrysopogon	*fallax*		<2	0.80
Cleome	*viscosa*		<2	0.30
Corchorus	*sidoides*		<2	0.40
Corymbia	*hamersleyana*		<2	3.00
Cymbopogon	*ambiguus*		<2	0.80
Cymbopogon	*procerus*		<2	1.30
Digitaria	*brownii*		<2	0.70
Duperreya	*commixta*		<2	0.50
Enneapogon	*robustissimus*		<2	0.70
Eragrostis	*tenellula*		<2	0.20
Eremophila	*fraseri*		<2	1.50
Eremophila	*platycalyx*	subsp. *pardalota*	<2	1.50
Eriachne	*pulchella*	subsp. *dominii*	<2	0.10
Eriachne	*tenuiculmis*		2 – 10	0.50
Eucalyptus	*victrix*		2 – 10	6.00
Eulalia	*aurea*		<2	0.30
Euphorbia	*biconvexa*		<2	0.35
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.20

Genus	Species	subsp. / var.	% Cover	Height
Goodenia	*lamprosperma*		<2	0.25
Gossypium	*robinsonii*		<2	3.00
Grevillea	*wickhamii*		<2	2.50
Heliotropium	*cunninghamii*		<2	0.25
Isotropis	*forrestii*		<2	0.70
Tephrosia	*rosea*	var. Fortescue creeks (M.I.H. Brooker 2186)	2 – 10	0.50
Themeda	*triandra*		2 – 10	0.50
Triodia	*pungens*		2 – 10	0.80
Triumfetta	aff. *chaetocarpa*		<2	0.60
Waltheria	*virgata*		<2	0.60

Site	Jimblebar Creek - Site JC05
Date	10/09/2014
Recorder	JB/DR
Photo	JC05
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	210941
Northing	7418457
Habitat	Floodplain/ Levee Bank
Slope	Low
Soil	Sandy Loam – Red
Rock Type	
% Leaves:Logs	<2: 2-10
Bare Ground	20%
Vegetation Condition	Very Good
Disturbance Type	Weeds; Livestock
Fire Age	Old (6+yrs)
Vegetation	Hummock Grassland of *Triodia pungens, Triodia basedowii* with Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* over Very Open Tussock Grassland of **Cenchrus ciliaris*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		2 – 10	0.50
Abutilon	*otocarpum*		<2	0.20
Acacia	*ancistrocarpa*		2 – 10	2.50
Acacia	*aptaneura*		<2	3.00
Acacia	*citrinoviridis*		<2	3.00
Acacia	*maitlandii*		<2	2.30
Acacia	*melleodora*		<2	1.50
Acacia	*pruinocarpa*		<2	2.50
Acacia	*pyrifolia*	var. *pyrifolia*	<2	1.50
Acacia	*sclerosperma*	subsp. *sclerosperma*	11 – 30	3.00
Acacia	*synchronicia*		<2	1.50
Androcalva	*luteiflora*		<2	1.00
Bonamia	*erecta*		<2	0.20
Capparis	*lasiantha*		<2	1.00
Chrysopogon	*fallax*		<2	0.70
Corchorus	*sidoides*		<2	0.35
Corymbia	*hamersleyana*		2 – 10	7.00
Cymbopogon	*ambiguus*		<2	0.30
Duperreya	*commixta*		<2	0.50
Eragrostis	*eriopoda*		<2	0.40
Eremophila	*forrestii*	subsp. *forrestii*	<2	0.50
Eremophila	*fraseri*		<2	1.00
Eremophila	*fraseri*		<2	0.80
Eremophila	*longifolia*		<2	1.50
Eulalia	*aurea*		<2	0.40
Euphorbia	*australis*	var. *subtomentosa*	<2	0.10
Euphorbia	*tannensis*	subsp. *eremophila*	<2	0.40
Gossypium	*robinsonii*		<2	2.50
Grevillea	*wickhamii*		<2	1.00

Genus	Species	subsp. / var.	% Cover	Height
Hakea	*lorea*	subsp. *lorea*	<2	2.20
Hibiscus	*sturtii*	var. *platychlamys*	<2	0.40
Psydrax	*latifolia*		<2	1.70
Ptilotus	*obovatus*		<2	0.50
Rhagodia	*eremaea*		<2	1.00
Senna	*artemisioides*	subsp. *helmsii*	<2	0.20
Sida		sp. spiciform panicles (E. Leyland s.n. 14/8/90)	<2	0.50
Solanum	*lasiophyllum*		<2	0.20
Triodia	*basedowii*		<2	0.80
Triodia	*pungens*		31 – 70	0.80
Ventilago	*viminalis*		<2	2.30
**Cenchrus*	*ciliaris*		2 – 10	0.50

Site	Jimblebar Creek - Site JC06
Date	11/09/2014
Recorder	JB/DR
Photo	116-0672
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	211217
Northing	7420164
Habitat	Hillslope
Slope	Low
Soil	Sandy Loam – Red
Rock Type	Ironstone/ Cherts
% Leaves:Logs	2-10: 2-10
Bare Ground	60%
Vegetation Condition	Very Good
Disturbance Type	Fire; Livestock; Weeds
Fire Age	Moderate (3-5yrs)
Vegetation	Low Open Woodland of *Acacia aptaneura, Acacia paraneura* over Open Shrubland of *Acacia wanyu, Eremophila fraseri, Senna glutinosa* subsp. *x luerssenii* over Very Open Hummock Grassland of Triodia *pungens, Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835)

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		2 – 10	0.35
Acacia	*aptaneura*		2 – 10	4.50
Acacia	*citrinoviridis*		<2	1.50
Acacia	*paraneura*		<2	5.00
Acacia	*pruinocarpa*		<2	1.20
Acacia	*pyrifolia*	var. *pyrifolia*	<2	1.50
Acacia	*wanyu*		<2	2.20
Amyema	*fitzgeraldii*		<2	
Aristida	*contorta*		<2	0.20
Aristida	*inaequiglumis*		<2	1.20
Boerhavia		cf. *coccinea*	<2	0.30
Chrysopogon	*fallax*		<2	0.50
Cleome	*viscosa*		<2	0.20
Corchorus	*crozophorifolius*		<2	0.50
Corymbia	*hamersleyana*		<2	4.50
Cymbopogon	*obtectus*		<2	0.70
Duperreya	*commixta*		<2	0.50
Enneapogon	*caerulescens*		<2	0.20
Enneapogon	*polyphyllus*		<2	0.20
Eragrostis	*eriopoda*		<2	0.35
Eremophila	*forrestii*	subsp. *forrestii*	<2	1.00
Eremophila	*fraseri*		2 – 10	1.50
Eremophila	*latrobei*	subsp. *filiformis*	<2	1.00
Eriachne	*pulchella*	subsp. *dominii*	<2	0.10
Euphorbia	*australis*		<2	0.10
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.15
Gossypium	*robinsonii*		<2	2.50
Hibiscus		sp. Gardneri (A.L. Payne PRP 1435)	<2	0.80

Genus	Species	subsp. / var.	% Cover	Height
Hibiscus	*sturtii*	var. *truncatus*	<2	0.30
Maireana	*villosa*		<2	0.30
Paraneurachne	*muelleri*		<2	0.70
Paspalidium		sp. *indet*	<2	0.15
Perotis	*rara*		<2	0.10
Portulaca		cf. *pilosa*	<2	0.20
Ptilotus	*aervoides*		<2	
Ptilotus	*calostachyus*		<2	0.50
Sclerolaena	*cornishiana*		<2	0.20
Senna	*artemisioides*	subsp. *helmsii*	<2	0.80
Senna	*glutinosa*	subsp. *x luerssenii*	<2	1.00
Sida		sp. indet	<2	0.20
Solanum	*lasiophyllum*		<2	0.40
Triodia	*pungens*		2 – 10	1.10
Triodia		sp. Shovelanna Hill (S. Van Leeuwen 3835)	<2	0.50

Site	Jimblebar Creek - Site JC07
Date	11/09/2014
Recorder	JB/DR
Photo	116-0676
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	211729
Northing	7429043
Habitat	Drainage Depression
Slope	Low
Soil	Sand – Brown
Rock Type	Ironstone/ Chert (gravels, cobbles)
% Leaves:Logs	2-10: 2-10
Bare Ground	44%
Vegetation Condition	Very Good
Disturbance Type	Livestock; Weeds; Flooding; (Camel)
Fire Age	Old (6+yrs)
Vegetation	High Shrubland of *Acacia pyrifolia* var *pyrifolia, Melaleuca glomerata* with Open Woodland of *Eucalyptus camaldulensis* subsp. *refulgens, Acacia citrinoviridis* over Low Open Woodland of *Acacia citrinoviridis* over Low Open Shrubland of *Corchorus crozophorifolius, Tephrosia rosea* var. Fortescue creeks (M.I.H. Booker 2186) with Very Open Tussock Grassland of **Cenchrus ciliaris, Eulalia aurea, Themeda triandra*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*			
Acacia	*citrinoviridis*			
Acacia	*pyrifolia*	var. *pyrifolia*		
Alternanthera	*nodiflora*			
Amaranthus	*undulatus*			
Ammannia	*baccifera*			
Aristida	*holathera*	var. *holathera*		
Bergia	*pedicellaris*			
Bergia	*perennis*			
Blumea	*tenella*			
Buchnera	*linearis*			
Calandrinia	*quadrivalvis*			
Centipeda	*minima*	subsp. *macrocephala*		
Chamaecrista	*symonii*			
Cleome	*viscosa*			
Corchorus	*crozophorifolius*			
Cucumis	*maderaspatanus*			
Cymbopogon	*procerus*			
Cynanchum	*floribundum*			
Cyperus	*ixiocarpus*			
Cyperus	*vaginatus*			
Duperreya	*commixta*			
Elytrophorus	*spicatus*			
Eragrostis	*cumingii*			
Eragrostis	*speciosa*			
Eragrostis	*tenellula*			
Eriachne	*pulchella*	subsp. *dominii*		
Eriachne	*tenuiculmis*			

Genus	Species	subsp. / var.	% Cover	Height
Eucalyptus	*camaldulensis*	subsp. *refulgens*		
Eulalia	*aurea*			
Euphorbia	*australis*			
Euphorbia	*biconvexa*			
Evolvulus	*alsinoides*	var. *villosicalyx*		
Fimbristylis	*elegans*			
Glycine	*canescens*			
Goodenia	*lamprosperma*			
Ipomoea	*polymorpha*			
Melaleuca	*glomerata*			
Oldenlandia	*galioides*			
Phyllanthus	*maderaspatensis*			
Pluchea	*dentex*			
Pluchea	*rubelliflora*			
Polycarpaea	*longiflora*			
Pterocaulon	*sphacelatum*			
Rostellularia	*adscendens*	var. *clementii*		
Stemodia	*grossa*			
Stemodia	*viscosa*			
Tephrosia	*rosea*	var. Fortescue Creeks (M.I.H. Booker 2186)		
Themeda	*avanacea*			
Themeda	*triandra*			
Trichodesma	*zeylanicum*			
Wahlenbergia	*tumidifructa*			
Waltheria	*indica*			

Site	Jimblebar Creek - Site JC08
Date	11/09/2014
Recorder	JB/DR
Photo	116-0693
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212320
Northing	7426369
Habitat	Crusty Sandplain
Slope	Low
Soil	Loamy Sand – Orange
Rock Type	
% Leaves:Logs	<2; <2
Bare Ground	30%
Vegetation Condition	Excellent
Disturbance Type	Camels
Fire Age	Old (6+yrs)
Vegetation	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Acacia pachyacra, Acacia ancistrocarpa* with Scattered Low Trees of *Corymbia hamersleyana, Hakea lorea* subsp. *lorea*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		<2	0.50
Acacia	*ancistrocarpa*		<2	1.70
Acacia	*pachyacra*		<2	2.50
Aristida	*contorta*		<2	0.15
Aristida	*inaequiglumis*		<2	1.00
Bonamia	*erecta*		<2	0.35
Chrysopogon	*fallax*		<2	1.30
Corchorus	*sidoides*		<2	0.40
Corymbia	*hamersleyana*		<2	7.00
Cymbopogon	*obtectus*		<2	1.00
Dysphania	*kalpari*		<2	0.10
Eragrostis	*eriopoda*		<2	0.50
Eremophila	*forrestii*	subsp. *forrestii*	<2	1.30
Eremophila	*longifolia*		<2	1.00
Eulalia	*aurea*		<2	0.60
Euphorbia	*tannensis*	subsp. *eremophila*	<2	0.50
Fimbristylis	*dichotoma*		<2	0.50
Hakea	*lorea*	subsp. *lorea*	<2	1.80
Halgania	*erecta*		<2	0.30
Hibiscus	*sturtii*	var. *platychlamys*	<2	0.20
Kennedia	*prorepens*		<2	0.40
Keraudrenia	*velutina*	subsp. *elliptica*	<2	0.40
Paraneurachne	*muelleri*		<2	0.50
Polycarpaea	*corymbosa*		<2	0.10
Pterocaulon	*sphacelatum*		<2	0.40
Ptilotus	*astrolasius*		<2	0.60
Ptilotus	*obovatus*		<2	0.80
Scaevola	*parvifolia*	subsp. *pilbarae*	<2	0.25
Sclerolaena	*cornishiana*		<2	0.20
Senna	*artemisioides*	subsp. *oligophylla x helmsii*	<2	0.80

Genus	Species	subsp. / var.	% Cover	Height
Senna	*artemisioides*	subsp. *oligophylla*	<2	1.00
Senna	*glutinosa*	subsp. *glutinosa*	<2	2.50
Solanum	*lasiophyllum*		<2	0.80
Streptoglossa	*macrocephala*		<2	0.35
Triodia	*basedowii*		31 – 70	0.80

Site	Jimblebar Creek - Site JC09
Date	11/09/2014
Recorder	JB/DR
Photo	116-0701
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212930
Northing	7427750
Habitat	Floodplain Levee
Slope	Low
Soil	Sandy Loam – Brown
Rock Type	
% Leaves:Logs	2-10: 2-10
Bare Ground	20%
Vegetation Condition	Good
Disturbance Type	Fire ; Weeds; Cattle
Fire Age	Old (6+yrs)
Vegetation	Closed Tussock Grassland of **Cenchrus ciliaris* with Low Open Forest of *Acacia citrinoviridis*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		71 – 100	0.60
Abutilon	*otocarpum*		<2	0.20
Abutilon		sp. indet	<2	0.20
Acacia	*citrinoviridis*		31 – 70	7.00
Amaranthus	*undulatus*		<2	0.10
Aristida	*holathera*	var. *holathera*	<2	0.30
Chrysopogon	*fallax*		<2	0.80
Cleome	*viscosa*		<2	0.30
Corchorus	*crozophorifolius*		<2	0.20
Duperreya	*commixta*		<2	0.50
Eremophila	*fraseri*		<2	0.60
Eriachne	*pulchella*	subsp. *dominii*	<2	0.10
Euphorbia	*australis*		<2	0.10
Euphorbia	*biconvexa*		<2	0.20
Euphorbia	*tannensis*	subsp. eremophila	<2	0.20
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.10
Indigofera	*monophylla*		<2	0.20
Senna	*artemisioides*	subsp. *helmsii*	<2	0.10
Solanum	*lasiophyllum*		<2	0.30

Site	Jimblebar Creek - Site JC10
Date	12/09/2014
Recorder	JB/DR
Photo	116-0717
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212609
Northing	7429113
Habitat	Upper Levee Bank Island
Slope	Low
Soil	Loamy Sand – Brown
Rock Type	
% Leaves:Logs	2-10: <2
Vegetation Condition	
Bare Ground	25%
Disturbance Type	Livestock; Weeds
Fire Age	Old (6+yrs0
Vegetation	Closed Tussock Grassland of **Cenchrus ciliaris* with High Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia citrinoviridis* over Scattered Low Shrubs of *Scaevola spinescens*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		<2	0.55
Acacia	*citrinoviridis*		<2	5.00
Acacia	*pachyacra*		<2	3.00
Acacia	*sclerosperma*	subsp. *sclerosperma*	2 – 10	2.50
Aristida	*holathera*	var. *holathera*	<2	0.50
Chrysopogon	*fallax*		<2	1.50
Corchorus	*crozophorifolius*		<2	1.00
Cullen	*leucanthum*		<2	1.50
Duperreya	*commixta*		<2	0.50
Eragrostis	*eriopoda*		<2	0.40
Eremophila	*longifolia*		<2	2.50
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.20
Scaevola	*spinescens*		<2	0.80
Senna	*glaucifolia*		<2	1.00
Senna	*artemisioides*	subsp. *helmsii x oligophylla*	<2	1.00
Solanum	*lasiophyllum*		<2	0.80
Triodia	*basedowii*		<2	1.00

Site	Jimblebar Creek - Site JC11
Date	12/09/2014
Recorder	JB/DR
Photo	116-0728
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212553
Northing	7430628
Habitat	Major Drainage Channel
Aspect	
Slope	Low
Soil	Sand – Brown
Rock Type	Mixed Chert/ Ironstone (cobbles, gravels)
% Leaves:Logs	2-10: 2-10
Bare Ground	20%
Vegetation Condition	Good
Disturbance Type	Livestock; Weeds; Camels; Flooding
Fire Age	Old (6+yrs)
Vegetation	Low Open Forest of *Acacia citrinoviridis, Acacia coriacea* subsp. *pendens* over Tussock Grassland of **Cenchrus ciliaris, Themeda triandra, Eulalia aurea* with High Open Shrubland of *Melaleuca glomerata*

Genus	Species	subsp. / var.	% Cover	Height
**Bidens*	*bipinnata*		<2	0.35
**Cenchrus*	*ciliaris*		11 – 30	0.60
Abutilon	*amplum*		<2	0.20
Acacia	*citrinoviridis*		31 – 70	7.00
Acacia	*coriacea*	subsp. *pendens*	<2	8.00
Acacia	*pyrifolia*	var. *pyrifolia*	<2	1.50
Alternanthera	*nodiflora*		<2	0.20
Aristida	*contorta*		<2	0.25
Aristida	*holathera*	var. *holathera*	<2	0.40
Centipeda	*minima*	subsp. *macrocephala*	<2	0.10
Cheilanthes	*sieberi*	subsp. *sieberi*	<2	0.20
Chrysopogon	*fallax*		2 – 10	1.50
Cleome	*viscosa*		<2	0.35
Corchorus	*crozophorifolius*		<2	0.80
Cyperus	*ixiocarpus*		<2	0.35
Eragrostis	*cumingii*		<2	0.30
Eragrostis	*polyphyllus*		<2	0.30
Eragrostis	*tenellula*		<2	0.20
Eucalyptus	*camaldulensis*	subsp. *refulgens*	<2	8.00
Eulalia	*aurea*		2 – 10	0.80
Euphorbia	*biconvexa*		<2	0.40
Euphorbia	*tannensis*	subsp. *eremophila*	<2	0.50
Evolvulus	*alsinoides*	var. *villosicalyx*	<2	0.20
Fimbristylis	*elegans*		<2	0.20
Glycine	*canescens*		<2	0.50
Goodenia	*lamprosperma*		<2	0.25
Grevillea	*wickhamii*		<2	1.00
Hybanthus	*aurantiacus*		<2	0.40
Ipomoea	*muelleri*		<2	0.50

Genus	Species	subsp. / var.	% Cover	Height
Ipomoea	*polymorpha*		<2	0.50
Ipomoea	*polymorpha*		<2	0.50
Melaleuca	*glomerata*		2 – 10	4.00
Oldenlandia	*galioides*		<2	0.20
Paspalidium	*rarum*		<2	0.20
Phyllanthus	*maderaspatensis*		<2	0.30
Pluchea	*dentex*		<2	0.30
Portulaca	*oleracea*		<2	0.10
Rostellularia	*adscendens*	var. *clementi*i	<2	0.25
Santalum	*lanceolatum*		<2	1.50
Setaria	*surgens*		<2	0.40
Sida		sp. spiciform panicles (E. Leyland s.n. 14/8/90)	<2	0.30
Stemodia	*viscosa*		<2	0.30
Themeda	*triandra*		2 – 10	1.00
Trichodesma	*zeylanicum*		<2	0.40
Triodia	*pungens*		2 – 10	1.00
Triumfetta	aff. *chaetocarpa*		<2	0.30
Waltheria	*indica*		<2	0.60
**Bidens*	*bipinnata*		<2	0.35

Site	Jimblebar Creek - Site JC12
Date	12/09/2014
Recorder	JB/DR
Photo	116-0736
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212039
Northing	7431649
Habitat	Loamy Sandplain
Aspect	
Slope	Low
Soil	Sandy Loam – Red
Rock Type	Ironstone; Quartz (pebbles)
% Leaves:Logs	<2: <2
Bare Ground	40%
Vegetation Condition	Excellent
Disturbance Type	
Fire Age	Old (6+yrs)
Vegetation	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Acacia pachyacra, Hakea lorea* subsp. l*orea* over Low Open Shrubland of *Solanum elatius, Eremophila forrestii* subsp. *forrestii, Acacia mellodora*

Genus	Species	subsp. / var.	% Cover	Height
Acacia	*aptaneura*		<2	1.70
Acacia	*citrinoviridis*		<2	2.00
Acacia	*melleodora*		<2	1.20
Acacia	*pachyacra*		<2	2.50
Anthobolus	*leptomerioides*		<2	1.00
Aristida	*contorta*		<2	0.25
Aristida	*holathera*	var. *holathera*	<2	0.40
Bonamia	*erecta*		<2	0.40
Corymbia	*hamersleyana*		<2	1.50
Cymbopogon	*obtectus*		<2	1.00
Dysphania	*kalpari*		<2	0.10
Eragrostis	*eriopoda*		<2	0.45
Eremophila	*forrestii*	subsp. *forrestii*	<2	0.80
Fimbristylis	*dichotoma*		<2	0.50
Hakea	*lorea*	subsp. *lorea*	<2	3.00
Paraneurachne	*muelleri*		2 – 10	0.40
Ptilotus	*astrolasius*		<2	0.40
Scaevola	*parvifolia*	subsp. *pilbarae*	<2	0.30
Senna	*artemisioides*	subsp. *oligophylla*	<2	0.50
Senna	*glutinosa*	subsp. *x luerssenii*	<2	0.60
Sida	*arenicola*		<2	0.50
Solanum	*elatius*		<2	0.50
Solanum	*lasiophyllum*		<2	0.50
Triodia	*basedowii*		31 – 70	0.80

Site	Jimblebar Creek - Site JC13
Date	12/09/2014
Recorder	JB/DR
Photo	116-0746
Shape/Size	50m x 50m
Datum	GDA 94
Zone	50K
Easting	212354
Northing	7432639
Habitat	Upper Floodplain Levy
Aspect	
Slope	Low
Soil	Sand – Red
Rock Type	
% Leaves:Logs	<2: <2
Bare Ground	25%
Vegetation Condition	Good
Disturbance Type	Weeds; Livestock
Fire Age	Old (6+yrs)
Vegetation	Tussock Grassland of **Cenchrus ciliaris, Eragrostis eriopoda*, *Aristida holathera* var. *holathera* over Open Hummock Grassland of *Triodia basedowii* with High Open Shrubland *Acacia sclerosperma* subsp. *sclerosperma*

Genus	Species	subsp. / var.	% Cover	Height
**Cenchrus*	*ciliaris*		31 – 70	0.60
Acacia	*adsurgens*		<2	2.50
Acacia	*citrinoviridis*		<2	3.50
Acacia	*pachyacra*		<2	2.50
Acacia	*sclerosperma*	subsp. *sclerosperma*	2 – 10	3.00
Adriana	*tomentosa*	var. *tomentosa*	<2	1.50
Aristida	*holathera*	var. *holathera*	2 – 10	0.45
Bonamia	*erecta*		<2	0.35
Chrysopogon	*fallax*		<2	1.50
Clerodendrum	*tomentosum*	var. *lanceolatum*	<2	1.80
Corymbia	*hamersleyana*		<2	3.50
Cymbopogon	*obtectus*		<2	1.00
Eragrostis	*eriopoda*		2 – 10	0.50
Eremophila	*longifolia*		<2	1.50
Grevillea	*juncifolia*	subsp. *juncifolia*		
Grevillea	*wickhamii*		<2	3.00
Hakea	*lorea*	subsp. *lorea*	<2	2.50
Paraneurachne	*muelleri*		<2	0.40
Ptilotus	*obovatus*		<2	1.00
Scaevola	*parvifolia*	subsp. *pilbarae*	<2	0.30
Senna	*artemisioides*	subsp. *helmsi*i	<2	0.80
Sida		sp. indet	<2	0.20
Solanum	*lasiophyllum*		<2	0.50
Stylobasium	*spathulatum*		<2	2.50
Triodia	*basedowii*		11 – 30	1.00
Triodia	*pungens*		<2	1.50