Mainline Rail Expansion

Level 2 Flora and Vegetation Survey

Prepared for BHP Billiton Iron Ore Pty Ltd
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Onshore Environmental Consultants Pty Ltd
ACN 095 837 120
PO Box 227
YALLINGUP WA 6282
Telephone / Fax (08) 9756 6206
E-mail: onshoreenv@westnet.com.au

Executive Summary

In August 2011 BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) commissioned Onshore Environmental Consultants Pty Ltd (Onshore Environmental) to undertake a Level 2 flora and vegetation survey of the Mainline Rail Expansion study area (the study area). The study area follows the existing BHP Billiton Iron Ore Mainline Rail from Yandi Junction north to Port Hedland covering a distance of approximately 270 km and extending 1 km either side of the existing track. The total area of the study area approximates 540 km^2.

The aim of the flora and vegetation survey was to obtain baseline data on the flora and vegetation present. A literature review of all previous publically available flora and vegetation surveys within the study area was undertaken, followed by four field trips over two seasons to review and further document flora and vegetation. Vegetation association mapping and targeted significant flora searches were completed across the entire study area.

A total number of 706 plant taxa (including varieties and subspecies) from 67 families and 229 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Poaceae, Malvaceae, Amaranthaceae, Chenopodiaceae, Asteraceae, Convolvulaceae, Cyperaceae and Goodeniaceae families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (58 taxa), followed by *Ptilotus* (19 taxa), *Sida* (18 taxa), *Eriachne* (16 taxa), *Corchorus* (16 taxa), *Senna* (16 taxa), *Hibiscus* (15 taxa), *Tephrosia* (13 taxa) and *Eragrostis* (12 taxa).

No plant taxon gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the WC Act or listed under the EPBC Act was recorded from the study area. There were 16 currently listed Priority flora species recorded from a total of 175 point locations distributed across the entire extent of the study area. The Priority flora included six Priority 1 taxa, one Priority 2 taxa, six Priority 3 taxa, and three Priority 4 taxa:

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) P1
- *Acacia levata* P3
- *Bonamia* aff. *oblongifolia* P1
- *Bulbostylis burbidgeae* P4
- *Eremophila spongiocarpa* P1
- *Eremophila youngii* subsp. *lepidota* P4
- *Euphorbia clementii* P2
- *Euphorbia stevenii* P3
- *Fimbristylis sieberiana* P3
- *Goodenia nuda* P4
- *Gymnanthera cunninghamii* P3
- *Heliotropium muticum* P1
- *Pterocaulon* cf. *xenicum* P3
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063) P1
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) P1
- *Themeda* sp. Hamersley Station (M.E Trudgen 11431) P3

A total of 16 introduced (weed) species were recorded from the study area; one taxon was listed as a Declared Pest under the *Biosecurity and Agriculture Management Act (2007)* (BAM Act), **Calotropis procera.*

There were 73 vegetation associations described and mapped within the study area. These were classified into 25 Broad Floristic Formations on the basis of the dominant vegetation stratum:

1 *Acacia* Low Closed Woodland
2 *Acacia* Low Open Forest
3 *Melaleuca* Low Woodland
4 *Eucalyptus* Low Woodland
5 *Corymbia* Low Woodland
6 *Acacia* Low Woodland
7 *Eucalyptus* Low Open Woodland
8 *Acacia* Low Open Woodland
9 *Acacia* Open Scrub
10 *Acacia* High Shrubland
11 *Acacia* High Open Shrubland
12 *Acacia* Low Open Heath
13 *Tecticornia* Low Open Heath
14 *Pluchea* Low Shrubland
15 *Maireana* Low Open Shrubland
16 *Triodia* Closed Hummock Grassland
17 *Triodia* Hummock Grassland
18 *Triodia* Open Hummock Grassland
19 *Cenchrus* Closed Tussock Grassland
20 *Astrebla/Eragrostis* Tussock Grassland
21 *Cenchrus* Tussock Grassland
22 *Eriachne* Tussock Grassland
23 Chrysopogon Open Tussock Grassland
24 *Eriachne* Open Tussock Grassland
25 *Eulalia* Open Tussock Grassland

Vegetation condition for the majority of vegetation associations within the study area was rated as 'Very Good' (57%), with a smaller proportion rated as 'Very Good to Excellent' (23%) or 'Good to Degraded' (20%). The most widespread disturbance recorded was related to grazing by domestic cattle and the introduction of weeds. The spread of weeds was facilitated by the existing Mainline Rail and adjacent service roads.

None of the plant taxa recorded from the study area are listed under the EPBC Act, and none of the vegetation associations described and mapped are affiliated with any known Commonwealth listed TECs. However, the Fortescue Marsh is listed as a Wetland of National Significance and is also on the Register of the National Estate. The Fortescue Marsh and associated vegetation associations (13 and 16a) are therefore considered to be of Commonwealth significance.

The field survey confirmed that none of the vegetation associations recorded within the study area were affiliated with any known State listed TECs from the Pilbara.

There were five PECs identified within a 90 km radius of the study area, and vegetation associations mapped within the study area were affiliated with three of these PECs, all located at the southern extent of the study area:

1. The western fringe of the Fortescue Marsh PEC (Priority 1) was affiliated with Vegetation associations 13 and 16a.
2. The Priority 1 PEC 'Freshwater claypans of the Fortescue Valley' was mapped and described as Vegetation association 7. A second vegetation association, 'Mosaic 1' was closely affiliated with both the above Priority 1 PECs and is likely to be of conservation significance.
3. A sub-type of the PEC 'Four plant assemblages of the Wona Land System' described as 'Mitchell Grass *(Astrebla* spp.) on gilgai' (Priority 3iii) was described and mapped as Vegetation association 20.

Vegetation associations 7, Mosaic 1, 13, 16a and 20 are therefore considered to be of State significance.

The following vegetation associations were determined to be of local significance owing to their restricted distribution, specific habitat type, and/or support of conservation significant plant taxa:

1. Vegetation associated with granite plateaux, rock piles and sheet outcrops often supporting the Priority 4 flora *Bulbostylis burbidgeae* – Vegetation associations 11, 17v, 18c, M5 and M6.
2. Vegetation occurring along major drainage lines and rivers with deeply incised drainage channels including major tributaries of Turner River and Yule River – Vegetation association 3.
3. Vegetation associated with crusting and cracking clay plains – Vegetation associations 14 and 22b.
4. Vegetation associated with calcrete plains fringing the larger drainage lines – Vegetation association 17l.
5. Vegetation occurring on undulating low hills above the western fringe of Fortescue Marsh, defined by a distinctive rocky dolerite and silcrete surface and dominance of the mid shrub *Acacia arrecta* – Vegetation association 17a.
6. Vegetation occurring on sandplains situated at the northern extent (Port Hedland end) of the study area – Vegetation associations 12b and 18e.
7. Vegetation associated with dolerite hills and ridges - Vegetation associations 17q, 17r and 17u.

Vegetation associations 3, 11, 12b, 14, 17a, 17l, 17q, 17r, 17u, 17v, 18c, 18e, 22b, M5 and M6 are therefore considered of local significance.

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1.1 Preamble

In response to increased volumes of iron ore being mined from operations located in the Central and Eastern Pilbara region of Western Australia, BHP Billiton Iron Ore are proposing to duplicate their existing Mainline Rail which extends approximately 270 km north from Yandi Junction to the town of Port Hedland (Figure 1).

To allow for appropriate environmental impact assessment to be completed for the project, Onshore Environmental was commissioned to undertake a two-season Level 2 flora and vegetation survey of the study area. The linear infrastructure area surveyed by Onshore Environmental included 1 km either side of the existing rail line (total study area approximating 540 km^2).

1.2 Previous Surveys

The literature review identified 32 previous flora and vegetation surveys that had been completed at least partially within the study area. The previous surveys were classified into several groups based on where they occurred in relation to the existing rail line. There were a number of additional previous surveys described from nearby areas occurring outside the study area.

Port Hedland to Yandi Junction

The following 32 flora and vegetation surveys have been completed within, or partially within, the study area extending between Port Hedland and Yandi Junction:

- Biota Environmental Services (2002) Hope Downs Rail Corridor Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey;
- Biota Environmental Services (2004) Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor;
- Ecologia Environment (2009a) BHPBIO RPG5 Nelson Point to Bing Siding Vegetation and Flora Report;
- Shepherd K.A. (2009) Targeted survey of Tecticornia (Chenopodiaceae) in the Nelson Point to Bing Siding Rail Duplication Project Area, Port Hedland;
- ENV Australia (2009a) Goldsworthy Rail Duplication Flora and Vegetation Assessment;
- ENV Australia (2010a) Goldsworthy Rail Duplication Flora and Fauna Desktop Assessment Supplement;
- ENV Australia (2010b) Wallwork Road Bridge Flora and Vegetation Assessment;
- Ecologia Environment (2004a) BHPB Ongoing Works Tabba, Turner and Woodstock Sidings;
- Ecologia Environment (2004b) Rapid Growth Project Rail Rare and Priority Flora Survey;
- Ecologia Environment (2004c) BHPIO RGP2 Great Northern Hwy to Bing Siding, Goldsworthy Junction, Boodarie Siding Declared Rare and Priority Flora and Weed Assessment;
- Ecologia Environment (2008a) RGP5 Walla to Bing Sidings and Repeater One Flora and Vegetation Report;

- Ecologia Environment (2008b) RGP5 Quarry One Flora and Vegetation Report;
- Ecologia Environment (2003) Railroad Interim Expansion Project Rare and Priority Flora Survey;
- ENV Australia (2007a) Turner River Bridge Extension Chainage 98.8-110.9 km Declared Rare and Priority Flora, And Introduced Species Survey;
- Ecologia Environment (2004d) BHPBIO On-going Works Rail Development Project- Turner River Bridge;
- ENV Australia (2008a) Turner River Camp Flora and Vegetation Assessment
- Ecologia Environment (2008c) RGP5 Walla Siding to Turner Camp and Repeater Two Flora and Vegetation Report;
- Ecologia Environment (2008d) RGP5 Quarry Two Flora and Vegetation Report;
- Ecologia Environment (2008e) BHPBIO RGP5 Turner Camp to Spring Siding and Repeaters Three and Four Flora and Vegetation Report;
- ENV Australia (2008b) Yandee Line Camp Redevelopment Declared Rare and Priority Flora, and Weed Survey;
- Ecologia Environment (2009b) BHPBIO RGP5 Quarry Three Lease Vegetation and Flora Report;
- Ecologia Environment (2008f) BHPBIO RPG5 Quarry Four Lease Flora and Vegetation Report;
- Ecologia Environment (2008g) RPG5: Redmont Camp Extension Flora and Vegetation Survey;
- ENV Australia (2007b) Quarry 8 Expansion- Declared Rare and Priority Flora and Weed Survey;
- Ecologia Environment (2008h) RGP5 Quarry 8 Drainage Area Flora and Vegetation Report;
- Ecologia Environment (2008i) BHPBIO RGP5 Chichester Deviation Vegetation and Flora Report;
- Ecologia Environment (2010) BHPBIO RGP5 Chichester Deviation Baseline Weed Survey;
- Syrinx Environmental (2010) Chichester Deviation Baseline Mulga (Acacia aneura) Monitoring Event;
- Ecologia Environment (2008j) BHPBIO RGP5 Spring Siding to Hesta Siding and Repeater Five Flora and Vegetation Report;
- Ecologia Environment (2008k) BHPBIO RGP5 Hesta Siding to Cowra Siding Vegetation and Flora Report;
- ENV Australia (2008c) RGP5: Eremophila spongiocarpa Search; and
- Ecologia Environment (2007) BHPBIO RGP5 Cowra to Kurrajurra Sidings and Cowra Camp Site Flora and Vegetation Survey.

Goldsworthy Rail Line

The Goldsworthy Rail extends east from the northern limit of the study area (south of Port Hedland) to BHP Billiton Iron Ore's Yarrie Mine. There has been one previous flora and vegetation survey completed along this infrastructure corridor:

- Ecologia Environment (2011) BHPBIO Rail Operations Biodiversity- Flora Survey Goldsworthy Junction to Yarrie.

Yandi Junction to Yandi (Marillana) Mine

The Yandi Junction to Yandi (Marillana) Mine rail spur links BHP Billiton Iron Ore's Marillana Mine, situated to the south, to the study area. Two previous surveys have been completed along this section of the rail.

- Ecologia Environment (2008l) RGP5 Borrow Areas (Yandi to Kurrajura Siding) –Targeted Rare and Priority Flora Survey; and
- Ecologia Environment (2008m) RGP5 Yandi to Kurrajura Siding and Yandi Repeater One Flora and Vegetation Report.

INDIAN OCEAN

POINT SAMSON

PORT HEDLAND

MARBLE BAR

TOM PRICE

NEWMAN

GREAT NORTHERN HIGHWAY

GOLDSWORTHY SHAY GAP ROAD

MUCCAN SHAY GAP RD

WOODIE WOODIE RD

DE GREY RIVER

PIPPINGARRA ROAD

PORT HEDLAND WITTENOOM ROAD

MARBLE BAR ROAD

NORTH WEST COASTAL HIGHWAY

ROEBOURNE WITTENOOM ROAD

NANUTARRA WITTENOOM ROAD

MUNJINA WITTENOOM ROAD

YULE RIVER

FORTESCUE RIVER

KARIJINI DRIVE

MUNJINA ROY HILL ROAD

SPEARHOLE CREEK

WESTERN CREEK

Pardoo (Atlas)

Yarrie

Spinifex Ridge - hematite

Wodgina (Atlas)

Whim Creek

Whim Creek

Nullagine (BC Iron JV FMG)

Cloudbreak

Christmas Creek

Nammuldi

Brockman No 2

Brockman No 4

Western Turner Syncline

Marandoo

BHPBYandi

Yandicoogina-Junction (Rio Tinto-HIYandi)

Mining Area C

Hope Downs

West Angelas

Mount Newman (Mount Whaleback)

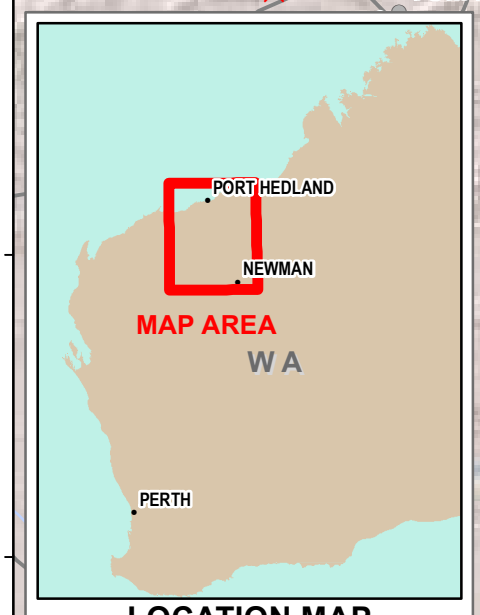
Orebody 23

Jimblebar

Coobina

550000 600000 650000 700000 750000 800000 850000

7800000 7750000 7700000 7650000 7600000 7550000 7500000 7450000 7400000



LOCATION MAP

GRIFFIN SPATIAL & MAPPING
PO Box 7215
EATON WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

BHPBIO MAINLINE

LOCATION MAP

0 5 10 20 30 40 50
Kilometers

1:1,250,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

Figure:	1	Date:	21/10/2013
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Legend

- 1km Rail Buffer
- Operating Mines
- Watercourses
- Roads

N

1.3 Climate

The climate of the Central Pilbara is arid-tropical with hot summers extending from October to April and mild winters from May to September. The climate is dry and rainfall is variable and unreliable. Rainfall occurs in both summer and winter months with the major falls received during summer months. Cyclones that develop over the Indian Ocean and then move inland bring heavy summer rainfall, especially from January to March. Winter rainfall is generally lighter and typically associated with cold fronts extending from southern parts into the Pilbara region. Annual average rainfall for the Pilbara ranges from 189 mm to over 400 mm (Beard 1975) with a long-term average of 318.8 mm for Newman and 317.6 mm for Port Hedland (Bureau of Meteorology (BOM) 2012a, 2012b).

Average maximum summer temperatures are typically between 35°C to 40°C and winter maximum temperature ranges from 22°C and 30°C. Summer temperatures can reach 49°C with frosts occasionally occurring inland during winter months. The prevailing wind direction for Newman is east south-east between May and August, with stronger west-north-west winds dominant between September and March. The prevailing wind directions for Port Hedland are east and south-east.

Above average rainfall was received at BHP Billiton Iron Ore's Yandi monitoring station throughout the summer of 2010/2011 (Figure 2a). Below average rainfall was received during August, September, October and December of 2011 (BHP Billiton Iron Ore 2012). The total rainfall for 2011 was 486.2 mm, which is well above the long term average of 318.8 mm for Newman (Bureau of Meteorology 2012a). Above average rainfall was also received in January and March 2012 at Yandi (BHP Billiton Iron Ore 2012).

Port Hedland also received above average rainfall during 2011 with a total of 551.8 mm compared to a long term average of 317.6 mm (Figure 2b). The above average falls were received during January, February, May, July and November 2011. Above average rainfall was also received in January and March 2012 (Bureau of Meteorology 2012b).

The four field trips took place between October and December 2011, March 2012 and April 2012. Seasonal conditions were rated as 'good' during late 2011 and 'very good' in early 2012.

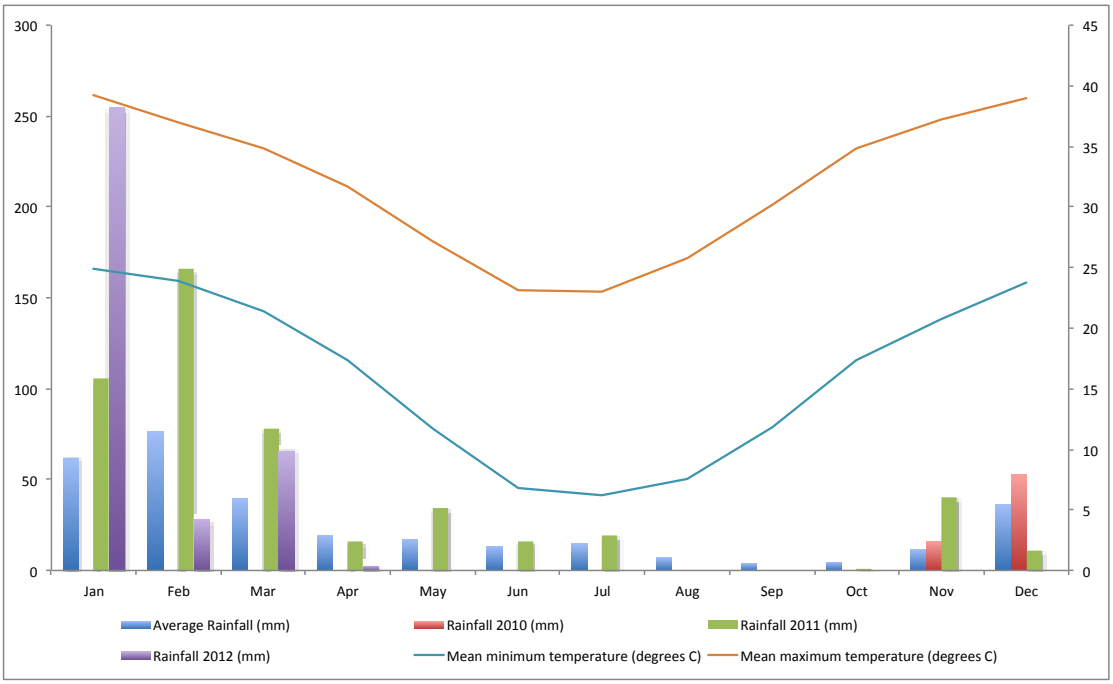


Figure 2a **Rainfall and climatic data recorded from BHPBIO's Yandi Monitoring Station (BHPBIO 2012) between October 2010 and April 2012. Long term rainfall and climate data is from Newman Airport (Bureau of Meteorology 2012a).**

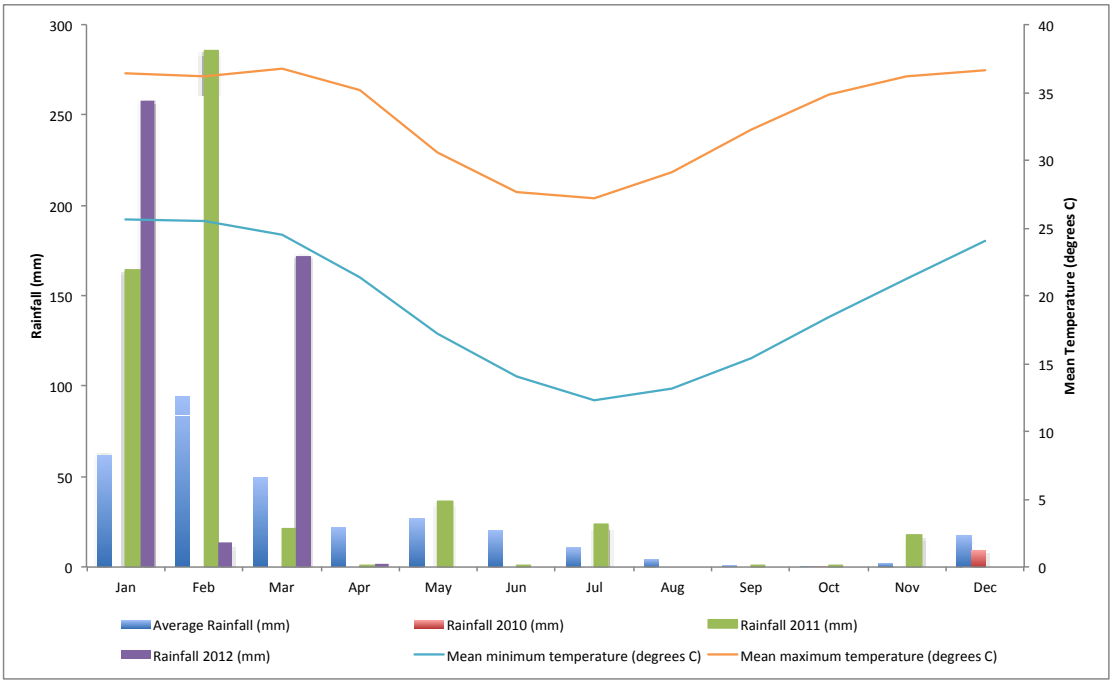


Figure 2b **Rainfall and climatic data recorded at Port Hedland Airport between October 2010 and April 2012(Bureau of Meteorology 2012b).**

1.4 Biogeographic Regions

The Interim Biogeographic Regionalisation for Australia (IBRA) describes a system of 85 'biogeographic regions' (bioregions) and 403 subregions covering the entire Australian continent (Thackway and Cresswell 1995). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna. The study area dissects the Pilbara bioregion from north to south running through each of the four subregions. The southern most subregion is the Hamersley subregion (PIL3) (Thackaway and Cresswell 1995), which is located in the southern section of the Pilbara Craton (Kendrick 2001). The PIL3 subregion is 6,215,095 hectares (ha) in size and described as mountainous areas of proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). The Hamersley subregion consists of rounded hills and ranges made up of jaspilite and dolomite with some shale, siltstone and volcanics. The valleys support Mulga low woodland over bunch grasses on fine textured soils while the hills are dominated by *Eucalyptus leucophloia* (Snappy Gum) over *Triodia brizoides* Hummock Grasses on skeletal sandy soils. Drainage flows into the Fortescue to the north, the Ashburton to the south, or the Robe to the west (Kendrick 2001, Beard 1975).

Further north the study area passes through the Fortescue Plains subregion (PIL2) described as alluvial plains and river frontage with extensive salt marsh, mulga-bunch grass and short grass communities. This area is the northern limit of Mulga (*Acacia anerua*) and contains large permanent wetlands and drainage lines fringed with River Red Gum (*Eucalyptus camaldulensis*) and Cadjeput (*Melaleuca argentea);* drainage flows to the north-west. The subregion contains the Fortescue Marsh, an extensive periodically inundated samphire marsh. The area of this subregion is 2,041,914 ha (Kendrick 2001).

The Chichester subregion forms the northern section of the Pilbara Craton and is characterised by undulating Archean granite and basalt plains and large areas of basalt ranges. Basalt ranges support *Eucalyptus leucophloia,* while a shrub steepe typically consisting of *Acacia inaequilatera* over *Triodia wiseana* occurs on the plains. The sub-regional area is 9,044,560 ha with drainage flowing to the north via rivers such as the De Grey, Oakover and Nullagine (Kendrick 2001).

Closer to the coast the study area runs through the Roebourne synopsis (PIL4). The area is described as quaternary alluvial and older colluvial coastal and sub-coastal plains. The vegetation is a grass savannah of bunch and hummock grasses with a dwarf shrub steepe of *Acacia stellaticeps, Acacia pyrifolia* and *Acacia inaequilatera.* Higher areas in the landscape support *Triodia* Hummock Grasslands, while ephemeral drainage lines contain *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Marine alluvial flats and river deltas support samphire (*Tecticornia*) and mangroves. The coastal plains have resistant linear ranges of basalts with some minor exposures of granite. This subregion is affected by cyclonic activity and has a subregional area of 2,008,983 ha (Kendrick 2001).

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 fall under a range of pastoral and mining leases. The dominant types of land use in the Pilbara are pastoralism (cattle grazing), mining, conservation (and associated tourism), unallocated Crown land, Crown reserves and urban areas (Kendrick 2001).

1.5.1 Pastoral

The pastoral industry in the Pilbara has become increasingly reliant on overseas export of live cattle through Port Hedland, with a progressive decline in sheep numbers (van Vreeswyk *et al* 2004). Many of the pastoral leases in the Pilbara are held by mining companies to ensure security of access to land adjacent to mines and infrastructure. The study area runs through a number of pastoral leases including Marillana, Mulga Downs, Yandeyarra, Woodstock, Abydos, Kangan, Wallareenya and Pippingarra.

1.5.2 Mining

The first mining exploration in the Pilbara commenced in the early 1800's and currently the Pilbara region provides the majority of WA's petroleum, gas and iron ore export, while gold mining is also an important industry (ANRA 2008). Manganese, asbestos and tin have also previously been mined in the Pilbara area. Salt is currently mined in the Pilbara at Port Hedland and Dampier.

Development of iron ore deposits was accelerated in the 1960's after the Commonwealth lifted the export embargo on iron ore. The iron ore industry in the region has historically focused on the exploitation of high grade (65-66% Fe) Brockman ores, but more recently there has been exploration and mining of pisolitic channel iron deposits and Marra Mamba ore. A number of existing mines are located in close proximity to the study area including Rio Tinto's Yandicoogina, Hope Downs and West Angelas operations and BHP Billiton Iron Ore's Yandi (Marillana) and Mining Area C operations. The Mainline Rail transports ore from all of BHP Billiton Iron Ore's mines in the Central and Eastern Pilbara.

1.5.3 Tourism

Besides mining and pastoral activities, tourism provides the only other significant economic driver in the Central Pilbara. The tourism industry is small but developing rapidly, with Karijini National Park and other conservation reserves being the primary tourism focus. The Hamersley sub-region has 14.1% of its total area reserved under some form of conservation, including the majority of Karijini National Park (Kendrick 2001).

1.6 Soils

The soils of the Pilbara Region have been defined and mapped at a scale of 1:2,000,000 by Bettanay *et al.* (1967). The study area is mainly covered by coherent and porous loam soils with weak pedologic development. This soil type is most commonly present in areas of Spinifex steppe with *Eucalyptus leucophloia*.

Tille (2006) collated 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 falls within the Fortescue Province, an area that occupies approximately 160,050 km^2 (6.3% of Western Australia) and includes the towns of Port Hedland, Karratha, Dampier, Roebourne, Newman, Tom Price, Paraburdoo, Pannawonica, Marble Bar, Nullagine and Jigalong. Soils and landform for the Fortescue Province are described as "Hills and ranges (with stony plains and some alluvial plains and sandplains) on the volcanic, granitic and sedimentary rocks of the Pilbara Craton. Stony soils with red loamy earths and red shallow loams (and some red/brown non-cracking clays, red deep sandy duplexes and red deep sands)" (Tille 2006). The Fortescue Province is divided into ten soil-landscape zones:

- Nullagine Hills Zone;
- De Grey-Roebourne Lowlands Zone;
- Chichester Ranges Zone;
- Abydos Plains and Hills Zone;
- Fortescue Valley Zone;
- Hamersley Plateaux Zone;
- Karratha Coast Zone;
- Warrawagine Hills Zone;
- Jigalong Plains Zone; and
- Harding Hills and Plains Zone.

The study area passes through seven of the zones; Nullagine Hills, De Grey-Roebourne Lowlands, Chichester Ranges, Abydos Plains and Hills, Fortescue Valley, Hamersley Plateaux, and the Karratha Coast. The features of these soil-landscape areas are described in Table 1.

Table 1 Soil landscape zones within the study area (Tille 2006).

Zone	Area	Description
Nullagine Hills Zone	17,650 km^2	Hills and ranges (with some stony plains) on volcanic and sedimentary rocks of the Pilbara Craton (including the Hamersley Basin). Stony soils with red shallow loams and sands. Spinifex grasslands with kanji (*Acacia inaequilatera*) and snappy gum (*Eucalyptus leucophloia*). Located in the north-eastern Pilbara around Marble Bar and Nullagine.
De Grey-Roebourne Lowlands Zone	19,350 km^2	Alluvial plains and sandplains (and some floodplains and stony plains) on alluvial and marine deposits over rocks of the northern Pilbara Craton. Red deep sandy duplexes with red loamy earths and some red/brown non- cracking clays, Cracking clays, red sandy earths and red deep loamy duplexes. Spinifex grasslands with kanji and tussock grasslands. Located in the northern Pilbara between Karratha and the De Grey River.
Chichester Ranges Zone	18,300 km^2	Hills and dissected plateaux (with some stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Stony soils with some red shallow loams and hard cracking clays. Spinifex grasslands with kanji and snappy gum (and some tussock grasslands). Located in the northern Pilbara between Pannawonica and Nullagine.
Abydos Plains and Hills Zone	15,900 km^2	Stony plains (with some hills) on granitic rocks of the Pilbara Craton (East Pilbara Terrane). Red deep sandy duplexes and red shallow loams with stony soils, red sandy earths and red loamy earths. Spinifex grasslands with kanji (and some tussock grasslands). Located in the northern Pilbara between Yandeyarra Community, Bamboo Springs Station and Marble Bar.
Fortescue Valley Zone	15,300 km^2	Alluvial plains, hardpan wash plains and sandplains (with stony plains, floodplains and some salt lakes) on alluvial deposits over sedimentary rocks of the Hamersley Basin. Red deep sands, red loamy earths and red/brown non-cracking clays with some red shallow loams and hard cracking clays. Mulga shrublands and spinifex grasslands (with some tussock grasslands and halophytic shrublands). Located in the Pilbara along the Fortescue River between Millstream National Park and Ethel Creek Station.

Zone	Area	Description
Hamersley Plateaux Zone	44,450 km^2	Hills and dissected plateaux (with some stony plains and hardpan wash plains) on sedimentary and volcanic rocks of the Hamersley Basin (Opthalmia Fold Belt). Stony soils with red shallow loams and some red/brown non-cracking clays and red loamy earths. Spinifex grasslands with snappy gum and kanji (and some mulga (*Acacia aneura*) shrublands). Located in the Pilbara between Pannawonica, Newman and Paraburdoo.
Karratha Coast Zone	2,150 km^2	Coastal mudflats (with sandy coastal plains and some hills) on marine deposits (and some sedimentary and volcanic rocks of the Pilbara Craton). Tidal soils with some calcareous loamy earths, salt lake soils and red/brown non-cracking clays. Bare mudflats (with some spinifex, tussock grasses, samphire and mangroves). Located along the Pilbara coast between Cape Preston and the De Grey River.

1.7 Geology

The ancient continental Western Shield dominates the geology of Western Australia. The Pilbara region makes up a portion of the Western Shield and consists of pre-Cambrian, Proterozoic and Archaean rocks. The area contains some of the earth's oldest rock formations, thought to be around 3.5 billion years old (ANRA 2008). Important mineral reserves, including iron ore, which is prevalent in the Pilbara, are associated with these rock formations.

The Pilbara Craton lies beneath the Proterozoic rocks of the Hamersley and Bangemall Basins. The Hamersley Basin covers the majority of the southern part of the Pilbara Craton and is separated into three stratigraphic groups; the Fortescue, Hamersley and Turee Creek rock groups.

The Fortescue Group consists mainly of basalt with beds of siltstone, mudstone, shale, dolomite and jaspilite. These rocks form the Chichester Plateau, which lies beneath the Hamersley Plateau. The Turee Creek Group consists of interbedded mudstone, siltstone, sandstone, conglomerate and carbonate. These rocks are the youngest of the three groups and are exposed mainly in the Ashburton Valley.

The Hamersley Group is the most relevant to the study area as it contains both the Brockman Iron Formation and the Marra Mamba Iron Formation, which together provide most of the major iron ore deposits in the Pilbara (O'Brien and Associates 1992). This group forms the Hamersley Range and Plateau and consists of jaspilite and dolomite. The jaspilite produces deposits of haematite and limonite, which are mined for iron ore.

The north of the Pilbara is dominated by the Archean rocks of the East and West Pilbara Granite-Greenstone Terranes. Included in this are granitoid rocks, basic and ultranasic volcanic rocks and acidic volcanic rocks. Also in this area are the Archean shale, siltstone and wacke and granitic intrusions of the Mallina Basin, the Archaean greywacke of the Mosquito Creek Basin and the late Archaean-Palaeoproterozoic basalt and sandstone of the Marble Bar sub-basin. The Fortescue Valley and other drainage lines contain tertiary calcrete and ferruginous pisolite deposits. Coastal areas have quaternary alluvial and aeolian deposits (Tille 2006).

1.8 Flora and Vegetation

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

Historical systematic flora surveys of the Pilbara are limited to work completed by Burbridge (1959) and Beard (1975), and further refining of the original Beard mapping by Shepherd *et al.* (2002).

Beard (1975) identified four major physiographic units within the section of the Fortescue District encompassing the study area:

1. Abydos Plain - extending from Cape Preston east to Pardoo Creek and south to the Chichester Range this unit comprises granitic soils with alluvial sands on low stony hills and granite outcrops;
2. Chichester Plateau - a plateau of mainly basalts but also including siltstone, mudstone, shale, dolomite and jaspilite. This unit forms a watershed between numerous rivers flowing north through the Abydos Plain to the coast, and the Fortescue drainage on the southern side of the range;
3. Fortescue Valley – this unit occupies a trough between the Chichester and Hamersley Plateaux. The eastern portion drains into the Fortescue Marsh while the western portion drains through the Chichester Plateau;
4. Hamersley Plateau - rounded hills and ranges, mainly of jaspilite and dolomite with some shale, siltstone and volcanic.

The original vegetation mapping of the Pilbara undertaken by Beard (1975) at a scale of 1:1,000,000 was refined by Shepherd *et al.* (2002), with twelve vegetation associations described within the study Area (Figure 3). While the Pre-European extent for each vegetation association exceeds 99%, the area protected within formal reserves for each unit is typically very low (Table 2).

Table 2 Pre-European extent of vegetation associations occurring within the study area (Shepherd *et al.* 2002).

Vegetation Sub-Association	Description	Pre-Euro. Extent (ha)	Current. Extent (ha)	% Remaining	% Current Extent Protected
Abydos Plain – Chichester 619	Medium woodland; river gum (E. camaldulensis)	70,655.35	70,633.15	99.97	0.33
Abydos Plain – Chichester 647	Hummock grasslands, dwarf-shrub steppe; Acacia translucens over soft spinifex	6,933.41	6,911.00	99.68	0.32
Abydos Plain – Chichester 93	Hummock grasslands, shrub steppe; kanji over soft spinifex	2,476,893.88	2,473,523.35	99.86	0.66
Abydos Plain 589	Mosaic: Short bunch grassland - savanna / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex soft spinifex	3,310.96	3293.12	99.46	6.81

Vegetation Sub-Association	Description	Pre-Euro. Extent (ha)	Current. Extent (ha)	% Remaining	% Current Extent Protected
Abydos Plain 647	Hummock grasslands, dwarf-shrub steppe; Acacia translucens over soft spinifex	25.22	25.22	100.00	0.00
Chichester Plateau 173	Hummock grasslands, shrub steppe; kanji over soft spinifex & T. wiseana on basalt	1,122,547.27	1,121,471.72	99.90	11.78
Chichester Plateau 175	Short bunch grassland - savanna/grass plain (Pilbara)	139,661.79	139,640.31	99.98	15.90
Fortescue Valley 29	Sparse low woodland; mulga, discontinuous in scattered groups	872485.65	872316.44	99.98	0.28
Fortescue Valley 111	Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex	430,134.57	430,080.03	99.99	1.60
Fortescue Valley 157	Hummock grasslands, grass steppe; hard spinifex Triodia wiseana	12,176.56	12173.37	99.97	0.03
Fortescue Valley 562	Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over T. wiseana	9,9721.08	9,9721.08	100.00	0.00
Fortescue Valley 676	Succulent steppe; samphire	8,1984.09	8,1976.20	99.99	0.01

A comprehensive and systematic field review of the entire Pilbara's regional flora, fauna and aquatic life and ecosystems is currently in preparation by the Department of Parks and Wildlife (DPaW). The survey has included 800 study sites distributed across the entire Pilbara region between 2002 and 2007.

The resources boom in the Pilbara over the past decade has resulted in a significant number of site-specific biological surveys being completed as part of the formal environmental approvals process. Since 1991 there have been at least 50 flora and vegetation assessments completed within and in close proximity to the study area (described in more detail in Section 3.1.1).

1.9 Land Systems

The Department of Agriculture 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.

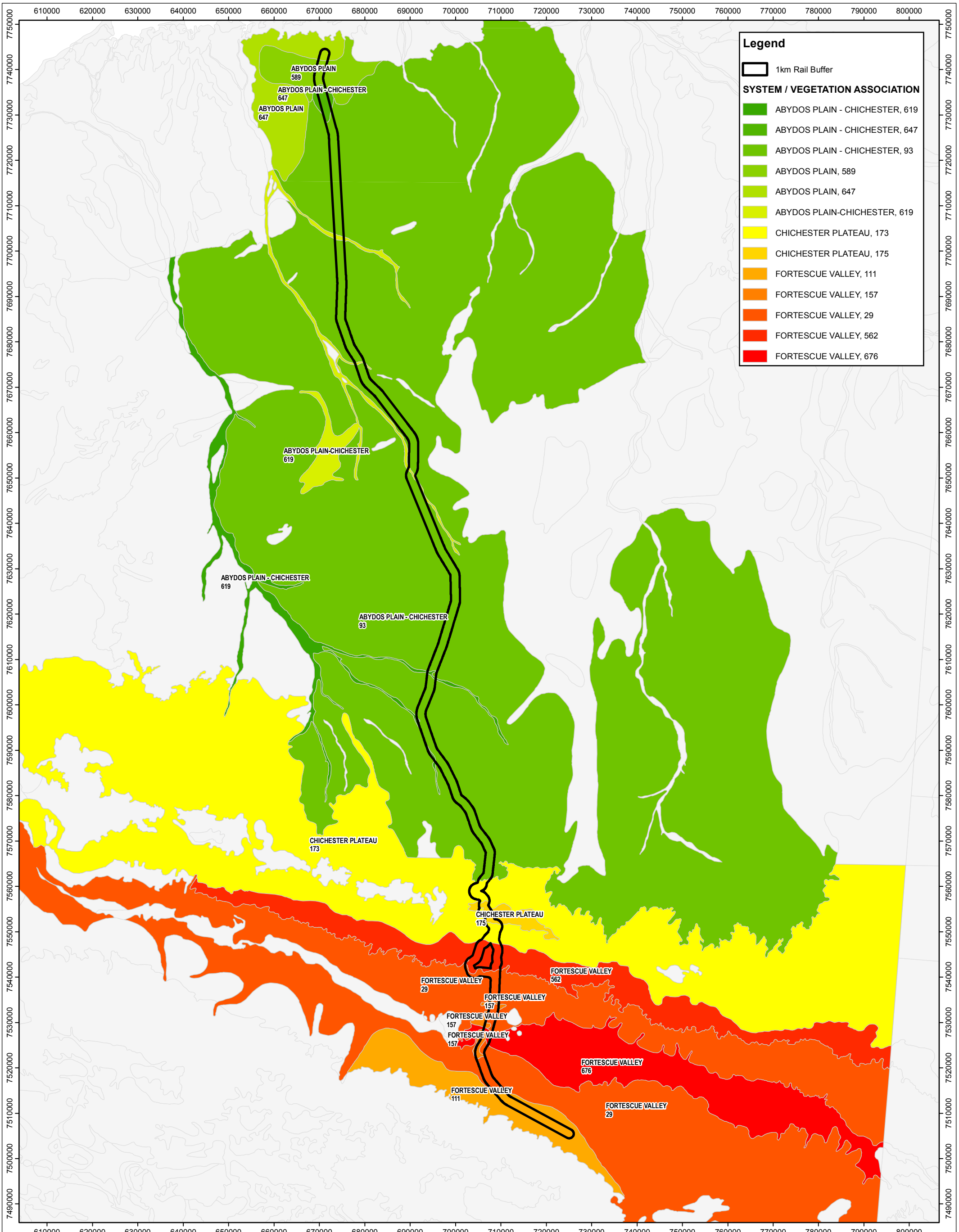
A total of 102 land systems were defined in the Pilbara at scale of 1:250,000 (van Vreeswyk *et al*. 2004), with 24 land systems occurring within the study area (Table

3, Figure 4). The dominant land systems represented at the southern extent of the study area are associated with stony alluvial and hardpan plains (Christmas, Jamindie and Boolgeeda Land Systems) and the saline clay flats of the Fortescue Marsh (Marsh Land System). All of these systems are situated at low points in the landscape. Moving north along the alignment elevation increases around the Chichester Rail Deviation where hills and ranges associated with the Newman, Capricorn and McKay Land Systems are encountered; this section also includes basalt upland gilgai plains of the Wona Land System, not represented at any other point within the study area. Stony plains and occasional granite tor fields of the Macroy Land System dominate the major length of the study area further north, dissected by major drainage lines of the River land System. The Uaroo Land System occurs at the northern extent of the study area defined by broad sandy plains.

Table 3 Land Systems occurring within the study area (descriptions from van Vreeswyk *et al.* 2004).

Land System Code	Land System	Representation in the Pilbara	Description
RGEADR	Adrian	235 km^2 or 0.1%	Stony plains and low silcrete hills supporting hard spinifex grasslands
RGEBOO	Boolaloo	1,502 km^2 or 0.8%	Granite hills, domes and tor fields and sandy plains with shrubby spinifex grasslands
RGEBGO	Boolgeeda	7,748 km^2 or 4.3 %	Stony plains with hard Spinifex grasslands or Mulga shrublands. The geology is quaternary colluvium
RGECAL	Calcrete	1,444 km^2 or 0.8 %	Low calcrete platforms and plains supporting shrubby hard spinifex grasslands
RGSCPR	Capricorn	5,296 km^2 or 2.9%	Hills and ridges of sandstone and dolomite supporting shrubby hard and sorf spinifex
RGECHR	Christmas	232 km^2 or 0.1%	Stony alluvial plains supporting snakewood and mulga shrublands with sparse tussock grasses
RGECOB	Coolibah	1,014 km^2 or 0.6%	Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey
RGECWA	Cowra	203 km^2 or 0.1%	Plains fringing the Marsh land system and supporting snakewood and mulga shrublands with some halophytic undershrubs
RGEDIV	Divide	5293 km^2 or 2.9 %	Level to gently undulating sandplains and occasional small dunes
RGEGRA	Granitic	4,020 km^2 or 2.2%	Rugged granitic hills supporting shrubby hard and soft spinifex grasslands
RGEJAM	Jamindie	2,074 km^2 or 1.1%	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey
RGEMAC	Macroy	13,095 km^2 or 7.2%	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands

Land System Code	Land System	Representation in the Pilbara	Description
RGEMCK	McKay	4,202 km^2 or 2.3%	Hills and ridges, plateau remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands
RGEMAL	Mallina	2,557 km^2 or 1.4%	Sandy surfaced alluvial plains supporting sorf spinifex (and occasionally hard spinifex) grasslands
RGEMSH	Marsh	977 km^2 or 0.5 %	Lakebeds and flood plains on saline alluvium. The system only occurs along the Fortescue River in the southeast central part of the survey area and is the most predominant alluvial valley fill in Western Australia
RGENEW	Newman	14,580 km^2 or 8.0 %	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands
RGEOAK	Oakover	1,529 km^2 or 0.8 %	Breakaways, mesas, plateau and stony plains of calcrete supporting hard spinifex grasslands
RGEPLA	Platform	1,570 km^2 or 0.9%	Dissected slopes and raised plains supporting hard spinifex grasslands
RGERIV	River	4,088 km^2 or 2.3 %	Active floodplains and major rivers supporting grassy eucalypt woodlands, tussock grassland and soft spinifex grasslands
RGEROB	Robe	865km^2 or 0.5%	Low limestone mesas and buttes supporting soft spinifex (and occasionally hard spinifex) grasslands
RGEROC	Rocklea	22,993 km^2 or 12.7 %	Rough hill and mountain tracts predominantly of basalt, the largest land system in the survey area and widespread throughout, relief up to 110 m
RGERUT	Ruth	346 km^2 or 0.2 %	Hills and ridges of volcanic and other rocks supporting hard spinifex (occasionally soft spinifex) grasslands
RGEUAR	Uaroo	7,681 km^2 or 4.2%	Broad sandy plains supporting shrubby hard and soft spinifex grasslands
RGEWON	Wona	1,815 km^2 or 1.0%	Basalt upland gilgai plains supporting tussock grasslands and minor hard spinifex grasslands



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admin@griffinspatial.com.au
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PRE EUROPEAN VEGETATION

ONSHORE

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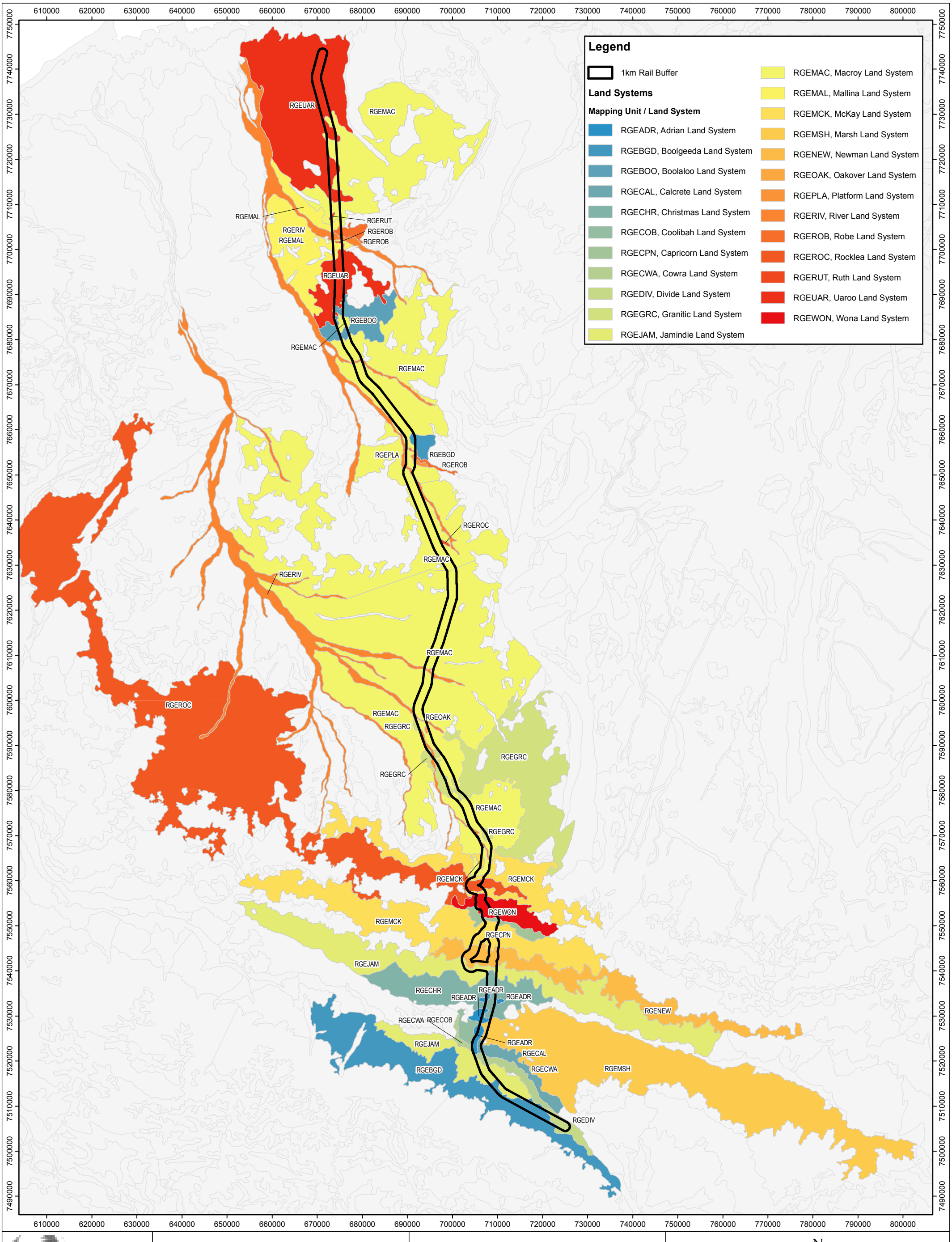

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LAND SYSTEMS

ONSHORE

Figure:	4	Date:	21/10/2013
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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 the following 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

Three State desktop searches were undertaken for information relating to rare flora (DPaW 2011a), Threatened Ecological Communities and Priority Ecological Communities (DPaW 2011b) previously collected or described within, or in close proximity to the study area. The database search was extended beyond the immediate survey limits to place flora values into a local and regional context. A 30 km buffer around the perimeter of the study area was investigated using the following corner points:

- North-west corner 642125mE 7755159mN (GDA94 Zone 50);
- North-east corner 691379mE 7771712mN (GDA94 Zone 50);
- South-west corner 693398mE 7473761mN (GDA94 Zone 50); and
- South-east corner 752746mE 7492736mN (GDA94 Zone 50).

The State database search investigated the following three databases:

1. The DPaW Threatened (Declared Rare) Flora Database;
2. The DPaW Declared Rare and Priority Flora List; and
3. 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 within a 10 km buffer around the study area boundary (DSEWPC 2012).

A search of the International Union for Conservation of Nature (IUCN) database was also completed (IUCN 2012).

2.3 Field Survey Methodology

2.3.1 Timing and Personnel

The field survey was completed as four 14 day field trips undertaken across two distinct seasonal periods. The first season survey was completed between October

and December 2011, with the second season survey completed between March and May 2012:

- 25th October -7th November 2011
- 21st November – 4th December 2011
- 12th March – 25th March 2012
- 18th April – 1st May 2012

There were six botanists from Onshore Environmental involved in the survey work including three Senior Botanists, Dr Darren Brearley, Dr Jerome Bull and Ms Ellen Palmer, each accompanied by a Botanist; Ms Jessica Waters, Mr Peter Sweeney and Mr Daniel Roberts.

2.3.2 Sampling of Study Sites

The survey involved systematic sampling using quadrats (referred to as study sites). The study sites were generally 50 m by 50 m, or an equivalent area (2,500 m^2) along narrow associations such as minor drainage lines. The area sampled for each study site is standard for the Pilbara Bioregion.

The number of study sites sampled was determined by the size and heterogeneity the study area. A total of 203 quadrats were formally assessed within the study area, distributed consistently along the entire length of the corridor (Figure 5). In addition there were 856 releve sites assessed within the study area. Data was simultaneously collected on a range of environmental parameters at each study site 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.

2.3.3 Targeted Seaches for Significant Species

The entire study area was ground-truthed at less than 1 km intervals during field assessment and mapping. This ground coverage provided the opportunity to record opportunistic locations for significant flora, and undertake closer examination of specific landforms where these flora may be expected to occur. These landforms included medium and large drainage lines, floodplains, marsh and claypans, calcrete plains, granite outcrops and boulder piles and areas supporting outcropping of mudstone/siltstone.

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Legend

- Rail Project Buffer
- Sample Sites

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VEGETATION SAMPLE SITES

MAPSHEET 1

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Mapsheet 1

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- Rail Project Buffer
- Sample Sites

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VEGETATION SAMPLE SITES

MAPSHEET 2

ONSHORE

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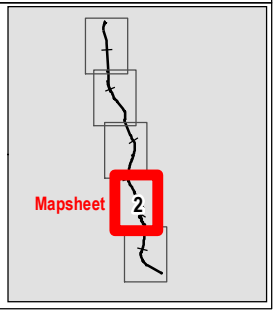

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- Sample Sites
- Rail Project Buffer

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VEGETATION SAMPLE SITES

MAPSHEET 3

ONSHORE

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Mapsheet 3

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- Sample Sites
- Rail Project Buffer

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VEGETATION SAMPLE SITES

MAPSHEET 4

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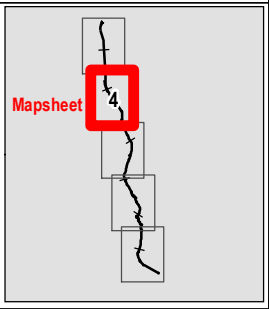

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Legend

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VEGETATION SAMPLE SITES

MAPSHEET 5

ONSHORE

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Projection: MGA Zone 50

5 Mapsheet

2.3.4 Weed Survey and Mapping

Numerous locations for introduced (weed) species had previously been identified within the study area. These records were re-visited by botanists from Onshore Environmental to confirm their occurrence. Additional opportunistic records for weed species were made while moving around the study area, and targeted weed searches were completed in high moisture habitats including medium and large drainage lines and flood plains.

2.3.5 Vegetation Association Mapping

The vegetation mapping utilised high-resolution aerial photography of the entire study area at a scale of 1:20,000, with definition of vegetation polygons based on contrasting shading patterns evident on the aerial. The location of 203 quadrats was overlaid on the aerial photography, and associated flora and vegetation data was used to provide vegetation association descriptions for individual polygons defined.

Ground-truthing of the study area by a total of six botanists from Onshore Environmental was completed during the first season survey in late 2011. Vegetation descriptions were applied to defined polygons using a combination of quadrat and releve plots to confirm dominant structural layers and associated plant taxa. A vegetation association map was compiled following completion of the first season survey. The vegetation map was further refined during the second season survey completed in early 2012, when the entire study area was ground trythed for a second time. There was changes made to some of the vegetation association boundaries in the field, and vegetation association descriptions were also refined.

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. Specimen identifications were confirmed by Dr. Jerome Bull and Dr Eleanor Bennett, with voucher specimens provided to the BHP Billiton sponsored botanist at the Western Australian Herbarium (WAH), Mr. Steve Dillon. Use was made of the WAH for confirmation of species identification. Nomenclature follows Green (1985 and 1987), Paczkowska and Chapman (2000) and the Western Australian State Herbarium.

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 4.

Table 4 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	The field survey represented an intensive assessment of the study area, confirmed by the high total flora count and diversity of plant families recorded. There were some collections where names could not be substantiated owing to sterile nature of specimens (generally first season collections). However, the second season survey followed significant summer rainfall allowing for the collection to be undertaken during very good seasonal conditions.
Sources of information	There have been 32 previous flora and vegetation surveys completed within all or part of the study area, providing an extensive local database.
The proportion of the task achieved and further work which might be needed	There was a comprehensive desktop review of the previous survey work completed within, and in close proximity to the study area, supported by four field trips to the study area. All allocated tasks were achieved during the investigation and no further work is needed at this site.
Timing / weather / season / cycle	A two season survey was carried out with field work completed within six separate months spanning October 2011 to May 2012 and including a second season undertaken after a period of significant summer rainfall.
Disturbances, e.g. fire, flood	Disturbances within the study area include fire (mosaic of burn ages recorded), grazing of lowland vegetation associations by domestic stock (cattle), introduction of weed species (particularly in riparian habitats), historical access tracks and exploration activities, and impacts to drainage lines/floodplains from the rail line. None of these disturbances affected the ability to complete the survey.
Intensity	A total of 203 quadrats were assessed within the study area along with 856 releve plots. This represents an intensive flora and vegetation survey.
Completeness	All tasks associated with a Level 2 flora and vegetation survey were thoroughly completed.
Resources	Appropriate resources were applied to the flora and vegetation survey.
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. Access to the study area was disrupted for three days during the field trip in March 2012 after the passage of Cyclone Lua. Small sections of the study area in close proximity to the existing rail line were inaccessible due to earthmoving and construction works.
Availability of contextual information	There were 32 previous flora and vegetation surveys identified during the literature review to have been undertaken within part of the study area, providing an extensive local database.
Experience levels	The six botanists working on the survey had a minimum of two years Pilbara experience each, with the two most senior botanists each possessing in excess of 10 years individual experience. The team has together completed numerous surveys across the entire range of the study area in 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 Sustainability, Environment, Water, Population and Communities (DSEWPaC) 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 flora and 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.

3.0 Results

3.1 Desktop Review

3.1.1 Previous surveys within the study area

The results from previous flora and vegetation surveys completed within, or partly within, the study area are summarised in Table 5 and Appendix 5. The literature reviewed has classified the surveys on the basis of position in relation to the existing BHP Billiton Iron Ore Mainline Rail, with additional surveys completed in close proximity also documented.

Table 5 Summary of background and results for previous surveys completed within, or partly within, the study area.

Survey	Consultant	Year	Field Survey Date	Inside study area	Conservation Significant Flora Recorded (Shaded taxa current)	Introduced (Weed) Taxa Recorded
Hope Downs Rail Corridor Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey	Biota	2002	25th April- 14th May, 29th May- 10 June, July 2001	Mostly, extends past Yandi Junction to Weeli Wolli Siding	*Euphorbia clementii* (P2), *Indigofera ixocarpa* (P2), *Bulbostylis burbidgeae* (P4), *Goodenia nuda* (P4), *Gymnanthera cunninghamii* (P3), *Phyllanthus aridus* (P3), *Themeda* sp. Hamersley Station (P3)	**Opuntia stricta, *Cenchrus ciliaris, *Cenchrus setiger, *Aerva javanica, *Argemone ochroleuca, *Echinochloa colona, *Eragrostis minor, *Setaria verticillata, *Stylosanthes hamata, *Euphorbia hirta, *Malvastrum americanum, *Solanum nigrum, *Citrullus colocynthis, *Cucumis melo* subsp. *agrestis, *Bidens bipinnata, * Sigesbeckia orientalis, *Sonchus oleraceus, *Tridax procumbens, *Flaveria trinervia, *Vachellia farnesiana, *Portulaca oleracea*
Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor	Biota	2004	March, April 2004	Mostly extends past the Yandi Junction to Mindy Mindy.	*Eremophila spongiocarpa* (P1), *Goodenia* sp. East Pilbara (P3), *Josephinia* ?sp. Marandoo (P1), *Euphorbia clementii* (P2), *Indigofera ixocarpa* (P2), *Paspalidium retiglume* (P2), *Stylidium weeliwolli* (P2), *Gymnanthera cunninghamii* (P3), *Phyllanthus aridus* (P3), *Themeda* sp. Hamersley Station (P3), *Bulbostylis burbidgeae* (P4), *Goodenia nuda* (P4)	**Cenchrus ciliaris, *Cenchrus setiger, *Chloris virgata, *Setaria verticillata, *Aerva javanica, *Stylosanthes hamata, *Malvastrum americanum, *Datura leichhardtii, *Solanum nigrum, *Citrullus colocynthis, *Bidens bipinnata, *Flaveria trinervia, *Vachellia farnesiana, *Portulaca oleracea*

Survey	Consultant	Year	Field Survey Date	Inside study area	Conservation Significant Flora Recorded (Shaded taxa current)	Introduced (Weed) Taxa Recorded
BHPBIO RPG5 Nelson Point to Bing Siding Vegetation and Flora Report	Ecologia	2009	January 2003, 6th May 2008	Yes	*Tecticornia* sp. (possible new species)	**Aerva javanica, *Cenchrus ciliaris, *Cenchrus setiger, *Chloris virgata, *Citrullus colocynthis, *Indigofera oblongifolia, *Trianthema portulacastrum, *Flaveria trinervia*
Targeted survey of Tecticornia in the Nelson Point to Bing Siding Rail Duplication Project Area, Port Hedland	Sheperd	2009	2nd-4th December 2009	Yes	*Tecticornia* sp. (possible new species)	Not recorded
Goldsworthy Rail Duplication Flora and Vegetation Assessment	ENV	2009	14th- 16th October 2008	Yes	*Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1)	**Tamarix aphylla* (Declared Weed), **Aerva javanica, *Cenchrus ciliaris, *Stylosanthes hamata*, **Chloris virgata*, **Citrullus colocynthis), *Portulaca oleracea*
Wallwork Road Bridge Flora and Vegetation Assessment	ENV	2010	29th January	Yes, the survey area crosses over a portion of the rail line and extends beyond it.	None	**Aerva javanica, *Cenchrus ciliaris.*
BHPB Ongoing Works Tabba, Turner and Woodstock Sidings	Ecologia	2004	30th April - 5th May 2004	Yes	*Bulbostylis burbidgeae* (P4)	**Aerva javanica, *Cenchrus ciliaris, *Vachellia farnesiana*
RGP Rail Rare and Priority Flora Survey	Ecologia	2004	26th- 27th November 2003, 14th - 21st January 2004	Yes	None	**Cenchrus ciliaris, *Chloris virgata, *Aerva javanica, *Cenchrus* sp., *Indigofera oblongifolia*, **Malvastrum americanum, *Citrullus colocynthus, *Portulaca oleracea, *Vachellia farnesiana*
BHPIO RGP2 Great Northern Hwy to Bing Siding, Goldsworthy Junction, Boodarie Siding Declared Rare and Priority Flora and Weed Assessment	Ecologia	2004	16th-19th August 2004	Yes	None	**Aerva javanica, *Cenchrus ciliaris, *C. echinatus, *Chloris virgata, *Stylosanthes hamata, *Citrullus colocynthis*, **Portulaca oleracea, *Flaveria tinervia*

Survey	Consultant	Year	Field Survey Date	Inside study area	Conservation Significant Flora Recorded (Shaded taxa current)	Introduced (Weed) Taxa Recorded
RGP5 Walla to Bing Sidings and Repeater One Flora and Vegetation Report	Ecologia	2008	6th-8th April	Yes	None	**Acetosa vesicaria, *Aerva javanica, *Cenchrus ciliaris, *Cenchrus setiger, *Citrullus colocynthis, *Cucumis melo, *Portulaca oleracea *Vachellia farnesiana, *Tribulus terrestris.*
RGP5 Quarry One Flora and Vegetation Report	Ecologia	2008	8th April 2008	Yes	None	**Aerva javanica, *Cenchrus ciliaris, *Cucumis melo *Portulaca oleracea.*
Railroad Interim Expansion Project Rare and Priority Flora Survey	Ecologia	2003	13th-15th May, 5th-7th August 2003	Yes	*Themeda* sp Hamersley Station (M.E. Trudgen 11431) (P3)	**Cenchrus ciliaris, *Aerva javanica, *Sylosanthes hamata, Citrullus colocynthis, *Vachellia farnesiana*
Turner River Bridge Extension Chainage 98.8-110.9km Declared Rare and Priority Flora and Introduced species Survey	ENV	2007	17th-21st July 2007	Yes	None	**Cenchrus ciliaris*
BHPBIO On-going Works Rail Development- Turner River Bridge	Ecologia	2004	3rd June 2004	Yes	None	**Aerva javanica, *Cenchrus ciliaris*
Turner River Camp Flora and Vegetation Assessment	ENV	2008	21st March 2008	Yes	None	**Cenchrus ciliaris, *Tamarix aphylla, *Aerva javanica, *Phoenix dactyfera*
RGP5 Walla Siding to Turner Camp and Repeater 2 Flora and Vegetation Report	Ecologica	2008	4th-8th April 2008	Yes	None	**Aerva javanica, *Cenchrus ciliaris, *Cynodon dactylon, *Passiflora foetida, *Portulaca oleracea*
RGP5 Quarry Two Flora and Vegetation Report	Ecologia	2008	8th April 2008	Yes	None	**Cenchrus ciliaris, *Passiflora foetida* \ **Portulaca oleracea*
BHPBIO RGP5 Turner Camp to Spring Siding and Repeaters Three and Four Flora and Vegetation Report	Ecologia	2008	28th, March, 30th March-4th April 2008	Yes	None	**Cenchrus ciliaris*, **Portulaca oleracea*, **Chloris barbata*, **Echinochloa colona*, **Vachellia farnesiana, *Tribulus terrestris, *Aerva javanica*.
Yandee Line Camp Redevelopment Declared Rare and Priority Flora, and Weed Survey	ENV	2008	29th-30th November 2006	Yes	None	**Tamarix aphylla* (Declared Weed), **Cenchrus ciliaris, *Phoenix dactylifera, *Aerva javanica*

Survey	Consultant	Year	Field Survey Date	Inside study area	Conservation Significant Flora Recorded (Shaded taxa current)	Introduced (Weed) Taxa Recorded
BHPBIO RGP5 Quarry Three Lease Vegetation and Flora Report	Ecologia	2009	3rd-5th April 2008	Yes	None	**Cenchrus ciliaris, *Passiflora foetida, *Portulaca oleracea, *Tribulus terrestris*
BHPBIO RGP5 Quarry Four Flora and Vegetation Report	Ecologia	2008	29th-30th March 2008	Yes	None	**Aerva javanica, *Argemone ochroleuca* subsp. *ochroleuca, *Cenchrus ciliaris, *Cenchrus echinatus, *Portulaca oleracea, *Tribulus terrestris, *Vachellia farnesiana*
RPG5: Redmont Camp Extension Flora and Vegetation Survey	Ecologia	2008	23rd October 2008	Yes	None	**Aerva javanica, *Cenchrus ciliaris*
Quarry Eight Expansion- Declared Rare and Priority Flora Survey	ENV	2007	27th-29th November 2006	Yes	None	**Cenchrus ciliaris, *Setaria verticillata, *Vachellia farnesiana, *Portulaca oleracea.*
RGP5 Quarry 8 Drainage Area Flora and Vegetation Report	Ecologia	2008	2nd April 2008	Yes	None	**Aerva javanica, *Cenchrus ciliaris,* Digitaria ciliaris, *Echinochloa colona, *Malvastrum americanum*, **Vachellia farnesiana*
BHPBIO RGP5 Chichester Deviation Vegetation and Flora Report	Ecologia	2008	4-9th October 2007, 6th - 10th May 2008	Yes	*Goodenia nuda* (P4)	**Aerva javanica*, **Bidens bipinnata*, **Cenchrus ciliaris*, **Cucumis melo* subsp. *agrestis, *Malvastrum americanum, *Vachellia farnesiana*
BHPBIO RGP5 Chichester Deviation Baseline Weed Survey	Ecologia	2010	20th-26th August 2009	Yes	None	**Aerva javanica, *Bidens bipinnata, *Malvastrum americanum, *Cenchrus ciliaris,*Vachellia farnesiana.*
Chichester Deviation Baseline Mulga (*Acacia eneura)* Monitoring Event	Syrinx Environmental	2010	2010	Yes	None	**Cenchrus ciliaris*
BHPBIO RGP5 Spring Siding to Hesta Siding and Repeater 5 Flora and Vegetation Report	Ecologia	2008	9th October 2007, 30th March-2nd April 2008, 5th April 2008	Yes	None	**Aerva javanica, *Acetosa vesicaria*, **Bidens bipinnata, *Cenchrus ciliaris, *Chloris barbata, *Cucumis melo, *Malvastrum americanum, *Portulaca oleracea, *Vachellia farnesiana, *Citrullus colocynthis*

Survey	Consultant	Year	Field Survey Date	Inside study area	Conservation Significant Flora Recorded (Shaded taxa current)	Introduced (Weed) Taxa Recorded
BHPIO RGP5 Hesta Siding to Cowra Siding Vegetation and Flora Report	Ecologia	2008	8th October 2007	Yes	*Eremophila spongiocarpa* (P1)	**Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Malvastrum americanum, *Vachellia farnesiana*
RGP5 *Eremophila spongiocarpa* Search	ENV	2008	27th-28th October 2008	Yes	*Eremophila spongiocarpa* (P1)	Not recorded
BHPBIO RGP5 Cowra to Kurrajurra Sidings and Cowra Camp Site Flora and Vegetation Survey	Ecologia	2007	5th-9th October, 22nd-23rd October 2007	Yes partially, study area extends past Yandi Junction to Kurrajurra Siding	None	**Acetosa vesicaria, *Aerva javanica, *Cenchrus ciliaris, *Malvastrum americanum, *Setaria verticillata, Tamarix aphylla*

3.1.2 Threatened Flora listed under the Commonwealth EPBC Act

A search of the EPBC Act Protected Matters Database (DSEWPaC 2011) identified one record of a 'Vulnerable' plant taxa potentially occurring within the study area, *Lepidium catapycnon.* There were no records identified from the IUCN database search.

A total of 32 populations of *L. catapycnon* were identified from the DPaW database search, with populations broadly distributed between the Pilbara towns of Newman, Nullagine and Wittenoom. The total area of extent approximates 21,736 km^2 with eight known populations occurring within Karijini National Park (Onshore Environmental 2011e). A further 18 flora and vegetation surveys conducted on BHP Billiton Iron Ore leases between 1994 and 2011 have recorded *Lepidium catapycnon*[1]. Eight of these surveys were targeted searches with the remaining ten reports being baseline flora and vegetation surveys (Onshore Environmental 2011e).

3.1.3 Threatened Flora listed under the WA Wildlife Conservation (Rare Flora) Notice 2013

The DPaW rare flora database search identified one Threatened Flora as occurring within a 50 km radius of the study area, *Lepidium catapycnon* (Table 6). *Lepidium catapycnon* has previously been recorded from a number of locations to the south and west of the study area, including BHP Billiton Iron Ore's Jinidi tenements (Onshore Environmental 2011c), South Flank tenements (Onshore Environmental 2011d), the eastern fringe of Packsaddle Range (Onshore Environmental 2011a) and Yandi mining lease (Onshore Environmental 2011b).

3.1.4 Priority Flora recognised by DPaW

The DPaW rare flora database search (DPaW 2011a) identified 31 Priority flora taxa as potentially occurring within a 50 km buffer around the perimeter of the study area (Table 6).

Table 6 Significant flora previously recorded from a 50 km buffer around the study area (DPaW 2011b).

SCC State Conservation Code (WC Act) and DPaW (2013)
FCC Federal Conservation Code (EPBC Act)

Species	SCC	FCC
Abutilon pritzelianum	1	-
Acacia leeuweniana	1	-
Acacia levata	3	-
Acacia subtiliformis	3	-
Adiantum capillus-veneris	2	-
Atriplex flabelliformis	3	-
Bulbostylis burbidgeae	4	-
Eremophila youngii subsp. *Lepidota*	4	-
Euphorbia clementii	2	-
Euphorbia stevenii	3	-
Gomphrena pusilla	2	-
Goodenia nuda	4	-

[1] *Lepidium catapycnon* is likely to have been recorded in other surveys where reports remain confidential and results have not been submitted for collation into the DPaW database.

Species	SCC	FCC
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	3	-
Gymnanthera cunninghamii	3	-
Heliotropium muticum	1	-
Indigofera sp. Gilesii (M.E. Trudgen 15869)	3	-
Lepidium catapycnon	T	T
Nicotiana heterantha	1	-
Nicotiana umbratica	3	-
Phyllanthus hebecarpus	3	-
Pityrodia sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)	1	-
Polymeria distigma	3	-
Rhynchosia bungarensis	4	-
Rostellularia adscendens var. *latifolia*	3	-
Sida sp. Barlee Range (S. van Leeuwen 1642)	3	-
Stylidium weeliwolli	2	-
Tecticornia globulifera	1	-
Tecticornia medusa	3	-
Tephrosia bidwillii	3	-
Tephrosia rosea var. Port Hedland (A.S. George 1114)	1	-
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	3	-

3.1.5 TECs listed under State and Federal Legislation

A search of the EPBC Act Protected Matters database (DSEWPaC 2011) 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 (2011b) confirmed there were no TEC records for the immediate study area. The EPBC Protected Matters database search did confirm that the Fortescue Marsh is situated within the 10 km buffer of the study area. This area is listed as a Wetland of National Significance and is also on the Register of the National Estate.

3.1.6 PECs recognised by DPaW

A search of the State database by DPaW confirmed that five PECs have previously been recorded within a 90 km radius of the study area, with the buffer for four of these PECs overlapping with the study area (Figure 6).

The Fortescue Valley Sand Dune Community (Priority 3 (iii)) is situated marginally south-east of the study area outside the southern extent of the study area (near Yandi Junction). The PEC is defined by linear sand dunes that are easily identified in the field. The PEC has previously been recorded at BHP Billiton Iron Ore's Marillana (Onshore Environmental 2012) and Mindy North tenements (D.Brearley *pers. comm.* 2013), with the largest local representation situated north-east of BHP Billiton Iron Ore's Coondiner tenement (D.Brearley *pers. comm.* 2013).

The Fortescue Marsh Community (Priority 1) is associated with the Fortescue Marsh, an extensive seasonally inundated (ephemeral) lake positioned at the upper terminis of the Fortescue River. It is the largest ephemeral wetland in the Pilbara and is recognised as a highly diverse system supporting many endemic and near endemic species. The study area passes around the western fringe of the Fortescue Marsh crossing a small number of associated drainage lines.

The Freshwater Claypans of the Fortescue Valley Community (Priority 1) occurs downstream of the the Fortescue Marsh at Mulga Downs Station, west of the study area. The claypans are a unique community supporting a ground cover of *Eriachne* and *Eragrostis* grasses with scattered *Eucalyptus victrix* (Coolibah) trees.

The Four Plant Assemblages of the Wona Land System Community consists of four sub-types occurring on a system of upland basalt gilgai plains supporting tussock grasslands on the Chichester Range. One of the sub-types, Mitchell Grass *(Astrebla* spp.) on Gilgai (Priority 3iii) occurs in close proximity to the study area.

The Weeli Wolli Spring Community (Priority 1) occurs approximately 50 km south of the study area associated with Weeli Wolli Creek and Weeli Wolli Spring. The vegetation is defined by a continuous stand of large *Melaleuca argentea* trees.

The PECs that were confirmed to occur within the study area are described in further detail in Section 3.5.

610000 620000 630000 640000 650000 660000 670000 680000 690000 700000 710000 720000 730000 740000 750000 760000 770000 780000 790000 800000

7740000 7730000 7720000 7710000 7700000 7690000 7680000 7670000 7660000 7650000 7640000 7630000 7620000 7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000 7520000 7510000 7500000 7490000

Wona Land System

Freshwater claypans of the Fortescue Valley

Freshwater claypans of the Fortescue Valley

Fortescue Valley Sand Dunes

Fortescue Valley Sand Dunes

Fortescue Valley Sand Dunes

Fortescue Marsh

Fortescue Marsh

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

GRIFFIN SPATIAL & MAPPING

PO Box 7215
EATON WA 6232
admin@griffinspatial.com.au
+61 8 9725 3213

BHPBIO MAINLINE

PRIORITY ECOLOGICAL COMMUNITY & THREATENED ECOLOGICAL COMMUNITY

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Kilometers
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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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Legend

- 1km Rail Buffer

TEC PEC Boundaries

- Fortescue Marsh
- Fortescue Valley Sand Dunes
- Freshwater claypans of the Fortescue Valley
- Wona Land System

N

3.2 Flora Species

A total number of 706 plant taxa (including varieties and subspecies) from 67 families and 229 genera were recorded from the study area (Table 7, Appendices 6 and 7). Species representation was greatest among the Fabaceae, Poaceae, Malvaceae, Amaranthaceae, Chenopodiaceae, Asteraceae, Convolvulaceae, Cyperaceae and Goodeniaceae families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (58 taxa), followed by *Ptilotus* (19 taxa), *Sida* (18 taxa), *Eriachne* (16 taxa), *Corchorus* (16 taxa), *Senna* (16 taxa), *Hibiscus* (15 taxa), *Tephrosia* (13 taxa) and *Eragrostis* (12 taxa).

Table 7 Statistics for total flora recorded from the study area.

Parameter	No. Taxa
No. Families	67
No. Genera	229
No. Species (incl. subspecies & varieties)	706
No. Native Species (incl. subsp. & var.)	690
No. Threatened Flora	0
No. Priority Flora	16
No. Introduced Species	16
Speciose Families	
Fabaceae	137
Poaceae	110
Malvaceae	78
Amaranthaceae	37
Chenopodiaceae	34
Asteraceae	31
Convolvulaceae	23
Cyperaceae	23
Goodeniaceae	20
Myrtaceae	17
Boraginaceae	15
Solanaceae	14
Euphorbiaceae	13
Speciose Genera	
Acacia (Fabaceae)	58
Ptilotus (Amaranthaceae)	19
Sida (Malvaceae)	18
Eriachne (Poaceae)	16
Corchorus (Malvaceae)	16
Senna (Fabaceae)	16
Hibiscus (Malvaceae)	15
Tephrosia (Fabaceae)	13
Eragrostis (Poaceae)	12
Goodenia (Goodeniaceae)	12
Heliotropium (Boraginaceae)	11
Euphorbia (Euphorbiaceae)	11
Triodia (Poaceae)	11
Abutilon (Malvaceae)	11
Cullen (Fabaceae)	10
Eremophila (Scrophulariaceae)	9
Solanum (Solanaceae)	9

3.3 Conservation Significant Flora Species

3.3.1 Threatened Flora

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

3.3.2 Priority Flora

There were 16 currently listed Priority flora species recorded from a total of 175 point locations distributed across the entire extent of the study area (Table 8, Figure 7). The location for all records is provided in Appendix 8. The Priority flora included six Priority 1 taxa, one Priority 2 taxa, six Priority 3 taxa, and three Priority 4 taxa.

Table 8 Priority flora recorded from the study area. SCC - State Conservation Code (WC Act).

Species	SCC	Description	Occurrence within study area
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	1	Shrub reaching 1-1.5 m, yellow or orange flowers during August, grows on red sand dunes and sand plains	8 locations, >65 plants, sandy loam soils on level to very gently inclined stony plains, Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with High Open Shrubland of *Acacia inaequilatera*
Acacia levata	3	Spreading, multi-stemmed shrub that reaches 1-3 m in height and up to 5 m wide, flowers yellow during May, grows in sand or sandy loam on granite hillslopes	3 locations, >35 plants, orange sand on gently inclined hill slope, Hummock Grassland of *Triodia basedowii* and *Triodia epactia* with Shrubland of *Acacia bivenosa, Acacia levata* and *Acacia arrecta* with High Open Shrubland of *Acacia ancistrocarpa* and *Acacia inaequilatera*
Bonamia aff. *oblongifolia*	1	Perennial herb or shrub, flowering blue in February, grows on sandy or gravelly soils	1 location, orange sand on very gently inclined plain, Low Open Heath of *Acacia stellaticeps* over Hummock Grassland of *Triodia schinzii* with Scattered Tall Shrubs of *Acacia sericophylla* and *Acacia tumida* var. *pilbarensis*
Bulbostylis burbidgeae	4	Tufted, erect to spreading annual sedge reaching 0.25 m in height, spiklets are in a simple umbel or solitary and flowers occur in March or between June to August, grows on granitic soils in crevices on granite outcrops or at the base of cliffs	65 locations, >1,248 plants, skeletal brown loamy sand restricted to granite rock piles, Open Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Triumfetta maconochieana* and *Cajanus cinereus* over Very Open Tussock Grassland of *Paspaidium clementii* and **Cenchrus ciliaris*
Eremophila spongiocarpa	1	Compact succulent leaved shrub growing up to 1m and producing white flowers from May to September, grows on weakly saline alluvial plains on the margins of the Fortescue Marsh	32 locations, 321 plants, brown sandy clay loam to medium clay soils on salt lake bed, fringes of lake and terminal drainage lines, Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia* indica subsp. bidens and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis*

Species	SCC	Description	Occurrence within study area
Eremophila youngii subsp. *lepidota*	4	Dense, spreading shrub, 0.2-1-3 m high, flowers purple-red-pink in January or March or June or August to September, grows on stony red sandy loam on flats, plains, floodplains, sometimes semi-saline clay flats	1 location
Euphorbia clementii	2	Erect herb to 0.6 m high, grows on stony plains and gravelly hill slopes	1 location, brown sandy loam on gently inclined plain
Euphorbia stevenii	3	Succulent perennial herb to between 0.1-0.5 m high, grows on clay or sandy soils	2 locations, 35 plants
Fimbristylis sieberiana	3	Shortly rhizomatous tufted perennial sedge, 0.25-0.6 m high, flowering brown between May to June, grows on mud, skeletal soil pockets, pool edges, sandstone cliffs	2 locations, 71 plants, mixture of moist alluvial sand and clay with exposed boulders and slabs, along channel of major drainage line and nearby to permanent pool
Goodenia nuda	4	Erect to ascending annual or biennial herb up to 0.5m high, flowering yellow from April to August, associated with flood plain, sand plains and drainage line habitats	28 locations, >445 plants, brown sandy loam and clay loam on stony flood plains, mulga flats and unincised medium drainage lines, Hummock Grassland of *Triodia epactia* with Shrubland of *Acacia maitlandii, Acacia pruinocarpa, Acacia tumida* var. *pilbarensis* with High Open Shrubland of *Grevillea wickhamii, Petalostylis labicheoides* with Scattered Low Trees of *Corymbia hamersleyana*
Gymnanthera cunninghamii	3	Erect shrub up to 2 m in height and producing cream, yellow or green flowers year round, grows in sandy soils along medium to large drainage lines	6 locations, 52 plants, brown alluvial sand along major drainage channels, Low Open Forest of *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *refulgens* and *Acacia coriacea* subsp. *pendens* over Open Shrubland *Acacia trachycarpa* over Very Open Sedges of *Cyperus vaginatus* and *Cyperus ixiocarpus*

Species	SCC	Description	Occurrence within study area
Heliotropium muticum	1	Ascending to spreading perennial herb reaching 0.3 m in height, grows on flat plains south of Port Hedland in brown loam and red silty sand	14 locations, <100 plants, red loamy sand on level to very gently undulating plains, Open Hummock Grasslandof *Triodia lanigera* and *Triodia epactia* with Low Shrubland of *Indigofera monophylla, Istropis atropurpurea* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) with Low Open Woodland of *Corymbia zygophylla* and *Corymbia hamersleyana*
Pterocaulon cf. *xenicum*	3	Erect perennial herb to 0.25 m in height, flowering pink	1 location, brown sandy loam on level plain (outcropping granite), Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with Open Shrubland of *Acacia colei* var. *colei* and *Acacia inaequilatera*
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	1	Erect spreading shrub to 0.6 m in height with red green foliage, grows on saline flats associated with salt lakes	1 location, brown sandy clay loam to medium clay soils on salt lake bed, fringes of lake and terminal drainage lines, Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia* indica subsp. bidens and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis*
Tephrosia rosea var. Port Hedland (A.S. George 1114)	1	Erect shrub reaching 1.7 m in height, flowers are red or purple and occur between August to September, grows on red sands near creeks and on disturbed road sides around Port Hedland	6 locations, 60 plants, red sand on level to very gently undulating plain generally disturbed areas along tracks and rail line
Themeda sp. Hamersley Station (M.E Trudgen 11431)	3	Tussocky perennial grass 0.9-1.8 m high, flowering August, grows on red clay on clay pans and grassy plains	3 locations, >14 plants, red brown clay on very gently inclined flood plain

715000 720000 725000

7515000

7510000

7505000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*

Acacia levata (A.l)

Bonamia aff. oblongifolia (B.o)

Bulbostylis burbidgeae (B.b)

Eremophila spongiocarpa (E.sp)

Eremophila youngii subsp. *lepidota (E.y)*

Euphorbia clementii (E.c)

Euphorbia stevenii (E.s)

Fimbristylis sieberiana (F.s)

Goodenia nuda (G.n)

Gymnanthera cunninghamii (G.c)

Heliotropium muticum (H.m)

Pterocaulon cf. xenicum (P.x)

Tecticornia sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*

Tephrosia rosea var. Port Hedland (A.S. George 1114) *(T.r)*

Themeda sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

715000 720000 725000

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MAPSHEET 1

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_Rev10032014	

N

0 250 500 1,000 1,500 2,000

Meters

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet

705000

710000

7525000

7520000

7515000

E.sp
E.sp
E.sp
E.sp
T.CC
E.sp
E.sp
E.sp
E.sp
E.y
E.sp
E.sp
E.sp
E.sp
E.sp
B.b
A.P
E.sp
E.sp

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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MAPSHEET 2

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_24102013	

N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 2

700000 705000 710000

7545000 7540000 7535000 7530000

G.n G.n G.n G.n G.n

E.sp E.sp E.sp E.sp E.sp E.sp E.sp E.sp E.sp E.sp

T.CC

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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MAPSHEET 3

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 3

700000 705000 710000

7560000 7555000 7550000 7545000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

E.s
A.P
T.HR
E.s
T.HR
G.n
G.n
G.n
G.n
G.n
G.n
G.n
G.n
G.n
G.n
G.n
G.n

700000 705000 710000

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MAPSHEET 4

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
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N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 4

700000 705000 710000

7575000 7570000 7565000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

B.b
F.s
G.c
A.l
F.s
G.n
B.b
B.b

700000 705000 710000

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MAPSHEET 5

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_24102013	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 5

690000 695000 700000

7595000 7590000 7585000 7580000

G.c G.c

B.b B.b B.b B.b B.b B.b B.b B.b B.b B.b B.b B.b

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

690000 695000 700000

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MAPSHEET 6

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 6

690000
695000
700000
7610000
7605000
7600000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*

Acacia levata (A.l)

Bonamia aff. oblongifolia (B.o)

Bulbostylis burbidgeae (B.b)

Eremophila spongiocarpa (E.sp)

Eremophila youngii subsp. *lepidota (E.y)*

Euphorbia clementii (E.c)

Euphorbia stevenii (E.s)

Fimbristylis sieberiana (F.s)

Goodenia nuda (G.n)

Gymnanthera cunninghamii (G.c)

Heliotropium muticum (H.m)

Pterocaulon cf. xenicum (P.x)

Tecticornia sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*

Tephrosia rosea var. Port Hedland (A.S. George 1114) *(T.r)*

Themeda sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

B.b
B.b
H.m
G.c
G.c

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MAPSHEET 7

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 7

695000 700000 705000

7630000 7625000 7620000 7615000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

B.b B.b B.b B.b B.b B.b

695000 700000 705000

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MAPSHEET 8

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 8

690000 695000 700000

7645000 7640000 7635000 7630000

B.b

G.c

G.c

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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MAPSHEET 9

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 9

690000
695000
7660000
7655000
7650000

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*

Acacia levata (A.l)

Bonamia aff. oblongifolia (B.o)

Bulbostylis burbidgeae (B.b)

Eremophila spongiocarpa (E.sp)

Eremophila youngii subsp. *lepidota (E.y)*

Euphorbia clementii (E.c)

Euphorbia stevenii (E.s)

Fimbristylis sieberiana (F.s)

Goodenia nuda (G.n)

Gymnanthera cunninghamii (G.c)

Heliotropium muticum (H.m)

Pterocaulon cf. xenicum (P.x)

Tecticornia sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*

Tephrosia rosea var. Port Hedland (A.S. George 1114) *(T.r)*

Themeda sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

H.m

H.m

E.c

G.c

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MAPSHEET 10

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by: GSM	Requested by: DB	Internal Reference: Mainline_sig_flora_20140310	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 10

675000 680000 685000

7675000 7670000 7665000 7660000

H.m

H.m

Legend

Rail Project Buffer

Rail

Significant Flora

Genus / Species

Abutilon sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*

Acacia levata (A.l)

Bonamia aff. oblongifolia (B.o)

Bulbostylis burbidgeae (B.b)

Eremophila spongiocarpa (E.sp)

Eremophila youngii subsp. *lepidota (E.y)*

Euphorbia clementii (E.c)

Euphorbia stevenii (E.s)

Fimbristylis sieberiana (F.s)

Goodenia nuda (G.n)

Gymnanthera cunninghamii (G.c)

Heliotropium muticum (H.m)

Pterocaulon cf. xenicum (P.x)

Tecticornia sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*

Tephrosia rosea var. Port Hedland (A.S. George 1114) *(T.r)*

Themeda sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

675000 680000 685000

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MAPSHEET 11

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20141003	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 11

670000 675000 680000

7690000 7685000 7680000

H.m B.b B.b H.m B.b B.b B.b B.b B.b B.b B.b B.b B.b H.m B.b B.b B.b B.b B.b

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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SIGNIFICANT FLORA MAPPING
MAPSHEET 12

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_sig_flora_20140310	

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Meters

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 12

670000
675000
7710000
7705000
7700000
7695000

T:HR
A.P
A.P

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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SIGNIFICANT FLORA MAPPING
MAPSHEET 13

ONSHORE

Figure:	7	Date:	10/03/2014
Sheet Size:	A3	Status:	Final
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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 13

670000
675000
7725000
7720000
7715000

H.m
T.r
H.m
A.P
A.P
A.P
A.P
A.P
P.x
B.b
B.b
T.HR

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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SIGNIFICANT FLORA MAPPING
MAPSHEET 14

ONSHORE

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 14

665000 670000 675000

7745000 7740000 7735000 7730000

B.o T.r T.r T.r T.r T.r H.m H.m H.m H.m

Legend

- Rail Project Buffer
- Rail

Significant Flora

Genus / Species

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) *(A.P)*
- *Acacia levata (A.l)*
- *Bonamia aff. oblongifolia (B.o)*
- *Bulbostylis burbidgeae (B.b)*
- *Eremophila spongiocarpa (E.sp)*
- *Eremophila youngii* subsp. *lepidota (E.y)*
- *Euphorbia clementii (E.c)*
- *Euphorbia stevenii (E.s)*
- *Fimbristylis sieberiana (F.s)*
- *Goodenia nuda (G.n)*
- *Gymnanthera cunninghamii (G.c)*
- *Heliotropium muticum (H.m)*
- *Pterocaulon cf. xenicum (P.x)*
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd and T. Colmer et al. KS 1063) *(T.CC)*
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) *(T.r)*
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) *(T.HR)*

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MAPSHEET 15

ONSHORE

Figure:	7	Date:	10/03/2014
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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 15

3.4 Introduced Flora

A total of 16 introduced (weed) species were recorded from the study area (Table 9, Figure 8, Appendix 9). One of the 16 weed species is listed as a Declared Pest under the BAM Act, *Calotropis procera.*

**Calotropis procera* (Rubber Tree) is a shrub or tree reaching 4 m in height. It produces cream/white or purple flowers all year round and occurs on sandy and clayey soils (Plate 1). Mature plants have corrugated corky bark and produce an inflated pod up to 12 cm long that burst to release seeds. Leaves are opposite and elliptical up to 20 cm long. The plant produces a milky white sap. It is native to tropical Asia and Africa but is now found in northern Australia across WA, South Australia, the Northern Territory and Queensland. It invades roadsides, drainage lines, and heavily grazed areas. It is toxic to humans and may also be toxic to stock.

**Calotropis procera* is a Priority 3 Declared Pest in that portion of Western Australia above the 26th parallel of latitude. This requires that infested areas must be managed to prevent the spread of seed or plant parts (Department of Agriculture 2012).

Plate 1 **Calotropis procera*

Table 9 Introduced weed species recorded from the study area.

Taxon	Common Name	Occurrence in study area
**Aerva javanica*	Kapok Bush	78 locations, >850 plants, range 1-75% ground cover
**Argemone ochroleuca*	Mexican Poppy	17 locations, >1,085 plants, range 1-10% ground cover
**Bidens bipinnata*	Bipinnate Beggars Tick	21 locations, >400 plants, range 1-30% ground cover
**Calotropis procera*	Rubber Tree	8 locations, 8 plants, <1% ground cover
**Cenchrus ciliaris*	Buffel Grass	213 locations, >7,000 plants, range 1-80% ground cover
**Cenchrus setiger*	Birdwood Grass	18 locations, >550 plants, range 1-45% ground cover
**Citrullus colocynthis*	Bitter Apple	26 locations, >70 plants, <5% ground cover
**Cucumis melo* subsp. *agrestis*	Ulcardo Melon	5 locations, range 1-30% ground cover
**Cucumis myriocarpus*	Prickly Paddy Melon	1 location, 1 plant
**Cynodon dactylon*	Couch Grass	7 locations, range 1-25% ground cover
**Flaveria trinervia*	Speedy Weed	26 locations, 186 plants, <1% ground cover
**Malvastrum americanum*	Spiked Malvastrum	35 locations, >770 plants, range 1-5% ground cover
**Merremia dissecta* var. *dissecta*	Alamo Vine	1 location, <1% ground cover
**Setaria verticillata*	Whorled Pigeon Grass	9 locations, 18 plants, range 1-3% ground cover
**Stylosanthes hamata*	Verano Stylo	11 locations, 138 plants, 1% ground cover
**Vachellia farnesiana*	Mimosa Bush	51 locations, 360 plants, range 1-25% ground cover

715000 720000 725000

7515000 7510000 7505000

*C.c *C.s *V.f

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta* var. *dissecta (*M.d)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

715000 720000 725000

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MAPSHEET 1

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 1

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Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo subsp. agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta var. dissecta (*M.d)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 2

ONSHORE

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 2

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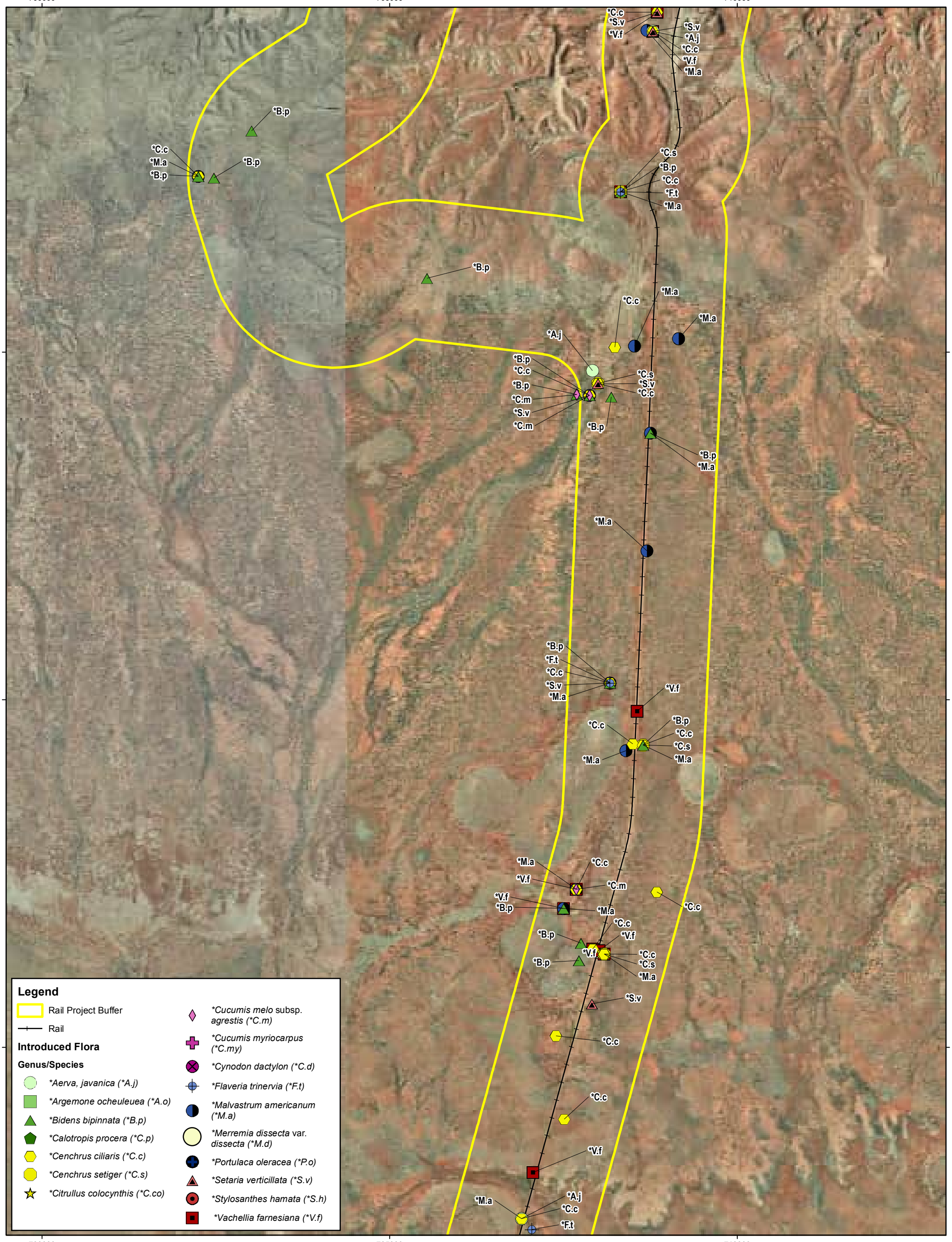

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta* var. *dissecta (*M.d)
- *Portulaca oleracea (*P.o)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 3

ONSHORE

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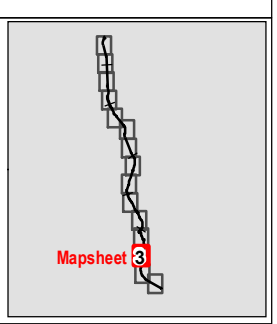

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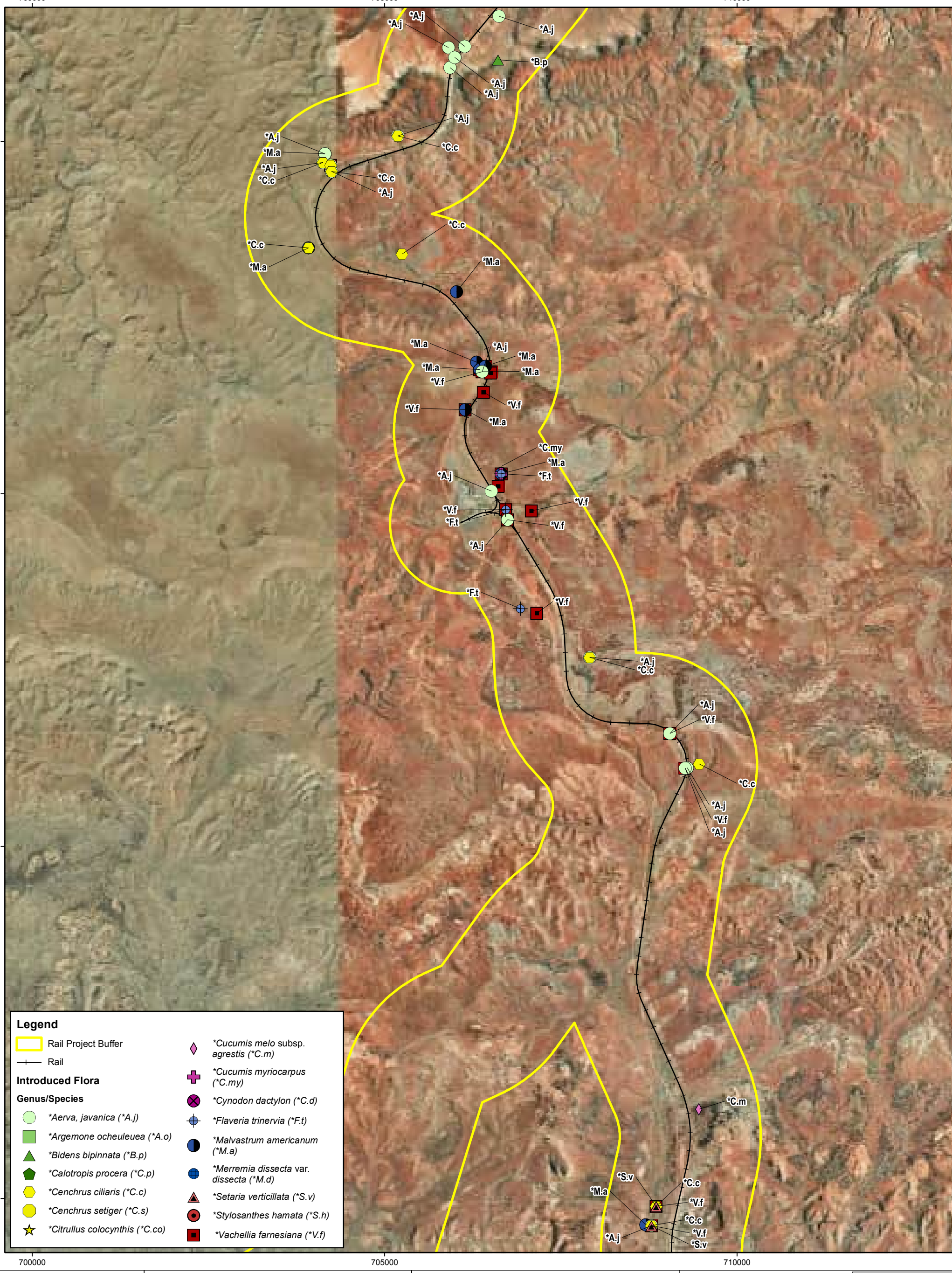

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta* var. *dissecta (*M.d)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 4

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Figure:	8	Date:	20/03/14
Sheet Size:	A3	Status:	Final
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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 4

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7575000 7570000 7565000

*A.j
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*S.v
*C.c
*A.o
*A.j
*A.o
*B.p
*C.c
*C.c
*C.d
*A.j
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*A.j
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*C.c
*A.o
*A.j
*A.j
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*C.c
*V.f
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*A.j
*A.o
*C.d
*A.o
*A.j
*A.j
*C.c
*C.c
*A.j
*A.j
*A.j

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta* var. *dissecta (*M.d)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 5

ONSHORE

Figure:	8	Date:	20/03/2014
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Projection: MGA Zone 50

Mapsheet 5

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Legend

Rail Project Buffer

Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- <ITA>*Merremia dissecta</ITA> var. <ITA>dissecta (*M.d)<ITA>
- *Portulaca oleracea (*P.o)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 6

ONSHORE

Figure:	8	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
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Meters

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 6

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7600000

*C.c
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*C.c
*C.c
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*A.j
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*V.f
*V.f
*M.a
*C.c
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*V.f
*C.c
*A.j
*C.c
*V.f
*C.c
*V.f
*A.o
*C.c
*C.c
*A.o

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo* subsp. *agrestis (*C.m)*
- *Cucumis myriocarpus (*C.my)*
- *Cynodon dactylon (*C.d)*
- *Flaveria trinervia (*F.t)*
- *Malvastrum americanum (*M.a)*
- *Merremia dissecta* var. *dissecta*
- *Setaria verticillata (*S.v)*
- *Stylosanthes hamata (*S.h)*
- *Vachellia farnesiana (*V.f)*

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MAPSHEET 7

ONSHORE

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 7

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*A.j *C.c *C.c *C.c *A.j *C.c *C.c *C.c *C.c *C.c *C.c *C.c *V.f *V.f *C.c *V.f *A.j *V.f *C.c

Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)
- *Argemone ocheuleuea (*A.o)
- *Bidens bipinnata (*B.p)
- *Calotropis procera (*C.p)
- *Cenchrus ciliaris (*C.c)
- *Cenchrus setiger (*C.s)
- *Citrullus colocynthis (*C.co)
- *Cucumis melo subsp. agrestis (*C.m)
- *Cucumis myriocarpus (*C.my)
- *Cynodon dactylon (*C.d)
- *Flaveria trinervia (*F.t)
- *Malvastrum americanum (*M.a)
- *Merremia dissecta var. dissecta(*M.d)
- *Setaria verticillata (*S.v)
- *Stylosanthes hamata (*S.h)
- *Vachellia farnesiana (*V.f)

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MAPSHEET 8

ONSHORE

Figure:	8	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
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Meters

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Legend

- Rail Project Buffer
- Rail

Introduced Flora

Genus/Species

- *Aerva, javanica (*A.j)*
- *Argemone ocheuleuea (*A.o)*
- *Bidens bipinnata (*B.p)*
- *Calotropis procera (*C.p)*
- *Cenchrus ciliaris (*C.c)*
- *Cenchrus setiger (*C.s)*
- *Citrullus colocynthis (*C.co)*
- *Cucumis melo subsp. agrestis (*C.m)*
- *Cucumis myriocarpus (*C.my)*
- *Cynodon dactylon (*C.d)*
- *Flaveria trinervia (*F.t)*
- *Malvastrum americanum (*M.a)*
- *Merremia dissecta var. dissecta (*M.d)*
- *Setaria verticillata (*S.v)*
- *Stylosanthes hamata (*S.h)*
- *Vachellia farnesiana (*V.f)*

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MAPSHEET 9

ONSHORE

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 9

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Legend

Rail Project Buffer

Rail

Introduced Flora

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*Cucumis myriocarpus (*C.my)*

*Cynodon dactylon (*C.d)*

*Flaveria trinervia (*F.t)*

*Malvastrum americanum (*M.a)*

Merremia dissecta var. *dissecta (*M.d)*

*Portulaca oleracea (*P.o)*

*Setaria verticillata (*S.v)*

*Stylosanthes hamata (*S.h)*

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MAPSHEET 10

ONSHORE

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Legend

Rail Project Buffer

Rail

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*Cynodon dactylon (*C.d)

*Flaveria trinervia (*F.t)

*Malvastrum americanum (*M.a)

*Merremia dissecta var. dissecta (*M.d)

*Portulaca oleracea (*P.o)

*Setaria verticillata (*S.v)

*Stylosanthes hamata (*S.h)

*Vachellia farnesiana (*V.f)

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MAPSHEET 11

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 11

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Legend

- Rail Project Buffer
- Rail

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Datum: GDA94
Projection: MGA Zone 50

Mapsheet 12

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Legend

- Rail Project Buffer
- Rail

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MAPSHEET 13

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Projection: MGA Zone 50

Mapsheet 13

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MAPSHEET 14

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Projection: MGA Zone 50

Mapsheet 13

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Legend

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MAPSHEET 15

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Mapsheet 15

3.5 Vegetation

A total of 73 vegetation associations were described and mapped within the study area (Figure 9). The vegetation associations have been classified into 25 Broad Floristic Formations on the basis of the dominant vegetation stratum (Table 10). Raw data is provided in Appendix 10.

Table 10 Vegetation descriptions for 25 vegetation associations mapped within the study area.

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
1a	*Acacia* Low Closed Woodland	Low Closed Woodland of *Acacia citrinoviridis, Acacia pruinocarpa* and *Acacia aptaneura* over Open Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna glutinosa* subsp. *x luerssenii* in brown clay loam on levee banks of major drainage lines	Very Good	Cattle grazing	Alluvial mixed rocks and gravels
1b	*Acacia* Low Closed Woodland	Low Closed Woodland of *Acacia aptaneura* over Very Open Tussock Grassland of *Chrysopogon fallax* and **Cenchrus ciliaris* with Scattered Shrubs of *Psydrax latifolia and Eremophila lanceolata* in red/brown clay loam on plains	Very Good	Grazing, introduced species	Ironstone and chert pebbles and cobbles with red brown clay loam
2a	*Acacia* Low Open Forest	Low Open Forest of *Acacia xiphophylla* and *Acacia aptaneura* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Acacia tetragonophylla* and *Acacia synchronicia* over Very Open Tussock Grassland of *Chrysopogon fallax, Aristida contorta* and *Sporobolus australasicus* in red brown sandy clay loam on stony plains	Good- Very Good	Livestock, fence disturbance, rail line, access tracks, fauna pit traps, introduced species	Ironstone and chert cobbles and pebbles
2b	*Acacia* Low Open Forest	Low Open Forest of *Acacia aptaneura, Acacia aneura x ayersiana* and *Acacia pruinocarpa* over Hummock Grassland of *Triodia epactia* and *Triodia* sp. Shovelanna Hill with Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Grevillea berryana* and *Dodonaea petiolaris* in red/brown loamy sand on stony plains	Excellent	Minor grazing, fence line and track nearby	Ironstone and chert dense pebbley scree
2c	*Acacia* Low Open Forest	Low Open Forest of *Acacia xiphophylla* over Low Scattered Shrubs of *Senna glutinosa* subsp. *glutinosa, Streptoglossa bubakii* and *Senna glaucifolia* over Scattered Tussock Grasses of *Astrebla pectinata, Eriachne obtusa* and *Eragrostis xerophila* in red brown medium clay on basalt plains	Very Good	Livestock, tracks, rail line	Basalt pebbles, cobbles and boulders

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
3	*Melaleuca* Low Woodland	Low Woodland of *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Acacia trachycarpa, Melaleuca glomerata* and *Acacia coriacea* subsp. *pendens* over Very Open Sedges of *Cyperus vaginatus* in brown sand along major drainage lines	Good - Very Good	Rail line, livestock, access tracks, introduced species, fire	Mixed alluvials, chert, ironstone, quartz and granite, pebbles, cobbles and gravels with brown sand
4a	*Eucalyptus* Low Woodland	Low Woodland of *Eucalyptus victrix* and *Acacia corriacea* subsp. *pendens* over Shrubland of *Acacia trachycarpa* and *Acacia pyrifolia* var. *pyrifolia* over Open Hummock Grassland of *Triodia epactia* in orange brown loamy sand along minor and medium drainage lines	Good- Very Good	Heavy cattle grazing, rial line, access track, introduced species, livestock	Alluvia granite, quartz and other mixed rocks, gravels, boulders, cobbles and pebbles
4b	*Eucalyptus* Low Woodland	Low Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over High Shrubland of *Acacia tumida* var. *pilbarensis, Acacia trachycarpa* and *Grevillea wickhamii* over Shrubland of *Cajanus cinereus* over Open Tussock Grassland of C*hrysopogon fallax, Heteropogon contortus* and *Eulalia aurea* in red brown silty loam along minor drainage lines	Very Good	Rail line, access tracks, livestock, introduced species	Quartz/Ironstone/Granite scattered pebbles with red brown silty loam
5a	*Corymbia* Low Woodland	Low Woodland of *Corymbia hamersleyana* and *Eucalyptus victrix* over Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Cajanus cinereus* over Very Open Tussock Grassland of *Chrysopogon fallax* in red/brown silty loam along major drainage lines	Very Good	Grazing, weeds	Mixed alluvials, chert, ironstone, quartz and granite, pebbles, cobbles and gravels with brown sand
5b	*Corymbia* Low Woodland	Low Woodland of *Corymbia candida* and *Corymbia aspera* over Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* over Open Hummock Grassland of *Triodia pungens* (and Very Open Tussock Grassland of **Cenchrus ciliaris* and *Chryopogon fallax)* in brown loamy sand on floodplains	Very Good	Tracks, rail line, livestock, introduced species	Brown loamy sand

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
6a	*Acacia* Low Woodland	Low Woodland of *Acacia paraneura, Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris* in red/brown sandy clay loam on plains and floodplains	Degraded - Excellent	Introduced species, livestock, rail line, tracks, water point, fence line, grazing, creek diversion	Ironstone pebbles and fine scree with red brown sandy clay loam
6b	Acacia Low Woodland	Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Tussock Grassland of *Aristida inaequiglumis, Chrysopogon fallax* and **Cenchrus ciliaris* with Open Shrubland of *Dodonea petiolaris* and *Eremophila forrestii* subsp. *forrestii* in red sandy loam on plains	Good -Excellent	Introduced species, livestock, fence lines, rail line, access, pipeline	Ironstone pebbles and cobbles
7	*Eucalyptus* Low Open Woodland	Low Open Woodland of *Eucalyptus victrix* over Low Open Shrubland of *Pluchea rubelliflora, Pluchea ferdinandi-muelleri* and *Atriplex bunburyana* with Scattered Tussock Grasses of *Eragrostis cumingii* in brown silty clay loam on drainage depressions	Good	Fire, Inundation, cattle, camels, track nearby, weeds	Silcrete/ Quartz (very scattered pebbles & cobbles)
8	*Acacia* Low Open Woodland	Low Open Woodland of *Acacia xiphophylla* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata, Maireana triptera* and *Sclerolaena cuneata* in red brown sandy clay loam on plains	Degraded - Very Good	Ironstone and silcrete scattered cobbles and pebbles with red brown sandy clay loam	Ironstone and silcrete scattered cobbles and pebbles with red brown sandy clay loam
9	*Acacia* Open Scrub	Open Scrub of *Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa* and *Acacia colei* var. *colei* over Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along minor and medium drainage lines	Very Good	Tracks, livestock, introduced species	Brown sandy loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
10a	*Acacia* High Shrubland	High Shrubland of *Acacia ampliceps, Acacia trachycarpa* and *Acacia coriacea* subsp. *pendens* over Open Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* with Very Open Sedges of *Cyperus vaginatus* in brown sand along medium drainage lines	Very Good	Livestock, flooding, introduced species, rail line nearby	Scattered riverine and granite gravel and pebbles
10b	*Acacia* High Shrubland	High Shrubland of *Acacia colei* var. *colei, Acacia bivenosa* and *Acacia tumida* var. *pilbarensis* over Open Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps, Pluchea ferdinandi-muelleri* and *Pluchea tetranthera* in orange sand on minor drainage lines and floodplains	Good - Very Good	Introduced species, rail line, livestock, flooding	Quartz, granite and mixed alluvial rock cobbles, pebbles and boulders with brown/red/orange sand
11	*Acacia* High Open Shrubland	High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* over Very Open Hummock Grassland of *Triodia epactia* and Very Open Tussock Grassland of *Tripogon loliiformis, Aristida contorta* and *Sporobolus australasicus* (with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda)* in skeletal brown sandy loam on granite plateaux / sheet outcrops	Very Good	Livestock, rail line, access tracks, quarry nearby, rubbish	Quartz and granite cobbles, pebbles, outcrops, flakes and boulders with brown sandy loam
12a	*Acacia* Low Open Heath	Low Open Heath of *Acacia stellaticeps* with High Shrubland of *Acacia trachycarpa* and *Hakea lorea* subsp. *lorea* and Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* in orange brown sand on floodplains	Very Good	Livestock, introduced species	Orange brown sand
12b	*Acacia* Low Open Heath	Low Open Heath of *Acacia stellaticeps* over Hummock Grassland of *Triodia schinzii* with High Open Shrubland of *Acacia tumida* var. *pilbarensis, Acacia colei* var. *colei* and *Melaleuca lasiandra* in red brown loamy sand on sandplains	Good - Very Good	Rail line, landfill, tracks, introduced species, livestock	Red brown loamy sand
12c	*Acacia* Low Open Heath	Low Open Heath of *Acacia bivenosa* and *Acacia synchronicia* over Hummock Grassland of *Triodia secunda, Triodia angusta* and *Triodia basedowii* in brown sandy loam on stony lower slopes and plains	Very Good	Rail line, access tracks	Brown sandy loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
13	*Tecticornia* Low Open Heath	Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia indica* subsp. *bidens* and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis* in brown medium clay on saline flats and marsh	Excellent- Very Good	Rail line, sccess track weeds, survey marker, fire grazing	Calcrete- scattered cobbles and pebbles, grey dolomite
14	*Pluchea* Low Shrubland	Low Shrubland of *Pluchea ferdinandi-muelleri, Pluchea rubelliflora* and *Carrissa lanceolata* over Open Hummock Grassland of *Triodia angusta* and Very Open Tussock Grassland of *Sporobolus australasicus, Chloris pectinata* and *Panicum decompositum* in grey medium clay on crusting plains	Good	Rail line, tracks, livestock	Mudstone pebbles and gravels with grey medium clay
15	*Maireana* Low Open Shrubland	Low Open Shrubland of *Maireana triptera, Ptilotus obovatus* and *Sclerolaena cuneata* with Scattered Low Trees of *Acacia xiphophylla* and *Acacia synchronicia* and Scattered Tussock Grasses of *Aristida inaequiglumis* and **Cenchrus ciliaris* in red sandy clay loam on wind scalded plains	Very Good	Livestock, rail line, fence line, introduced species	Ironstone pebbles and cobbles with red sandy clay loam
16a	*Triodia* Closed Hummock Grassland	Closed Hummock Grassland of *Triodia longiceps* and *Triodia pungens* with Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia bivenosa* and *Melaleuca glomerata* in brown sandy clay loam on undulating plains	Very Good-Excellent	Introduced species, rail line, access tracks, fenceline	Silcrete, quartz, calcrete and ironstone pebbles
16b	*Triodia* Closed Hummock Grassland	Closed Hummock Grassland of *Triodia basedowii* and *Triodia longiceps* with High Shrubland of *Acacia synchronicia, Acacia sclerosperma* and *Eremophila longifolia* and Low Open Woodland of *Acacia aptaneura* in red brown clay loam on plains	Very Good	Rail line, introduced species, access track, fence line	Very scattered ironstone pebbles and gravels with red brown clay loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
17a	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* over Low Shrubland of *Acacia arrecta, Acacia sibirica* and *Acacia bivenosa* in red loamy sand on hill slopes with Low Open Woodland of *Acacia rhodophloia, Acacia pruinocarpa* and *Acacia aptaneura* on rocky hill crests	Excellent- Very Good	Borrow pits, introduced species, rail line, access road nearby, fire, minor grazing	Dolerite, chert, silcrete pebbles, scree, cobbles and outcrops
17aa	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia secunda* and *Triodia longiceps* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in orange sandy clay loam on plains and floodplains	Very Good - Excellent	Rail line, access tracks, fire, bores, soil disturbance, litter, livestock, weeds	Quartz and granite cobbles and pebbles with orange brown sandy clay loam
17b	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia brizoides*, *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia acradenia* in brown silty loam on hill slopes	Very Good	Rail line, access tracks nearby	Milky silcrete outcrops, cobbles and pebbles with brown silty loam
17c	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia brizoides* and *Triodia wiseana* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Low Shrubs of *Acacia bivenosa, Ptilotus obovatus* and *Senna glutinosa* subsp. *glutinosa* in brown silty loam on scree slopes	Very Good	Fire, rail line, access road, earthworks	Shale and ironstone cobbles, pebbles and outcropping
17d	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* and *Grevillea berryana* over Low Open Shrubland of *Gompholobium oreophilum* in sandy clay loam on drainage depressions	Good- Very Good	Fire, rail line, access tracks	Ironstone, quartz, chert pebbles and cobbles
17e	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Hakea lorea* subsp. *lorea, Acacia ancistrocarpa* and *Acacia inaequilatera* and Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* and *Corymbia hamersleyana* in red sand on plains	Excellent- Very Good	Rail line, access road nearby, fire, fence line, livestock	Ironstone fine scree and pebbles with red sand

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
17f	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia wanyu, Acacia ancistrocarpa* and *Acacia inaequilatera* in orange/red/brown silty loam on stony plains	Excellent- Very Good	Rail line, access tracks, fenceline, fire	Ironstone/chert cobbles and pebbles with orange red brown silty loam
17g	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii* with Scattered Tall Trees of *Acacia aptaneura* and *Acacia pruinocarpa* over High Open Shrubland of *Acacia ancistrocarpa* in red sand on plains	Very Good	Grazing, introduced species, rail line, access tracks nearby	Ironstone very fine gravvelly scree
17h	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia basedowii, Triodia epactia, Triodia wiseana* and *Triodia basedowii* over High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* and *Grevillea wickhamii* over Low Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia acradenia* (and Scattered Low Trees of *Corymbia hamersleyana)* in red brown silty/sandy loam on undulating low hills and stony plains	Very Good	Livestock, access tracks, weeds, old borrow pits	Quartz, calcrete, ironstone, mudstone, chert and granite pebbles, cobbles and outcrops with red brown silty sandy loam
17i	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps* in red/orange sandy loam on sandy plains	Excellent - Very Good	Rail line, access tracks, fence line, livestock, quarry, dam nearby, fire	Ironstone, quartz and granite cobbles and pebbles with orange red sandy loam
17j	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Acacia ancistrocarpa* and *Acacia bivenosa* in orange loamy sand on sandy plains	Very Good	Rail line, livestock, access tracks, quarrys, fence lines	Quartz and granite cobbles, pebbles and gravels with red/orange/brown loamy sand

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
17k	*Triodia* Hummock Grassland	Hummock Grassland of *Trioida lanigera, Triodia wiseana* and *Triodia epactia* with High Shrubland of *Acacia sericophylla, Acacia tumida* var. *pilbarensis, Acacia eriopoda* and *Acacia colei* in swales with High Open Shrubland of *Acacia inaequilatera* and *Acacia orthocarpa* on rises in red brown silty clay/sandy loam on undulating hills and swales	Excellent - Very Good	Rail line, fire, livestock, access track	Quartz, silcrete and granite pebbles cobbles and granite with orange/red/brown loamy sand
17l	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia longiceps* and *Tridoia epactia* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains	Very Good	Rail line, livestock, access road, introduced species, rubbish, fire, dam, solar equipment	Quartz, calcrete and granite cobbles, pebbles and gravel brown sandy clay loam
17m	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia longiceps* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia ancistrocarpa* and *Acacia acradenia in* brown loamy sand in minor drainage lines	Very Good	Rail, access tracks, introduced species	Granite, quartz and calcrete
17n	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with High Shrubland of *Petalostylis labicheoides, Acacia maitlandii* and *Acacia tumida* var. *pilbarensis* and Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along drainage lines and on floodplains	Very Good-Excellent	Access tracks, rail line, fire, minor grazing	Ironstone and alluvial pebbles and bobbles
17o	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia arrecta* in brown sandy loam on low undulating hills	Very Good-Excellent	Rail line, access tracks, introduced species, earthworks	Granite/ironstone cobbles and pebbles with brown sandy loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
17p	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia, Triodia basedowii* and *Triodia wiseana* with High Open Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills	Very Good-Excellent	Rail line, access tracks, introduced species, livestock, fire, rubbish	Granite and quartz, cobbles, pebbles, gravels and outcrops with brown loamy sand
17q	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* and *Trioida lanigera* with Open Shrubland of *Acacia robeorum, Acacia inaequilatera* and *Acacia bivenosa* in brown sandy loam on low dolerite/basalt hills	Very Good	Rehabilitation, ripping, introduced species	Dolerite and quartz pebbles, cobbles and gravels and red/brown sandy loam
17r	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon dioicum* ms and *Cajanus cinereus* and Scattered Tall Shrubs of *Grevillea wickhamii* in brown silty loam on dolerite ridges	Excellent	Rail line nearby, radio repeater tower nearby, introduced species	Dolerite outcropping, cobbles and bounders with brown silty loam
17s	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia inaequilatera* over Open Tussock Grassland of *Aristida contorta* in red brown sandy clay loam on raised plains and quartz hills	Very Good	Rail line, access tracks	Quartz pebbles and cobbles with brown sandy clay loam
17t	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* in red brown sandy loam on granite and quartz hill slopes and footslopes	Very Good-Excellent	Rail line, access tracks, quarry, rubbish, introduced species, livestock	Granite, quartz, dolerite, basalt and calcrete cobbles, pebbles and outcrops
17u	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens, Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over Scattered Tall Shrubs of *Acacia inaequilatera* in brown sandy clay loam on dolerite hill slopes	Very Good-Excellent	Rail line, tracks, fire, access tracks, introduced species	Dolerite - slate, pebbles, cobbles and outcropps

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
17v	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* with Low Shrubland of *Indigofera rugosa* and Scattered Low Trees of *Grevillea pyramidalis* in brown sandy loam on quartz and granite hill slopes	Very Good	Rail line, access track nearby	Granite and quartz with brown sandy loam
17w	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* (and Very Open Tussock Grassland of **Cenchrus ciliaris)* in red/brown loamy sand on levee banks and floodplains	Very Good	Access tracks, rail line, introduced species, fire	Mixed cobbles and pebbles with orange/red brown loamy sand
17x	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* with High Open Shrubland of *Acacia aptaneura* and *Grevillea berryana* over Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* in brown loamy sand on low undulating chert hills	Very Good	Rail line, fence line, access track, fire	Ironstone - pebbles & cobbles, scattered quartz
17y	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with High Open Shrubland of *Acacia colei* var. *colei* and *Acacia inaequilatera* over Shrubland of *Acacia colei* var. *colei* and *Acacia ancistrocarpa* in red brown sandy loam on plains	Very Good	Livestock, rail line, access tracks, quarry nearby, rail yards	Quartz, granite, chert and ironstone pebbles, outcrops and cobbles with red brown sandy loam
17z	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia pungens* with Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* in grey brown sandy loam on sandy plain	Very Good	Rail line, tracks, introduced species	Grey brown sandy loam
18a	*Triodia* Open Hummock Grassland	Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia atkinsiana, Acacia marramamba* and *Acacia maitlandii* in brown sandy loam on hill crests and hill slopes	Very Good-Excellent	Fence line, rail line, access tracks, fire, donkeys	Ironstone pebbles, cobbles and outcropping

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
18b	*Triodia* Open Hummock Grassland	Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* and *Corymbia hamersleyana* over Open Shrubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in brown sandy loam on hill slopes and hill crests	Very Good-Excellent	Fire, rail line, access tracks	Ironstone - cobbles & pebbles, Mudstone - pebbles, cobbles, outcropping Metamorphosed sandstone? (purple/grey) - cobbles, pebbles, outcrops
18c	Triodia Open Hummock Grassland	Open Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon dioicum* ms, *Triumfetta maconochieana* and *Cajanus cinereus* over Very Open Tussock Grassland of *Paspaidium clementii* and **Cenchrus ciliaris* in skeletal brown loamy sand on granite rockpiles	Very Good	Fore, introduced species	Granite outcrops, boulders, pebbles and cobbles with skeletal brown loamy sand
18d	*Triodia* Open Hummock Grassland	Open Hummock Grassland of *Triodia epactia* and *Trioida basedowii* with Scattered Low Trees of *Corymbia hamersleyana* over Open Shrubland of *Cajanus cinereus* and *Acacia pyrifolia* var. *pyrifolia* in red sandy loam in minor drainge lines	Very Good	Livestock, rail line, access track	Granite/calcrete - outcrops and scattered cobbles with red sandy loam
18e	*Triodia* Open Hummock Grassland	Open Hummock Grassland *of Triodia lanigera* with Low Open Woodland of *Corymbia zygophylla* and *Corymbia hamersleyana* over Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Isotropis atropurpurea, Indigofera monophylla* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) in orange red loamy sand on sand plains	Very Good	Rail line, access track, livestock, fire	Scattered quartz cobbles and pebbles with orange/red loamy sand
19	*Cenchrus* Closed Tussock Grassland	Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Woodland of *Corymbia hamersleyana* and *Acacia aptaneura* and Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia ancistrocarpa* in red brown silty loam on floodplains	Good - Degraded	Introduced species, grazing by livestock, old windmill, tracks, rail line	Red brown silty loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
20	*Astrebla/Eragrostis* Tussock Grassland	Tussock Grassland of *Astrebla pectinata, Aristida inaequiglumis* and *Sporobolus australasicus* with Low Open Shrubland of *Sida fibulifera, Corchorus trilocularis* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) and Open Herbs of *Operculina aequisepala* in brown medium clay on basalt plains	Good	Grazing, rail line, access track, livestock, weeds, quarry	Basalt pebbles, cobbles and boulders
21	*Cenchrus* Tussock Grassland	Tussock Grassland of **Cenchrus ciliaris* and *Eulalia aurea* with Low Open Woodland of *Corymbia aspera* and *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia tumida* var. *pilbarensis* and *Acacia sclerosperma* in brown sandy loam on major drainage lines	Good	Introduced species, rail line, access tracks, fire	Brown sandy loam
22a	*Eriachne* Tussock Grassland	Tussock Grassland of *Eriachne benthamii* and *Eriachne flaccida* with Low Woodland of *Eucalyptus victrix* over Hummock Grassland of *Triodia epactia* in brown grey silty loam in drainage depressions	Very Good	Rail line, livestock, tracks, introduced species	Brown grey silty loam
22b	*Eriachne* Tussock Grassland	Tussock Grassland of *Eriachne benthamii* and *Eulalia aurea* with High Open Shrubland of *Hakea lorea* subsp. *lorea* over Open Shrubland of *Acacia colei* var. *colei* in brown medium clay on clay plains	Very Good	Access track, rail line	Brown medium clay
23	Chrysopogon Open Tussock Grassland	Open Tussock Grassland of *Chrysopogon fallax, Eulalia aurea* and *Eriachne obtusa* with Low Open Woodland of *Corymbia hamersleyana* and *Corymbia candida* over High Open Shrubland of *Grevillea wickhamii* and *Cajanus cinereus* in red silty loam on floodplains	Very Good	Rail line, access tracks, livestock, weeds	Quartz, ironstone and granite scattered cobbles and pebbles with red silty loam
24	*Eriachne* Open Tussock Grassland	Open Tussock Grassland of *Eriachne benthamii, Eriachne flaccida* and *Chrysopogon fallax* with Scattered Low Trees of *Corymbia aspera* over High Open Shrubland of *Acacia trachycarpa* and *Acacia colei* var. *colei* in brown loamy sand along minor drainage lines	Very Good	Rail line, access tracks, introduced species	Brown loamy sand

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
25	*Eulalia* Open Tussock Grassland	Open Tussock Grassland of *Eulalia aurea* and *Themeda triandra* with Low Open Woodland of *Acacia coriacea* subsp. *pendens* and *Acacia xiphophylla* over Open Shrubland of *Acacia coriacea* subsp. *pendens, Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* in red brown clay on floodplains	Very Good	Introduced species, rail line, access track	Riverine gravel and ironstone
M1	Mosaic: Acacia Low Open Woodland/ Triodia Closed Hummock Grassland	Mosaic: Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronica* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata;* Closed Hummock Grassland of *Triodia angusta* in red brown sandy clay loam on undulating plains	Very Good	Fire, livestock, introduced species, tracks	Red brown sandy clay loam
M2	Mosaic: *Triodia* Hummock Grassland	Mosaic: Hummock Grassland of *Triodia secunda* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps* over Scattered Tussock Grasses of *Sporobolus australasicus;* Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera, Acacia ancistrocarpa* and *Acacia colei* var. *colei* in red/orange silty/sandy clay loam on plains	Very Good	Rail line, access tracks, fence lines, fire, introduced species	Granite and Quartz; pebbles and cobbles
M3	Mosaic: Acacia Low Open Woodland/ Acacia Low Woodland	Mosaic: Low Woodland of *Acacia paraneura, Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris;* Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata, Maireana triptera* and *Sclerolaena cuneata* in red loamy sand on plains	Very Good	Introduced species, rail line, access tracks	Ironstone/chert- pebbly scree with red loamy sand

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
M4	Mosaic: Triodia Open Hummock Grassland/ Triodia Hummock Grassland	Mosaic: Open Hummock Grassland of *Triodia lanigera, Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Low Open Shrubland of *Acacia atkinsiana* and *Acacia bivenos*a in brown sandy loam on hill crests and hill slopes; Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* in brown sandy clay loam in drainage basins and on plains	Very Good	Fire, rail line, access track nearby	Ironstone, dolerite and quartz pebbles and cobbles
M5	*Mosaic: Triodia* Hummock Grassland / Acacia High Open Shrubland	Mosaic: Hummock Grassland of *Triodia epactia, Triodia basedowii* and *Trioida wiseana* with High Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis, Aristida contorta* and *Sporobolus australasicus* in skeletal brown sandy loam on granite plateau / sheet outcrops	Very Good	Access track, rail line, livestock, rubbish, introduced species, fire	Granite sheets, outcrops, flakes, pebbles and cobbles with skeletal brown sandy loam
M6	Mosaic: *Triodia* Hummock Grassland/ Acacia High Open Shrubland	Mosaic: Hummock Grassland of *Triodia longiceps, Triodia angusta* and *Triodia wiseana* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis* in skeletal brown sandy loam on granite plateau / sheet outcrops	Good - Very Good	Rail line, livestock, access tracks, man made rock piles, introduced species	Granite and quartz slabs, outcrops, pebbles and cobbles with orange brown sandy loam

Code	Broad Floristic Formation	Vegetation Association Description	Condition	Disturbances	Surface Geology
M7	Mosaic: *Triodia* Hummock Grassland/Acacia High Open Shrubland	Mosaic: Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps;* High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* (and Very Open Tussock Grassland of *Tripogon loliiformis*) in orange loamy sand on undulating granitic plains with granitic outcrops	Very Good	Access tracks, livestock, rail line, introduced species	Granite/quartz - outcrops, cobbles and pebbles with orange loamy sand

Broad Floristic Formation	1a. *Acacia* Low Closed Woodland
Vegetation Association	Low Closed Woodland of *Acacia citrinoviridis, Acacia pruinocarpa* and *Acacia aptaneura* over Open Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna glutinosa* subsp. *x luerssenii* in brown clay loam on levee banks of major drainage lines

Area Mapped	43.32 ha
Quadrats Sampled	ME48
Location	Map 11- 13
Leaf Litter Cover (%)	90
Bare Ground (%)	15
Soils and Geology	Alluvial mixed rocks and gravels with brown clay loam
Land Form	Levee banks of major drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Bidens bipinnata, *Malvastrum americanum, *Setaria verticillata, *Cucumis melo* subsp. *agrestis*, **Portulaca oleracea*
Vegetation Condition	Very Good
Disturbances	Cattle grazing, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia citrinoviridis, Acacia aptaneura, Acacia pruinocarpa, Acacia distans*, *Ehretia saligna*
Shrubs <1m	*Senna artemisioides* subsp. *helmsii, Senna glutinosa* subsp. x *luerssenii*
Tussock Grasses	**Cenchrus ciliaris*
Herbs	**Bidens bipinnata, *Malvastrum americanum*

Broad Floristic Formation	1b. *Acacia* Low Closed Woodland
Vegetation Association	Low Closed Woodland of *Acacia aptaneura* over Very Open Tussock Grassland of *Chrysopogon fallax* and **Cenchrus ciliaris* with Scattered Shrubs of *Psydrax latifolia and Eremophila lanceolata* in red/brown clay loam on plains
	
Area Mapped	102.12 ha
Quadrats Sampled	PME04, EMES2-14, H058, ME68
Location	Maps 7-15
Leaf Litter Cover (%)	10
Bare Ground (%)	15
Soils and Geology	Ironstone and chert pebbles and cobbles with red brown clay loam
Land Form	Plains and floodplains
Priority Ecological Community	No
Rare Flora	None
Introduced (Weed) Species	**Cucumis melo* subsp. *agrestis*, **Cenchrus ciliaris, *Malvastrum americanum*
Vegetation Condition	Very Good
Disturbances	Grazed, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura*, *Acacia pruinocarpa, Acacia ayersiana, Acacia catenulate* subsp. *occidentalis, Acacia aneura*
	Acacia adsurgens,
Shrubs <1m	*Eremophila forrestii* subsp. *forrestii, Psydrax latifolia, Eremophila lanceolata, Ptilotus obovatus, Sida* aff. *fibulifera, Sida* sp. verrucose glands (F.H. Mollemans 2423), *Sida* sp. dark green fruits (S. Van leeuwen 2260)
Hummock Grasses	*Triodia pungens, Triodia basedowii*
Tussock Grasses	*Chrysopogon fallax, *Cenchrus ciliaris*

Broad Floristic Formation	2a. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia xiphophylla* and *Acacia aptaneura* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Acacia tetragonophylla* and *Acacia synchronicia* over Very Open Tussock Grassland of *Chrysopogon fallax, Aristida contorta* and *Sporobolus australasicus* in red brown sandy clay loam on stony plains

Area Mapped	1,701.40 ha
Quadrats Sampled	FMG017, FMG018, FMG019, FMG054, FMG055, FMG072, H234, H245, H256, ME43, ME45, ME46, ME47, ME49
Location	Maps 9-12
Leaf Litter Cover (%)	2-15
Bare Ground (%)	15
Soils and Geology	Ironstone and chert cobbles and pebbles with red brown sandy clay loam
Land Form	Stony plains
Priority Ecological Community	None
Rare Flora	*Themeda* sp. Hamersley Station (M.E. Trudgen 11601)
Introduced (Weed) Species	**Vachellia farnesiana, *Cenchrus ciliaris, *Setaria verticillata, *Malvastrum americanum, *Bidens bipinnata*
Vegetation Condition	Good - Very Good
Disturbances	Livestock, fences, rail line, access tracks, introduced weeds
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Acacia xiphophylla, Acacia aptaneura*
Tall Shrubs >2m	*Acacia victoriae, Acacia paraneura*
Shrubs 1-2m	*Rhagodia eremaea, Eremophila forrestii* subsp. *forrestii, Acacia tetragonophylla, Acacia synchronicia, Acacia adsurgens, Dodonaea petiolaris*
Shrubs <1m	*Senna glaucifolia, Senna oligophylla* subsp. *x helmsii, Corchorus tridens, Pterocaulon sphaeranthoides*
Tussock Grasses	*Sporobolus australasicus, Aristida contorta, Chrysopogon fallax, *Cenchrus ciliaris, Eragrostis xerophila, Eriachne benthamii, Eulalia aurea, Aristida latifolia, Eriachne pulchella, Eragrostis tenellula, Enneapogon polyphyllus, Dichanthium sericeum* subsp. *humilis, Enneapogon caerulescens, Digitaria ctenantha, Themeda* sp. Hamersley Station (M.E. Trudgen 11431)
Sedges	*Bulbostylis barbata*
Herbs	*Cleome viscosa, Boerhavia coccinea, Blumea tenella*

Broad Floristic Formation	2b. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia aptaneura, Acacia aneura x ayersiana* and *Acacia pruinocarpa* over Hummock Grassland of *Triodia epactia* and *Triodia* sp. Shovelanna Hill with Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Grevillea berryana* and *Dodonaea petiolaris* in red/brown loamy sand on stony plains

Area Mapped	354.25 ha
Quadrats Sampled	ME52, ME54, PME07, PME06, EMES2.37, EMES2.39, H244, JBME41
Location	Maps 11-13
Leaf Litter Cover (%)	5
Bare Ground (%)	20
Soils and Geology	Ironstone and chert dense pebbly scree with red brown loamy sand
Land Form	Stony plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent
Disturbances	Minor grazing, fence line and track nearby
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Acacia aneura x ayersiana, Acacia macraneura, Acacia pruinocarpa, Acacia ayersiana*
Shrubs 1-2m	*Eremophila forrestii* subsp. *forrestii, Grevillea berryana, Dodonaea petiolaris, Psydrax latifolia, Acacia atkinsiana*
Hummock Grassland	*Triodia* sp. Shovelanna Hill, *Triodia pungens, Triodia basedowii*

Broad Floristic Formation	2c. *Acacia* Low Open Forest
Vegetation Association	Low Open Forest of *Acacia xiphophylla* over Low Scattered Shrubs of *Senna glutinosa* subsp. *glutinosa, Streptoglossa bubakii* and *Senna glaucifolia* over Scattered Tussock Grasses of *Astrebla pectinata, Eriachne obtusa* and *Eragrostis xerophila* in red brown medium clay on basalt plains

Area Mapped	164.09 ha
Quadrats Sampled	ME80, EMES2-66, FMGKF, FMGKH
Location	Maps 16 and 17
Leaf Litter Cover (%)	20
Bare Ground (%)	20
Soils and Geology	Basalt pebbles, cobbles and boulders with red brown medium clay
Land Form	Basalt plains
Priority Ecological Community	No (adjacent to Wona Land System - Mitchell Grass plains *(Astrebla* spp.) on gilgai Priority 3(iii) PEC)
Rare Flora	None
Introduced (Weed) Species	**Aerva javanica, *Cenchrus ciliaris, *Vachellia farnesiana*
Vegetation Condition	Very Good
Disturbances	Livestock, tracks, rail line, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia xiphophylla,*
Shrubs <1m	*Senna glutinosa* subsp. *glutinosa, Senna glaucifolia, Streptoglossa bubakii, Senna artemisioides* subsp. *helmsii, Senna artemisioides* subsp. *oligophylla, Sida fibulifera, Corchorus tridens*
Tussock Grasses	*Astrebla pectinata, Eriachne obtusa, Eragrostis xerophila, Aristida inaequiglumis, Eriachne benthamii*

Broad Floristic Formation	3. *Melaleuca* Low Woodland
Vegetation Association	Low Woodland of *Melaleuca argentea, Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Acacia trachycarpa, Melaleuca glomerata* and *Acacia coriacea* subsp. *pendens* over Very Open Sedges of *Cyperus vaginatus* in brown sand along major drainage lines

Area Mapped	1,577.22 ha
Quadrats Sampled	EMES2-118, EMES2-93, H077, JBME119, JME269, JME277, JME79, ME101, ME112, ME139, ME143, ME157, ME179, ME82, PME122, PME123, PME41, PME43, PME87
Location	In major drainage lines throughout the Study area.
Leaf Litter Cover (%)	Maps 1-15
Bare Ground (%)	15
Soils and Geology	Mixed alluvials, chert, ironstone, quartz and granite, pebbles, cobbles and gravels with brown sand
Land Form	Major drainage lines
Priority Ecological Community	None
Rare Flora	*Gymnanthera cunninghamii*
Introduced (Weed) Species	**Cenchrus ciliaris, *Argemone ochroleuca, *Cenchrus setiger, *Bidens bipinnata, *Aerva javanica, *Flaveria trinervia*
Vegetation Condition	Good - Very Good
Disturbances	Rail line, livestock, access tracks, introduced species, fire
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Melaleuca argentea, Eucalyptus camaldulensis* subsp. *refulgens, Eucalyptus victrix, Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia tumida* var. *pilbarensis, Acacia trachycarpa, Melaleuca glomerata, Melaleuca linophylla, Grevillea wickhamii, Petalostylis labicheoides, Acacia ampliceps, Atalaya hemiglauca, Acacia acradenia, Acacia coriacea* subsp. *coriacea, Melaleuca linophylla, Acacia eriopoda*
Shrubs <1m	*Pluchea rubelliflora, Corchorus crozophorifolius, Pluchea ferdinandi-muelleri, Corchorus parviflorus, Acacia stellaticeps*
Hummock Grasses	*Triodia longiceps, Triodia epactia, Triodia angusta, Triodia pungens*
Tussock Grasses	**Cenchrus ciliaris, Eriachne festucacea, Leptochloa fusca* subsp. *fusca, Eulalia aurea, Chrysopogon fallax, Sporobolus actinocladus, Eriachne benthamii, *Cenchrus setiger, Heteropogon contortus*
Sedges	*Cyperus vaginatus, Typha domingensis*
Herbs	*Stemodia grossa, Wahlenbergia tumidifructa*

Broad Floristic Formation	4a. *Eucalyptus* Low Woodland
Vegetation Association	Low Woodland of *Eucalyptus victrix* and *Acacia coriacea* subsp. *pendens* over Shrubland of *Acacia trachycarpa* and *Acacia pyrifolia* var. *pyrifolia* over Open Hummock Grassland of *Triodia epactia* in orange brown loamy sand along minor and medium drainage lines
	
Area Mapped	929.31 ha
Quadrats Sampled	DME12, EMES2-59, EMES2-65, EMES2-70, FMG023, FMG024, FMG074, FMGBG, JBME106, JBME26, JME111, JME117, JME121, JME124, JME222, JME223, JME256, JME86, ME50, ME64, ME77, ME97, PME27, PME34
Location	Drainage lines on maps 11-42
Leaf Litter Cover (%)	<10
Bare Ground (%)	30
Soils and Geology	Alluvia granite, quartz and other mixed rocks, gravels, boulders, cobbles and pebbles with brown loamy sand
Land Form	Medium and minor drainage lines
Priority Ecological Community	None
Rare Flora	*Goodenia nuda*
Introduced (Weed) Species	**Cynodon dactylon, *Cenchrus ciliaris, *Flaveria trinervia, *Vachellia farnesiana, *Aerva javanica*
Vegetation Condition	Good- Very Good
Disturbances	Heavy cattle grazing, rail line, access track, introduced species, livestock,
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus victrix, Acacia coriacea* subsp. *pendens, Atalaya hemiglauca, Corymbia hamersleyana*
Shrubs >2m	*Acacia citrinoviridis, Petalostylis labicheoides, Acacia tumida* var. *pilbarensis, Melaleuca glomerata, Melaleuca linophylla*
Tall Shrubs 1-2m	*Acacia trachycarpa, Acacia pyrifolia* var. *pyrifolia, Petalostylis labicheoides, Acacia maitlandii, Androcalva luteiflora, Acacia bivenosa, Acacia ampliceps*
Shrubs <1m	*Indigofera monophylla, Waltheria virgata, Pluchea dentex, Pluchea rubelliflora, Goodenia lamprosperma*
Hummock Grasses	*Triodia epactia, Triodia longiceps, Triodia angusta*
Tussock Grasses	**Cenchrus ciliaris, Eulalia aurea, Chrysopogon fallax, Cymbopogon procerus, Eriachne tenuiculmis, Sorghum plumosum, Themeda triandra*
Sedges	*Cyperus vaginatus*

Broad Floristic Formation	4b. *Eucalyptus* Low Woodland
Vegetation Association	Low Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over High Shrubland of *Acacia tumida* var. *pilbarensis, Acacia trachycarpa* and *Grevillea wickhamii* over Shrubland of *Cajanus cinereus* over Open Tussock Grassland of *Chrysopogon fallax, Heteropogon contortus* and *Eulalia aurea* in red brown silty loam along minor drainage lines

Area Mapped	34.80 ha
Quadrats Sampled	JME263
Location	Drainage line on Map 44
Leaf Litter Cover (%)	4
Bare Ground (%)	15
Soils and Geology	Quartz/Ironstone/Granite scattered pebbles with red brown silty loam
Land Form	Medium and minor drainage lines
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Malvastrum americanum, *Portulaca oleracea*
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks, livestock, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Corymbia candida, Eucalyptus victrix*
Tall Shrubs >2m	*Grevillea wickhamii, Acacia tumida* var. *pilbarensis, Acacia trachycarpa*
Shrubs 1-2m	*Cajanus cinereus*
Shrubs <1m	*Corchorus parviflorus, Tephrosia rosea* var. *clementii, Indigofera monophylla*
Hummock Grasses	*Triodia epactia*
Tussock Grasses	*Chrysopogon fallax, Eriachne obtusa, Eulalia aurea, Themeda triandra, Heteropogon contortus*
Herbs	*Polymeria ambigua*

Broad Floristic Formation	5a. *Corymbia* Low Woodland
Vegetation Association	Low Woodland of *Corymbia hamersleyana* and *Eucalyptus victrix* over Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Cajanus cinereus* over Very Open Tussock Grassland of *Chrysopogon fallax* in red/brown silty loam along major drainage lines
	
Area Mapped	13.32 ha
Quadrats Sampled	JME270
Location	Drainage line on maps 44-45
Leaf Litter Cover (%)	1-15
Bare Ground (%)	25
Soils and Geology	Mixed alluvials, chert, ironstone, quartz and granite, pebbles, cobbles and gravels with brown sand
Land System	River
Land Form	Major drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Grazing, weeds
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Eucalyptus victrix*
Shrubs 1-2m	*Acacia pyrifolia* var. *pyrifolia, Cajanus cinereus*
Shrubs <1m	*Corchorus parviflorus*
Tussock Grasses	*Chrysopogon fallax*

Broad Floristic Formation	5b.*Corymbia* Low Woodland
Vegetation Association	Low Woodland of *Corymbia candida* and *Corymbia aspera* over Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* over Open Hummock Grassland of *Triodia pungens* (and Very Open Tussock Grassland of **Cenchrus ciliaris* and *Chryopogon fallax)* in brown loamy sand on floodplains

Area Mapped	73.50 ha
Quadrats Sampled	PME136, H092, PME137, ME190
Location	Floodplains on map 55 and 56
Leaf Litter Cover (%)	15
Bare Ground (%)	35
Soils and Geology	Brown loamy sand
Land Form	Floodplain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Aerva javanica, *Cenchrus setiger, *Citrullus colocynthis*
Vegetation Condition	Very Good
Disturbances	Tracks, rail line, livestock, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia aspera, Corymbia candida, Corymbia flavescens*
Shrubs 1-2m	*Acacia tumida* var. *pilbarensis, Acacia colei* var. *colei, Acacia acradenia, Acacia inaequilatera, Acacia trachycarpa, Acacia ancistrocarpa*
Shrubs <1m	*Pluchea dunlopii Pluchea tetranthera, Corchorus incanus, Indigofera monophylla, Melhania oblongifolia, Corchorus laniflorus, Senna notabilis, Pterocaulon sphaeranthoides*
Hummock Grasses	*Triodia epactia*
Tussock Grasses	**Cenchrus ciliaris, Chrysopogon fallax, Aristida holathera* var. *holathera*

Broad Floristic Formation	6a. Acacia Low Woodland
Vegetation Association	Low Woodland of *Acacia paraneura, Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris* in red/brown sandy clay loam on plains and floodplains
	
Area Mapped	209.48 ha
Quadrats Sampled	ME1, ME3, ME14, ME20, JME2
Location	Map 1-6
Leaf Litter Cover (%)	<5
Bare Ground (%)	20-30
Soils and Geology	Ironstone pebbles and fine scree with red brown sandy clay loam
Land Form	Floodplains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris*
Vegetation Condition	Degraded - Excellent
Disturbances	Introduced species, livestock, rail line, tracks, water point, fence line, grazing, creek diversion
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia paraneura, Acacia aptaneura, Acacia pruinocarpa, Corymbia deserticola*
Shrubs >2m	*Hakea lorea* subsp. *lorea*
Shrubs 1-2m	*Acacia synchronicia, Eremophila forrestii* subsp. *forrestii, Rhagodia eremaea, Acacia sclerosperma*
Shrub <1m	*Senna artemisioides* subsp. *helmsii, Ptilotus obovatus, Sida platycalyx, Maireana planifolia, Corchorus sidoides*

Hummock Grassland	*Triodia basedowii, Triodia pungens*
Tussock Grassland	**Cenchrus ciliaris Sporobolus australasicus, Paraneurachne muelleri, Dactyloctenium radulans, Chrysopogon fallax*
Herbs	**Portulaca oleracea, Boerhavia coccinea, Trianthema triquetra*

Broad Floristic Formation	6b. *Acacia* Low Woodland
Vegetation Association	Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Tussock Grassland of *Aristida inaequiglumis, Chrysopogon fallax* and **Cenchrus ciliaris* with Open Shrubland of *Dodonea petiolaris* and *Eremophila forrestii* subsp. *forrestii* in red sandy loam on plains
	
Area Mapped	1,257.27 ha
Quadrats Sampled	JME14, ME10, ME13, ME18, ME21, JME18 , PME02, JBME5, H055, FMG042, H056, H020, ME23
Location	Maps 3-7
Leaf Litter Cover (%)	<10
Bare Ground (%)	60
Soils and Geology	Ironstone pebbles and cobbles with red sandy loam
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Portulaca oleracea*
Vegetation Condition	Good - Excellent
Disturbances	Introduced species, livestock, fence lines, rail line, access, pipeline
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Acacia pruinocarpa, Acacia aneura, Acacia catenulata* subsp. *occidentalis*
Shrubs >2m	*Eremophila longifolia*
Shrubs 1-2m	*Dodonaea petiolaris, Eremophila forrestii* subsp. *forrestii, Acacia synchronicia, Psydrax latifolia, Eremophila latrobei* subsp. *filiformis, Acacia wanyu, Senna artemisioides* subsp. *oligophylla, Senna glutinosa* subsp. *x luerssenii*
Hummock Grassland	*Triodia basedowii, Triodia epactia, Triodia lanigera*
Tussock Grassland	*Aristida inaequiglumis, Chrysopogon fallax, *Cenchrus ciliaris, Themeda triandra*
Herbs	**Portulaca oleracea, Cleome viscosa, Salsola australis*

Broad Floristic Formation	7. *Eucalyptus* Low Open Woodland
Vegetation Association	Low Open Woodland of *Eucalyptus victrix* over Low Open Shrubland of *Pluchea rubelliflora, Pluchea ferdinandi-muelleri* and *Atriplex bunburyana* with Scattered Tussock Grasses of *Eragrostis cumingii* in brown silty clay loam on drainage depressions
	
Area Mapped	11.28 ha
Quadrats Sampled	ME15S2, EMES2.16
Location	Map 8
Leaf Litter Cover (%)	5
Bare Ground (%)	35
Soils and Geology	Silcrete and quartz very scattered cobbles and pebbles in brown soil
Land Form	Drainage depression
Priority Ecological Community	Freshwater claypans of the Fortescue Valley (Priority 1)
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Malvastrum americanum, *Vachellia farnesiana, *Bidens bipinnata*
Vegetation Condition	Good
Disturbances	Fire, inundation, livestock, access track nearby, introduced species
Average Fire Age	Recent
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus victrix*
Shrubs <1m	*Pluchea rubelliflora*, *Pluchea ferdinandi-muelleri, Corchorus sidoides* subsp. *sidoides*, *Acacia sclerosperma, Atriplex buburyana*, *Sida fibulifera*
Tussock Grasses	*Eragrostis cumingii*
Herbs	*Convolvulus angustissimus, Cleome viscosa*

Broad Floristic Formation	8. *Acacia* Low Open Woodland
Vegetation Association	Low Open Woodland of *Acacia xiphophylla* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata, Maireana triptera* and *Sclerolaena cuneata* in red brown sandy clay loam on plains
	
Area Mapped	463.57 ha
Quadrats Sampled	EMES2.26, FMG013, FMG014, FMG040H057, JBME9, JME19, JME7, JME9, ME24, ME25,ME26, ME31, ME5, ME7, PME05
Location	Maps 2-8
Leaf Litter Cover (%)	<10
Bare Ground (%)	30
Soils and Geology	Ironstone and silcrete scattered cobbles and pebbles with red brown sandy clay loam
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris*
Vegetation Condition	Degraded – Very Good
Disturbances	Introduced species, surface erosion, grazing, rail line, access track, fence, mining camp, livestock
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia xiphophylla, Acacia aptaneura, Acacia paraneura*
Tall Shrubs >2m	*Acacia synchronicia, Rhagodia eremaea*
Shrubs 1-2m	*Eremophila forrestii* subsp. *forrestii*

Shrubs <1m	*Maireana pyramidata, Maireana triptera, Enchylaena tomentosa, Eremophila cuneifolia, Maireana carnosa, Ptilotus obovatus, Sclerolaena cuneata, Sclerolaena costata*
Hummock Grasses	*Triodia basedowii, Triodia longiceps*
Tussock Grasses	*Aristida contorta, Eriachne obtusa, Eriachne helmsii, *Cenchrus ciliaris*
Herbs	**Portulaca oleracea, Boerhavia coccinea, Trianthema triquetra, Trianthema oxycalyptra* var. *oxycalyptra*

Broad Floristic Formation	9. *Acacia* Open Scrub
Vegetation Association	Open Scrub of *Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa* and *Acacia colei* var. *colei* over Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along minor and medium drainage lines
	
Area Mapped	227.03 ha
Quadrats Sampled	EMES2-137, FMG094, JME186, JBME101, ME145, H066, EMES2-116,
Location	Maps 30 - 54
Leaf Litter Cover (%)	5
Bare Ground (%)	20
Soils and Geology	Brown sandy loam
Land Form	Minor and medium drainage lines
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Tracks, livestock, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia tumida* var. *pilbarensis, Acacia bivenosa, Acacia ancistrocarpa, Grevillea wickhamii, Petalostylis labicheoides, Acacia colei* var. *colei*
Shrubs 1-2m	*Acacia acradenia, Acacia tumida* var. *pilbarensis, Petalostylis labicheoides, Acacia ancistrocarpa*
Shrubs <1m	*Corchorus parviflorus, Indigofera monophylla, Dampiera candicans, Bonamia rosea*
Hummock Grasses	*Triodia epactia, Triodia lanigera*
Tussock Grasses	**Cenchrus ciliaris, Chrysopogon fallax*

Broad Floristic Formation	10a. *Acacia* High Shrubland
Vegetation Association	High Shrubland of *Acacia ampliceps, Acacia trachycarpa* and *Acacia coriacea* subsp. *pendens* over Open Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* with Very Open Sedges of *Cyperus vaginatus* in brown sand along medium drainage lines

Area Mapped	229.52 ha
Quadrats Sampled	ME129, ME130, H289, PME70, PME74, ME162, JME229
Location	Map 36 – 48
Leaf Litter Cover (%)	<3
Bare Ground (%)	65
Soils and Geology	Scattered riverine and granite gravel and pebbles
Land Form	Medium drainage lines
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Aerva javanica*
Vegetation Condition	Very Good
Disturbances	Livestock, flooding, introduced species, rail line nearby
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus victrix*
Tall Shrubs >2m	*Acacia ampliceps, Acacia trachycarpa, Acacia coriacea* subsp. *pendens, Acacia acradenia*
Shrubs <1m	*Pluchea rubelliflora, Stemodia grossa, Acacia stellaticeps, Cajanus cinereus, Pluchea ferdinandi-muelleri*
Hummock Grasses	*Triodia longiceps, Triodia epactia, Triodia wiseana, Triodia secunda*
Tussock Grasses	*Eriachne benthamii, *Cenchrus ciliaris, Eriachne festucacea, Eulalia aurea, Themeda triandra, Cymbopogon ambiguus, Leptochloa fusca* subsp. *fusca*
Sedges	*Cyperus vaginatus*

Broad Floristic Formation	10b. *Acacia* High Shrubland
Vegetation Association	High Shrubland of *Acacia colei* var. *colei, Acacia bivenosa* and *Acacia tumida* var. *pilbarensis* over Open Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps, Pluchea ferdinandi-muelleri* and *Pluchea tetranthera* in orange sand on minor drainage lines and floodplains
	
Area Mapped	485.33 ha
Quadrats Sampled	EMES2-102, EMES2-126, EMES2-95, FMG088, FMG096, H237, H248, H281, H282, JBME95, JME192, JME195, JME202, JME204, JME249, ME113, ME118, ME127, PME117, PME53, PME54, PME55, PME56, PME58, PME60, PME64, PME90
Location	Drainage lines in the central parts of the Study area, maps 31-36
Leaf Litter Cover (%)	<3
Bare Ground (%)	30-60
Soils and Geology	Quartz, granite and mixed alluvial rock cobbles, pebbles and boulders with brown/red/orange sand
Land Form	Minor drainage lines and floodplains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Vachellia farnesiana, *Aerva javanica, *Portulaca oleracea*
Vegetation Condition	Good - Very Good
Disturbances	Introduced species, rail line, livestock, flooding
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Acacia coriacea* subsp. *pendens, Hakea lorea* subsp. *lorea*
Tall Shrubs >2m	*Acacia acradenia, Acacia trachycarpa*, *Acacia colei* var. *colei*, *Acacia tumida* var. *pilbarensis, Grevillea wickhamii, Acacia trachycarpa, Acacia inaequilatera, *Vachellia farnesiana*
Shrubs 1-2m	*Acacia bivenosa, Acacia ancistrocarpa, Cullen leucanthum*, *Corchorus tectus*, *Acacia eriopoda*
Shrubs <1m	*Pluchea ferdinandi-muelleri, Acacia stellaticeps, Hibiscus sturtii* var. *campylochlamys, Pluchea dentex, Indigofera monophylla, Sida clementii*
Hummock Grasses	*Triodia lanigera, Triodia epactia*
Tussock Grasses	**Cenchrus ciliaris*, *Eragrostis cumingii, Eriachne obtusa, Chrysopogon fallax, Sporobolus australasicus, Sporobolus actinocladus, Eriachne elongata, Panicum decompositum, Themeda triandra*
Sedges	*Cyperus ixiocarpus, Bulbostylis barbata*

Broad Floristic Formation	11. *Acacia* High Open Shrubland
Vegetation Association	High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* over Very Open Hummock Grassland of *Triodia epactia* and Very Open Tussock Grassland of *Tripogon loliiformis, Aristida contorta* and *Sporobolus australasicus* (with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda)* in skeletal brown sandy loam on granite plateaux / sheet outcrops
	
Area Mapped	61.72 ha
Quadrats Sampled	EMES2-85, FMGRE, EMES2-82, H291, PME76, PME86, PME78, JME246, PME102, JBME124, JME284, JBME130, FMGBB, H072, FMGBC, PME110, EMES2-124, H089, EMES2-131, H291, JME292, ME167, PME107, EMES2-123, PME106, PME111, ME95
Location	Maps 27-57
Leaf Litter Cover (%)	<1
Bare Ground (%)	80
Soils and Geology	Quartz and granite cobbles, pebbles, outcrops, flakes and boulders with brown sandy loam
Land Form	Granite slabs, outcrops and hills
Priority Ecological Community	None
Rare Flora	*Bulbostylis burbidgeae*
Introduced (Weed) Species	**Cenchrus ciliaris, *Aerva javanica*
Vegetation Condition	Very Good
Disturbances	Livestock, rail line, access tracks, quarry nearby, rubbish
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Ficus brachypoda, Acacia coriacea* subsp. *pendens, Terminalia canescens, Flueggea virosa, Mallotus nesophilus*
Tall Shrubs >2m	*Acacia tumida* subsp. *pilbarensis, Clerodendrum floribundum, Senna glutinosa* subsp. *glutinosa, Acacia orthocarpa, Grevillea wickhamii, Acacia colei* var. *colei*
Shrubs <1m	*Cajanus cinereus, Gossypium robinsonii, Gomphrena cunninghamii, Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Triumfetta maconochieana, Tephrosia* sp. D Kimberley Flora (R.D. Royce 1848)
Hummock Grasses	*Triodia epactia, Triodia longiceps*
Tussock Grasses	*Eriachne ciliata, Sporobolus australasicus, Tripogon loliiformis, Aristida contorta, Eriachne mucronata, Cymbopogon procerus*
Sedges	*Bulbostylis barbata, Bulbostylis burbidgeae*

Broad Floristic Formation	12a. *Acacia* Low Open Heath
Vegetation Association	Low Open Heath of *Acacia stellaticeps* with High Shrubland of *Acacia trachycarpa* and *Hakea lorea* subsp. *lorea* and Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* in orange brown sand on floodplains

Area Mapped	48.85 ha
Quadrats Sampled	ME98, JME247
Location	Floodplains surrounding major drainage lines, maps 28 and 40
Leaf Litter Cover (%)	3
Bare Ground (%)	15
Soils and Geology	Orange brown sand
Land Form	Undulating floodplain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Livestock, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Hakea lorea* subsp. *lorea, Acacia trachycarpa Grevillea wickhamii*
Shrubs <1m	*Acacia stellaticeps, Pluchea ferdanandi-muelleri*
Hummock Grasses	*Triodia pungens*, *Triodia basedowii*

Broad Floristic Formation	12b. *Acacia* Low Open Heath
Vegetation Association	Low Open Heath of *Acacia stellaticeps* over Hummock Grassland of *Triodia schinzii* with High Open Shrubland of *Acacia tumida* var. *pilbarensis, Acacia colei* var. *colei* and *Melaleuca lasiandra* in red brown loamy sand on sandplains
	
Area Mapped	1,206.41 ha
Quadrats Sampled	H110, H111, H112, H113, JME58, JME59, JME368, JME369, JME370, ME200, ME201, ME202, ME203, PME141, PME143, PME144,
Location	Northern part of the Study area maps 59 and 60
Leaf Litter Cover (%)	<4
Bare Ground (%)	15
Soils and Geology	Red brown loamy sand
Land Form	Sandplains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger*
Vegetation Condition	Good - Very Good
Disturbances	Rail line, landfill, tracks, introduced species, livestock
Average Fire Age	-
Vegetation Structure & Floristics	
Trees >10m	*Corymbia aspera*
Tall Shrubs >2m	*Acacia tumida* subsp. *pilbarensis, Acacia ancistrocarpa, Acacia colei* var. *colei*, *Melaleuca lasiandra, Hakea lorea* var. *lorea, Grevillea pyramidalis*
Shrubs <1m	*Acacia stellaticeps, Bonamia erecta, Indigofera monophylla, Pluchea dunlopii, Pluchea tetranthera, Ptilotus australasicus, Ptilotus calostachyus, Corchorus incanus, Ptilotus australasicus, Ptilotus arthrolasius, Bonamia rosea*
Hummock Grasses	*Triodia schinzii*
Tussock Grasses	**Cenchrus ciliaris, Eriachne helmsii, Digitaria brownii, Aristida holathera* var. *holathera*

Broad Floristic Formation	12c. *Acacia* Low Open Heath
Vegetation Association	Low Open Heath of *Acacia bivenosa* and *Acacia synchronicia* over Hummock Grassland of *Triodia secunda, Triodia angusta* and *Triodia basedowii* in brown sandy loam on stony lower slopes and plains
	
Area Mapped	36.34 ha
Quadrats Sampled	EMES2.63, JME58, JME59
Leaf Litter Cover (%)	<5
Bare Ground (%)	40
Soils and Geology	Brown sandy loam
Land Form	Stony hill slopes and plains (low hills and rises / plains)
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks
Average Fire Age	Old
Vegetation Structure & Floristics	
Low Trees <10m	*Corymbia hamersleyana*
Shrubs <1-2m	*Acacia bivenosa, Acacia synchronicia*
Hummock Grasses	*Triodia secunda, Triodia angusta, Triodia basedowii*

Broad Floristic Formation	13. *Tecticornia* Low Open Heath
Vegetation Association	Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia indica* subsp. *bidens* and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis* in brown medium clay on saline flats and marsh
	
Area Mapped	362.38 ha
Quadrats Sampled	ME29, ME33, ME39, JME38, JME39, JME36, JME34, JME24
Location	Maps 8-9
Leaf Litter Cover (%)	<5
Bare Ground (%)	35
Soils and Geology	Calcrete scattered cobbles and pebbles and grey dolomite with brown medium clay
Land Form	Marsh
Priority Ecological Community	Fortescue Marsh (Priority 1 PEC)
Rare Flora	*Eremophila spongiocarpa, Tecticornia* sp. Christmas Creek
Introduced (Weed) Species	**Cenchrus ciliaris, *Malvastrum americanum, *Flaveria trinervia, *Setaria verticillata*
Vegetation Condition	Excellent - Very Good
Disturbances	Rail line, access track, introduced species, survey marker, fire, grazing
Average Fire Age	Very Old
Vegetation Structure & Floristics	
Shrubs <1m	*Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J English KS552), *Tecticornia indica* subsp. *bidens, Tecticornia indica* subsp. *leiostachya, Tecticornia auriculata, Muehlenbeckia florulenta, Frankenia ambita, Atriplex bunburyana, Cullen cinereum*
Tussock Grasses	*Eragrostis pergracilis, Enneapogon polyphyllus, Eragrostis dielsii*
Herbs	*Nicotiana rosulata* subsp. *rosulata, Nictotiana occidentalis*

Broad Floristic Formation	14. *Pluchea* Low Shrubland
Vegetation Association	Low Shrubland of *Pluchea ferdinandi-muelleri, Pluchea rubelliflora* and *Carrissa lanceolata* over Open Hummock Grassland of *Triodia angusta* and Very Open Tussock Grassland of *Sporobolus australasicus, Chloris pectinata* and *Panicum decompositum* in grey medium clay on crusting plains

Area Mapped	52.62 ha
Quadrats Sampled	JBME144, JBME143, ME180
Location	Map 53
Leaf Litter Cover (%)	<1
Bare Ground (%)	40
Soils and Geology	Mudstone pebbles and gravels with grey medium clay
Land Form	Stony clay plain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Rail line, tracks, livestock
Average Fire Age	Old
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Acacia inaequilatera, Acacia colei* var. *colei*
Shrubs <1m	*Pluchea ferdinandi-muelleri, Pluchea rubelliflora, Carissa lanceolata, Acacia stellaticeps, Pluchea tetranthera, Indigofera monophylla, Acacia bivenosa, Stemodia grossa*
Hummock Grasses	*Triodia basedowii*, *Triodia longiceps*, *Triodia angusta*
Tussock Grasses	*Sporobolus australasicus, Chloris pectinata, Panicum decompositum*

Broad Floristic Formation	15. *Maireana* Low Open Shrubland
Vegetation Association	Low Open Shrubland of *Maireana triptera, Ptilotus obovatus* and *Sclerolaena cuneata* with Scattered Low Trees of *Acacia xiphophylla* and *Acacia synchronicia* and Scattered Tussock Grasses of *Aristida inaequiglumis* and **Cenchrus ciliaris* in red sandy clay loam on wind scalded plains

Area Mapped	83.04 ha
Quadrats Sampled	JME8, JME3, ME24
Location	Maps 1-6
Leaf Litter Cover (%)	0.5
Bare Ground (%)	80
Soils and Geology	Ironstone pebbles and cobbles with red sandy clay loam
Land Form	Wind scalds on plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Good
Disturbances	Livestock, rail line, fence line, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees <10m	*Acacia xiphophylla*
Tall Shrubs >2m	*Acacia synchronicia*
Shrubs <1m	*Sclerolaena cuneata*, *Maireana triptera, Ptilotus obovatus, Maireana pyramidata*, *Salsola australis, Atriplex bunburyana*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	**Cenchrus ciliaris*

Broad Floristic Formation	16a. *Triodia* Closed Hummock Grassland
Vegetation Association	Closed Hummock Grassland of *Triodia longiceps* and *Triodia pungens* with Shrubland of *Acacia sclerosperma* subsp. *sclerosperma, Acacia bivenosa* and *Melaleuca glomerata* in brown sandy clay loam on undulating plains

Area Mapped	382.48 ha
Quadrats Sampled	ME30, ME32, JME22, FMG41, FMG60, FMG61, EMES2.27, PME03
Location	Maps 8 and 9 around the outskirts of the Fortescue Marsh
Leaf Litter Cover (%)	1-2
Bare Ground (%)	10-20
Soils and Geology	Calcrete scattered cobbles and pebbles and grey dolomite with brown sandy/clay loam
Land Form	Undulating plains surrounding the Fortescue Marsh
Priority Ecological Community	Fortescue Marsh (Priority 1)
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good - Excellent
Disturbances	Rail line, access track, introduced species, survey marker, fire grazing
Average Fire Age	Very Old (>10 yrs)

Vegetation Structure & Floristics	
Shrubs 1-2m	*Acacia sclerosperma* subsp. *sclerosperma, Acacia bivenosa, Melaleuca glomerata, Santalum lanceolatum*
Shrubs <1m	*Maireana georgei, Corchorus sidoides* subsp. *sidoides*
Hummock Grasses	*Triodia angusta, Triodia pungens, Triodia longiceps*
Tussock Grasses	*Eragrostis pergracilis, Sporobolus australasicus, Eragrostis eriopoda, Eulalia aurea*

Broad Floristic Formation	16b. *Triodia* Closed Hummock Grassland
Vegetation Association	Closed Hummock Grassland of *Triodia basedowii* and *Triodia longiceps* with High Shrubland of *Acacia synchronicia, Acacia sclerosperma* subsp. *sclerosperma* and *Eremophila longifolia* and Low Open Woodland of *Acacia aptaneura* in red brown clay loam on plains

Area Mapped	84.79 ha
Quadrats Sampled	JME6, ME8
Location	Map 2
Leaf Litter Cover (%)	2.5
Bare Ground (%)	20
Soils and Geology	Very scattered ironstone pebbles and gravels with red brown clay loam
Land Form	Stony plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, introduced species, access track, fence line
Average Fire Age	Very Old (>10 yrs)
Vegetation Structure & Floristics	
Trees <10m	*Acacia aptaneura, Acacia sericophylla*
Mallee	*Eucalyptus trivalva*
Shrubs >2m	*Acacia synchronicia, Rhagodia eremaea, Acacia sclerosperma* subsp. *sclerosperma, Eremophila longifolia*
Shrubs 1-2m	*Stylobasium spathulatum*
Shrubs <1m	*Ptilotus obovatus*
Hummock Grasses	*Triodia longiceps, Triodia basedowii*
Tussock Grasses	**Cenchrus ciliaris*

Broad Floristic Formation	17a. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* over Low Shrubland of *Acacia arrecta, Acacia sibirica* and *Acacia bivenosa* in red loamy sand on hill slopes with Low Open Woodland of *Acacia rhodophloia, Acacia pruinocarpa* and *Acacia aptaneura* on rocky hill crests

Area Mapped	908.66 ha
Quadrats Sampled	ME28, ME40, ME42, ME44, DME07, EMES2-24, EMES2-29, EMES2.15, EMES2.25, FMG070, FMGKD,
Location	Maps 7-10
Leaf Litter Cover (%)	<1-15
Bare Ground (%)	35
Soils and Geology	Dolerite, chert, silcrete pebbles, scree, cobbles and outcrops red loamy sand
Land Form	Hillslopes and rocky hillcrests
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Portulaca oleracea, *Bidens bipinnata*
Vegetation Condition	Excellent - Very Good
Disturbances	Borrow pits, introduced species, rail line, access road nearby, fire, minor grazing
Average Fire Age	Moderate

Vegetation Structure & Floristics	
Trees >10m	*Corymbia deserticola* subsp. *deserticola, Acacia rhodophloia, Acacia pruinocarpa, Acacia aptaneura, Corymbia hamersleyana, Eucalyptus leucophloia* subsp. *leucophloia*
Mallee	*Eucalyptus gamophylla*
Tall Shrubs >2m	*Grevillea berryana, Hakea chordophylla*
Shrubs 1-2m	*Acacia sibirica*
Shrubs <1m	*Acacia arrecta, Acacia sibirica, Acacia bivenosa, Senna glutinosa* subsp. *glutinosa, Senna glutinosa* subsp. *x luerssenii, Ptilotus nobilis, Acacia kempeana, Acacia maitlandii, Eremophila latrobei* subsp. *latrobei, Psydrax latifolia*
Hummock Grasses	*Triodia wiseana, Triodia brizoides, Triodia basedowii, Triodia lanigera*
Tussock Grasses	*Eriachne mucronata*

Broad Floristic Formation	17b. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia brizoides*, *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia acradenia* in brown silty loam on hill slopes
	
Area Mapped	41.17 ha
Quadrats Sampled	ME99, JME153, JME154
Location	One location on isolated silcrete hill on map 28
Leaf Litter Cover (%)	1
Bare Ground (%)	35
Soils and Geology	Milky silcrete outcrops, cobbles and pebbles with brown silty loam
Land Form	Mesa hillslopes and crests
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks nearby
Average Fire Age	Old to Very Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia acradenia*
Shrubs <1m	*Acacia bivenosa, Senna glutinosa* subsp. *glutinosa*
Hummock Grasses	*Triodia brizoides, Triodia epactia, Triodia wiseana*
Tussock Grasses	*Eriachne pulchella*

Broad Floristic Formation	17c. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia brizoides* and *Triodia wiseana* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Low Shrubs of *Acacia bivenosa, Ptilotus obovatus* and *Senna glutinosa* subsp. *glutinosa* in brown silty loam on scree slopes

Area Mapped	156.97 ha
Quadrats Sampled	ME66, JME53, ME65, PME12
Location	Map 15 and 16
Leaf Litter Cover (%)	<1
Bare Ground (%)	35-65
Soils and Geology	Shale and ironstone cobbles, pebbles and outcropping with brown silty loam
Land Form	Scree slopes
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Fire, rail line, access road, earthworks
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus leucophloia* subsp. *leucophloia, Acacia pruinocarpa*
Tall Shrubs 1-2m	*Acacia bivenosa, Ptilotus obovatus, Senna glutinosa* subsp. *glutinosa, Ptilotus astrolasius*
Shrubs <1m	*Scaevola spinescens, Ptilotus calostachyus, Cleome viscosa*
Hummock Grasses	*Triodia brizoides, Triodia wiseana*

Broad Floristic Formation	17d. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* and *Triodia epactia* with Low Woodland of *Acacia aptaneura* and *Grevillea berryana* over Low Open Shrubland of *Gompholobium oreophilum* in sandy clay loam on drainage depressions

Area Mapped	206.29 ha
Quadrats Sampled	EMES2.51, ME60, JME54
Location	Drainage basins and plains around the Chichester Deviation, maps 14 and 15
Leaf Litter Cover (%)	<1
Bare Ground (%)	30-40
Soils and Geology	Ironstone, quartz, chert pebbles and cobbles with sandy clay loam
Land Form	Drainage basins and plains
Priority Ecological Community	None
Rare Flora	^*Goodenia nuda*
Introduced (Weed) Species	None
Vegetation Condition	Good- Very Good
Disturbances	Fire, rail line, access tracks
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees <10m	*Acacia aptaneura, Grevillea berryana, Acacia ayersiana*
Tall Shrubs >2m	*Acacia atkinsiana*
Shrubs 1-2m	*Eremophila latrobei* subsp. *filiformis, Acacia ptychophylla*
Shrubs <1m	*Gompholobium oreophilum*
Hummock Grasses	*Triodia basedowii, Triodia epactia*
Tussock Grasses	*Eriachne pulchella* subsp. *dominii*

Broad Floristic Formation	17e. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Hakea lorea* subsp. *lorea, Acacia ancistrocarpa* and *Acacia inaequilatera* and Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* and *Corymbia hamersleyana* in red sand on plains
	
Area Mapped	2,603.19 ha
Quadrats Sampled	ME2, ME4, ME6, ME9, ME11, ME12, ME19, DME1, DME2, DME3, JME1, JME5, EMES2.03, FMG047, FMG012, H015, H054, H008, PME01
Location	Maps 1-6
Leaf Litter Cover (%)	<10
Bare Ground (%)	30-40
Soils and Geology	Ironstone fine scree and pebbles with red sand
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Excellent to Very Good
Disturbances	Rail line, access road nearby, fire, fence line, livestock
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees <10m	*Corymbia deserticola* subsp. *deserticola, Corymbia hamersleyana, Acacia pruinocarpa*
Mallee	*Eucalyptus gamophylla*
Tall Shrubs >2m	*Hakea lorea* subsp. *lorea, Acacia ancistrocarpa, Acacia inaequilatera, Acacia trudgeniana, Hakea chordophylla*
Shrubs 1-2m	*Acacia adsurgens, Acacia tenuissima, Acacia sclerosperma* subsp. *sclerosperma, Acacia inaequilatera*

Shrubs <1m	*Indigofera monophylla, Bonamia rosea, Senna notabilis, Scaevola parvifolia* subsp. *pilbarae, Ptilotus astrolasius, Dicrastylis cordifolia, Corchorus tectus, Corchorus sidoides, Stylobasium spathulatum, Petalostylis cassioides*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	*Paraneurachne muelleri, Aristida inaequiglumis, *Cenchrus ciliaris, Eragrostis eriopoda, Aristida holathera* subsp. *holathera, Aristida contorta*
Herbs	*Heliotropium pachyphyllum*

Broad Floristic Formation	17f. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia wanyu, Acacia ancistrocarpa* and *Acacia inaequilatera* in orange/red/brown silty loam on stony plains

Area Mapped	349.30 ha
Quadrats Sampled	ME16, ME22, EMES2.9, EME2.10, JBME3
Location	Maps 3-6
Leaf Litter Cover (%)	<10
Bare Ground (%)	25-35
Soils and Geology	Ironstone/chert cobbles and pebbles with orange red brown silty loam
Land Form	Stony plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent - Very Good
Disturbances	Rail line, access tracks, fence line, fire
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Acacia pruinocarpa, Corymbia hamersleyana, Corymbia deserticola*
Tall Shrubs >2m	*Acacia adsurgens, Acacia trachycarpa*
Shrubs 1-2	*Acacia wanyu, Acacia ancistrocarpa, Acacia inaequilatera*
Hummock Grasses	*Triodia basedowii*

Broad Floristic Formation	17g. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii* with Scattered Tall Trees of *Acacia aptaneura* and *Acacia pruinocarpa* over High Open Shrubland of *Acacia ancistrocarpa* in red sand on plains
	
Area Mapped	254.32 ha
Quadrats Sampled	JME12, ME17, H019, H018
Location	Maps 4 and 5
Leaf Litter Cover (%)	3
Bare Ground (%)	45
Soils and Geology	Ironstone very fine gravelly scree with red sand
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Grazing, introduced species, rail line, access tracks nearby
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Acacia pruinocarpa, Corymbia deserticola*
Mallee	*Eucalyptus gamophylla*
Tall Shrubs >2m	*Acacia ancistrocarpa, Acacia trudgeniana, Hakea chordophylla, Hakea lorea* subsp. *lorea*
Shrubs 1-2m	*Acacia adsurgens*
Shrubs <1m	*Indigofera monophylla, Ptilotus obovatus, Corchorus tectus*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	*Aristida inaequiglumis, Aristida holathera* var. *holathera, Paraneurachne muelleri, Eulalia aurea*

Broad Floristic Formation	17h. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia basedowii, Triodia epactia* and *Triodia wiseana* over High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* and *Grevillea wickhamii* over Low Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia acradenia* (and Scattered Low Trees of *Corymbia hamersleyana)* in red brown silty/sandy loam on undulating low hills and stony plains
	
Area Mapped	5,515.81 ha
Quadrats Sampled	EMES2-112, EMES2-136, H065, H083, H094, H096, H100, JBME102, JBME105, JBME107, JME230, JME236, JME237, JME238, JME245, JME250, JME252, JME254, JME255, JME257, JME261, JME264, JME272, JME273, ME136, ME137, ME138, ME140, ME141, ME142, ME146, ME147, ME148, ME149, ME150, ME152, ME153, ME154, ME155, ME156, PME118, PME37, PME38, PME77, PME79, PME85, PME88, PME89, PME92, PME93, PME94, PME95, PME96, PME97, PME98,
Location	Maps 38-46
Leaf Litter Cover (%)	<7
Bare Ground (%)	65
Soils and Geology	Quartz, calcrete, ironstone, mudstone, chert and granite pebbles, cobbles and outcrops with red brown silty sandy loam
Land Form	Undulating low hills and stony plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris, *Vachellia farnesiana*
Vegetation Condition	Very Good

Disturbances	Fire, rail line, access tracks, livestock, old borrow pits, introduced species
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia tumida* var. *pilbarensis, Grevillea wickhamii, Acacia inaequilatera, Acacia colei* var. *colei, Acacia orthocarpa, Petalostylis labicheoides*
Shrubs <1m	*Acacia ancistrocarpa, Acacia bivenosa, Acacia acradenia, Corchorus parviflorus, Ptilotus calostachyus, Ptilotus astrolasius, Goodenia stobbsiana, Corchorus lasiocarpus* subsp. *lasiocarpus*, *Tephrosia* sp. Bungaroo Creek (*M. E. Trudgen 11601*), *Acacia stellaticeps, Bonamia rosea, Cajanus cinereus*, *Bonamia erecta*, *Scaevola parvifolia*
Hummock Grasses	*Triodia basedowii*, *Triodia epactia, Triodia wiseana*
Tussock Grasses	*Heteropogon contortus*, *Chrysopogon fallax*, *Tripogon loliiformis, Aristida contorta, Themeda triandra*

Broad Floristic Formation	17i. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps* in red/orange sandy loam on sandy plains

Area Mapped	4,996.59 ha
Quadrats Sampled	H075, H101, H116, H117, H118, H119, JME280, JME285, JME290, JME294, JME295, JME310, JME311, JME312, JME313, JME341, JME354, JME356, JME359, JME363, ME160, ME166, ME168, ME169, ME183, ME189, ME191, ME193, ME194, ME195, ME196, ME198, PME108, PME109, PME125, PME133, PME142,
Location	Maps 47-59
Leaf Litter Cover (%)	<5
Bare Ground (%)	65
Soils and Geology	Ironstone, quartz and granite cobbles and pebbles with orange red sandy loam
Land Form	Sandy plain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent – Very Good
Disturbances	Rail line, access tracks, fence line, livestock, quarry, dam nearby, fire
Average Fire Age	Variable – Moderate to Old

Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana, Corymbia deserticola, Corymbia candida, Corymbia aspera*
Tall Shrubs >2m	*Acacia inaequilatera, Acacia ancistrocarpa, Acacia pyrifolia, Hakea lorea* var. *lorea, Acacia colei* var. *colei, Grevillea pyramidalis*
Shrubs 1-2m	*Acacia orthocarpa, Acacia bivenosa, Carissa lanceolata, Acacia trachycarpa, Senna glutinosa* subsp. *glutinosa*
Shrubs <1m	*Acacia stellaticeps, Pluchea tetranthera, Ptilotus calostachyus, Tephrosia* sp. Bungaroo Creek, *Isotropis atropurpurea, Corchorus incanus, Indigofera monophylla, Corchorus elachocarpus, Sida cardiophylla, Sida* sp. Pilbara
Hummock Grasses	*Triodia lanigera, Triodia basedowii, Triodia epactia*
Tussock Grasses	*Schizachyrium fragile, Eriachne pulchella* subsp. *dominii, Aristida holathera* var. *holathera*
Herbs	*Goodenia microptera, Goodenia lamprosperma*

Broad Floristic Formation	17j. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Acacia ancistrocarpa* and *Acacia bivenosa* in orange loamy sand on sandy plains
	
Area Mapped	4,135.84 ha
Quadrats Sampled	ME114, ME115, ME116, ME119, ME120, ME121, ME122, ME128, ME131, ME132, ME135, EMES2-106, FMG095, H238, H239, H249, H260, H264, H275, H276, H290, JME190, JME193, JME194, JME196, JME198, JME199, JME219, JME220, JME221, JME224, JME227, PME58, PME59, PME67, PME68, PME69, PME73, PME91
Location	Sandy plains in the central part of the Study area, maps 31-38
Leaf Litter Cover (%)	1-7
Bare Ground (%)	40
Soils and Geology	Quartz and granite cobbles, pebbles and gravels with red/orange/brown loamy sand
Land Form	Sandy plain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, fire, livestock, access road nearby, introduced species
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia inaequilatera, Grevillea wickhamii, Acacia maitlandii, Owenia vernicosa, Grevillea pyramidalis*
Shrubs 1-2m	*Acacia ancistrocarpa, Acacia tumida* var. *pilbarensis*
Shrubs <1m	*Acacia ancistrocarpa, Acacia bivenosa, Hibiscus sturtii* var. *campylochlamys, Indigofera monophylla, Gossypium australe, Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601), *Corchorus parviflorus, Senna glutinosa* subsp. *glutinosa, Bonamia rosea, Isotropis atropurpurea*
Hummock Grasses	*Triodia lanigera, Triodia epactia, Triodia wiseana*, *Triodia basedowii*
Tussock Grasses	*Aristida contorta, Eriachne obtusa, Aristida holathera* var. *holathera*

Broad Floristic Formation	17k. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Trioida lanigera, Triodia wiseana* and *Triodia epactia* with High Shrubland of *Acacia sericophylla, Acacia tumida* var. *pilbarensis, Acacia eriopoda* and *Acacia colei* in swales with High Open Shrubland of *Acacia inaequilatera* and *Acacia orthocarpa* on rises in red brown silty clay/sandy loam on undulating hills and swales

Area Mapped	1,202.11 ha
Quadrats Sampled	ME125, ME126, EME99, PME61, ME124, JME205, JME206, PME63, JBME96, JME203, JME207, JME208, H288, H263, PME64, EMES2-99, JBME99, PME81, H274
Leaf Litter Cover (%)	0.5-2
Bare Ground (%)	55
Soils and Geology	Quartz, silcrete and granite pebbles cobbles and granite with orange/red/brown loamy sand
Land Form	Undulating hills and swales
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Excellent – Very Good
Disturbances	Rail line, fire, livestock, access track
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Corymbia flavescens*
Tall Shrubs >2m	*Acacia inaequilatera, Acacia eriopoda, Acacia eriopoda, Acacia orthocarpa, Grevillea pyramidalis, Acacia colei* var. *colei*

Shrubs 1-2m	*Acacia ancistrocarpa, Acacia acradenia, Acacia sericophylla, Acacia adsurgens, Acacia maitlandii, Grevillea wickhamii*
Shrubs <1m	*Indigofera monophylla, Tribulus suberosus, Senna artemisioides* subsp. *helmsii*
Hummock Grasses	*Triodia lanigera, Triodia basedowii, Triodia wiseana, Triodia epactia*
Tussock Grasses	*Chrysopogon fallax, Eragrostis eriopoda, Aristida holathera* subsp. *holathera*

Broad Floristic Formation	17l. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia longiceps* and *Tridoia epactia* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains

Area Mapped	1,242.44 ha
Quadrats Sampled	EMES2-94, FMG080, H258, H265, JBME100, JME150, JME180, JME181, JME182, JME189, JME191, JME201, ME106, ME107, ME109, ME117, ME133, ME192, ME71, ME87, PME44, PME52, PME57, PME75, PME83
Location	Low-lying plains in throughout the Study area, maps 21-56
Leaf Litter Cover (%)	<1
Bare Ground (%)	50
Soils and Geology	Quartz, calcrete and granite cobbles, pebbles and gravel brown sandy clay loam
Land Form	Low-lying calcrete loam plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Portulaca oleracea, *Vachellia farnesiana*
Vegetation Condition	Very Good
Disturbances	Rail line, livestock, access road, introduced species, rubbish, fire, dam, solar equipment
Average Fire Age	Old
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Acacia synchronicia, Senna glutinosa* subsp. x *luerssenii*
Shrubs 1-2m	*Acacia bivenosa, Acacia ancistrocarpa, Acacia orthocarpa, *Vachellia farnesiana, Acacia sclerosperma* subsp. *sclerosperma*

Shrubs <1m	*Acacia stellaticeps, Pluchea tetranthera, Pluchea rubelliflora, Pluchea ferdinandi-muelleri, Acacia synchronicia, Sida fibulifera*
Hummock Grasses	*Triodia epactia, Triodia longiceps*
Tussock Grasses	*Eriachne obtusa, Eragrostis cumingii, Chrysopogon fallax, Dactyloctenium radulans, Eragrostis eriopoda, *Cenchrus ciliaris, Eragrostis setifolia, Eragrostis xerophila, Sporobolus actinocladus*
Sedges	*Bulbostylis barbata*
Herbs	*Goodenia microptera, Mollugo molluginea, Stylidum desertorum*

Broad Floristic Formation	17m.*Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia longiceps* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia ancistrocarpa* and *Acacia acradenia in* brown loamy sand in minor drainage lines

Area Mapped	250.79 ha
Quadrats Sampled	PME46, PME47, JME136, JME165, EMES2-114
Location	Drainage lines between map 26-52
Leaf Litter Cover (%)	<1
Bare Ground (%)	55
Soils and Geology	Brown loamy sand
Land Form	Minor drainage lines
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail, access tracks, introduced species
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Hakea lorea* subsp. *lorea, Acacia coriacea, Atalaya hemiglauca, Corymbia zygophylla*
Tall Shrubs >2m	*Acacia trachycarpa, Acacia ancistrocarpa, Acacia acradenia, Grevillea pyramidalis, Grevillea wickhamii, Acacia orthocarpa, Acacia bivenosa, Petalostylis labicheoides*
Shrubs <1m	*Senna notabilis, Indigofera monophylla*
Hummock Grasses	*Triodia epactia, Triodia longiceps*
Tussock Grasses	*Paraneurachne muelleri, *Cenchrus ciliaris, Chrysopogon fallax, Themeda triandra*

Broad Floristic Formation	17n. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with High Shrubland of *Petalostylis labicheoides, Acacia maitlandii* and *Acacia tumida* var. *pilbarensis* and Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along drainage lines and on floodplains
	
Area Mapped	507.78 ha
Quadrats Sampled	ME55, ME57, EMES2.43, PME10, H261, JME61, JME63
Location	Maps 12 - 16
Leaf Litter Cover (%)	2.5-6
Bare Ground (%)	20-35
Soils and Geology	Ironstone and alluvial pebbles and bobbles with brown sandy loam
Land Form	Minor drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good - Excellent
Disturbances	Access tracks, rail line, fire, minor grazing, introduced species
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Eucalyptus leucophloia* subsp. *leucophloia, Acacia aptaneura, Corymbia candida, Eucalyptus victrix*
Tall Shrubs >2m	*Petalostylis labicheoides, Acacia maitlandii, Acacia tumida* var. *pilbarensis, Grevillea wickhamii, Acacia pruinocarpa, Gossypium robinsonii, Acacia pyrifolia, Acacia monticola*

Shrubs 1-2m	*Acacia atkinsiana*, *Dodonaea petiolaris*, *Androcalva luteiflora, Acacia atkinsiana*
Shrubs <1m	*Ptilotus obovatus, Indigofera monophylla, Corchorus lasiocarpus* subsp. *lasiocarpus, Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)
Hummock Grasses	*Triodia epactia, Triodia basedowii, Triodia pungens*
Tussock Grasses	*Eulalia aurea, Themeda triandra, Cymbopogon ambiguus, *Cenchrus ciliaris, Chrysopogon fallax, Eriachne tenuiculmis*

Broad Floristic Formation	17o. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia arrecta* in brown sandy loam on low undulating hills

Area Mapped	161.45 ha
Quadrats Sampled	ME76, FMG069
Location	Map 17 and 18
Leaf Litter Cover (%)	0.5
Bare Ground (%)	50
Soils and Geology	Granite/Ironstone cobbles and pebbles with brown sandy loam
Land Form	Low hill crests
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea*
Vegetation Condition	Very Good - Excellent
Disturbances	Rail line, access tracks, introduced species, earthworks
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus leucophloia* subsp. *leucophoia*
Tall Shrubs 1-2m	*Acacia inaequilatera, Acacia ancistrocarpa, Acacia monticola*
Shrubs <1m	*Acacia arrecta, Indigofera monophylla*
Hummock Grasses	*Triodia basedowii, Triodia epatica, Triodia lanigera*
Sedges	*Fimbristylis dichotoma*

Broad Floristic Formation	17p.*Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia, Triodia basedowii* and *Triodia wiseana* with High Open Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills
	
Area Mapped	3,974.13 ha
Quadrats Sampled	EMES2-107, EMES2-79, EMES2-83, FMG093, H235, JBME82, JBME92, JME103, JME106, JME109, JME148, JME151, JME160, JME183, JME188, JME232, JME233, ME100, ME103, ME104, ME105, ME110, ME111, ME144, ME79, ME84, ME85, ME88, ME92, PME26, PME31, PME32, PME39, PME49, PME50, PME51, PME82,
Location	Central part of the Study area, maps 22-41
Leaf Litter Cover (%)	<1
Bare Ground (%)	10-25
Soils and Geology	Granite and quartz, cobbles, pebbles, gravels and outcrops with brown loamy sand
Land Form	Low undulating granite hills
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Portulaca oleracea, *Cenchrus ciliaris, *Aerva javanica*
Vegetation Condition	Very Good -Excellent
Disturbances	Rail line, access tracks, introduced species, livestock, fire, rubbish
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Eucalyptus leucophloia* subsp. *leucophloia*
Tall Shrubs >2m	*Acacia orthocarpa, Acacia inaequilatera, Grevillea wickhamii, Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa, Acacia bivenosa*
Shrubs 1-2m	*Senna glutinosa* subsp. *pruinosa, Acacia maitlandii, Senna glutinosa* subsp. *glutinosa, Acacia bivenosa, Acacia acradenia*
Shrubs <1m	*Acacia stellaticeps, Acacia hilliana, Senna notabilis, Corchorus parviflorus*
Hummock Grasses	*Triodia basedowii Triodia epactia, Triodia wiseana*

Broad Floristic Formation	17q. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia robeorum, Acacia inaequilatera* and *Acacia bivenosa* in brown sandy loam on low dolerite/basalt hills
	
Area Mapped	121.63 ha
Quadrats Sampled	PME45, PME42, EMES2-91, EMES2-89
Location	Maps 27 and 28
Leaf Litter Cover (%)	<1
Bare Ground (%)	30-80
Soils and Geology	Dolerite and quartz pebbles, cobbles and gravels and red/brown sandy loam
Land Form	Low dolerite/basalt hills
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Vachellia farnesiana, *Cenchrus ciliaris, *Aerva javanica*
Vegetation Condition	Very Good
Disturbances	Rehabilitation, ripping, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Acacia inaequilatera, Acacia robeorum, Acacia ancistrocarpa, Acacia orthocarpa*
Shrubs 1-2m	*Senna glutinosa* subsp. *pruinosa, Senna glutinosa* subsp. *glutinosa, Acacia bivenosa, Acacia stellaticeps*
Shrubs <1m	*Ptilotus calostachyus*
Hummock Grasses	*Triodia epactia*, *Triodia lanigera*
Tussock Grasses	*Acacia contorta*

Broad Floristic Formation	17r. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618) and *Cajanus cinereus* and Scattered Tall Shrubs of *Grevillea wickhamii* in brown silty loam on dolerite ridges

Area Mapped	33.20 ha
Quadrats Sampled	ME123, PME66, H076, EMES2-125, JME213
Location	Small isolated dykes and ridges in central/northern parts of the Study area, maps 34-36
Leaf Litter Cover (%)	<1
Bare Ground (%)	40
Soils and Geology	Dolerite outcropping, cobbles and bounders with brown silty loam
Land Form	Dolerite dykes/ridges
Priority Ecological Community	None
Rare Flora	*Bulbostylis burbidgeae*
Introduced (Weed) Species	**Cenchrus ciliaris, *Aerva javanica*
Vegetation Condition	Excellent
Disturbances	Rail line nearby, radio repeater tower nearby, introduced species
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Acacia coriacea* subsp. *pendens*
Tall Shrubs >2m	*Grevillea wickhamii, Acacia brom flats*
Shrubs 1-2m	*Gossypium australe, Cajanus cinereus*
Shrubs <1m	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618), *Corchorus incanus, Triumfetta maconochieana, Corchorus parviflorus, Tribulus suberosus, Cleome viscosa*
Hummock Grasses	*Triodia epactia*
Tussock Grasses	*Aristida burbidgeae*, *Cymbopogon ambiguus*, **Cenchrus ciliaris, Chrysopogon fallax*

Broad Floristic Formation	17s. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia inaequilatera* over Open Tussock Grassland of *Aristida contorta* in red brown sandy clay loam on raised plains and quartz hills

Area Mapped	180.35 ha
Quadrats Sampled	JME353, EMES2-140, JBME150
Location	Map 56
Leaf Litter Cover (%)	<5
Bare Ground (%)	30-60
Soils and Geology	Quartz pebbles and cobbles with brown sandy clay loam
Land Form	Raised stony plains and quartz hills
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks
Average Fire Age	Old
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Acacia inaequilatera, Grevillea pyramidalis*
Shrubs 1-2m	*Acacia maitlandii*
Shrubs <1m	*Acacia stellaticeps, Acacia ancistrocarpa, Indigofera monophylla*
Hummock Grasses	*Triodia epactia, Triodia lanigera*
Tussock Grasses	*Aristida contorta*

Broad Floristic Formation	17t. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* in red brown sandy loam on granite and quartz hill slopes and footslopes
	
Area Mapped	1,624.88 ha
Quadrats Sampled	ME72, ME38, ME73, ME37, ME78, ME81, ME83, ME86, EMES2-73, EMES2-74, JME97, PME17, JME118, PME29, FMG057, PME32, JME114, PME30,
Location	Maps 19-25
Leaf Litter Cover (%)	<1-2.5
Bare Ground (%)	25
Soils and Geology	Granite, quartz, dolerite, basalt and calcrete cobbles, pebbles and outcrops
Land Form	Hillslopes and footslopes
Priority Ecological Community	None
Rare Flora	*Goodenia nuda, Acacia levata*
Introduced (Weed) Species	**Portulaca oleracea, *Aerva javanica, *Cenchrus ciliaris, *Bidens bipinnata*
Vegetation Condition	Very Good-Excellent
Disturbances	Rail line, access tracks, quarry, rubbish, introduced species, livestock
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia inaequilatera, Acacia ancistrocarpa, Acacia bivenosa, Grevillea pyramidalis, Acacia pachyachra, Acacia tenuissima*
Shrubs 1-2m	*Acacia levata*
Shrubs <1m	*Acacia arrecta, Indigofera monophylla, Gossypium australe, Acacia stellaticeps*
Hummock Grasses	*Triodia wiseana, Triodia epactia*
Tussock Grasses	*Paraneurachne muelleri*

Broad Floristic Formation	17u. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia pungens, Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over Scattered Tall Shrubs of *Acacia inaequilatera* in brown sandy clay loam on dolerite hill slopes

Area Mapped	1,286.71 ha
Quadrats Sampled	ME69, ME74, ME75, PME18, PME19, JME90, PME20, PME22
Location	Maps 17-21
Leaf Litter Cover (%)	<1
Bare Ground (%)	45
Soils and Geology	Dolerite slate, pebbles, cobbles and outcrops with brown sandy clay loam
Land Form	Hillslopes
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Aerva javanica, *Cenchrus ciliaris, *Malvastrum americanum, *Portulaca oleracea*
Vegetation Condition	Very Good - Excellent
Disturbances	Rail line, tracks, fire, access tracks, introduced species
Average Fire Age	Young to Moderate
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia inaequilatera, Acacia ancistrocarpa, Acacia pyrifolia, Hakea chordophylla*
Shrubs <1m	*Ptilotus nobilis, Ptilotus rotundifolius, Tribulus suberosus, Ptilotus clementii, Senna glutinosa* subsp. *glutinosa*
Hummock Grasses	*Triodia epactia, Triodia basedowii, Triodia wiseana, Triodia lanigera*
Tussock Grasses	*Cymbopogon ambiguus, Eriachne mucronata, Digitaria brownii*

Broad Floristic Formation	17v. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* with Low Shrubland of *Indigofera rugosa* and Scattered Low Trees of *Grevillea pyramidalis* in brown sandy loam on quartz and granite hill slopes

Area Mapped	79.00 ha
Quadrats Sampled	PME21
Location	Map 17
Leaf Litter Cover (%)	<1
Bare Ground (%)	50
Soils and Geology	Granite and quartz with brown sandy loam
Land Form	Hillslopes (lower slopes)
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Rail line, access track nearby
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Grevillea pyramidalis*
Shrubs <1m	*Indigofera rugosa*
Hummock Grasses	*Triodia epactia*

Broad Floristic Formation	17w. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* (and Very Open Tussock Grassland of **Cenchrus ciliaris)* in red/brown loamy sand on levee banks and floodplains

Area Mapped	215.40 ha
Quadrats Sampled	PME134, JME324, JME249, JME262, H090, JME253, H070, JME309, JME314
Location	Drainage lines between map 38 and map 54
Leaf Litter Cover (%)	<5
Bare Ground (%)	20
Soils and Geology	Mixed cobbles and pebbles with orange/red brown loamy sand
Land Form	Levee bank/ floodplains and minor drainage lines
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Access tracks, rail line, introduced species, fire
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia tumida* var. *pilbarensis, Acacia colei* var. *colei, Cullen stipulaceum*
Shrubs 1-2m	*Acacia ancistrocarpa, Acacia tumida* var. *pilbarensis, Cajanus* cf. *cinereus, Acacia acradenia, Petalostylis labicheoides*
Shrubs <1m	*Acacia stellaticeps*
Hummock Grasses	*Triodia epactia, Triodia basedowii, Triodia wiseana*
Tussock Grasses	**Cenchrus ciliaris, Chrysopogon fallax, Aristida inaequiglumis, Eriachne benthamii*
Herbs	*Cassytha filiformis*

Broad Floristic Formation	17x. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia pungens* with High Open Shrubland of *Acacia aptaneura* and *Grevillea berryana* over Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* in brown loamy sand on low undulating chert hills

Area Mapped	5.59 ha
Quadrats Sampled	ME27
Location	Map 7
Leaf Litter Cover (%)	1
Bare Ground (%)	20-30
Soils and Geology	Ironstone/chert pebbles and cobbles, scattered quartz with brown loamy sand
Land Form	Chert low hill
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Portulaca oleracea*
Vegetation Condition	Very Good
Disturbances	Rail line, fence line, access track, fire
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia aptaneura*, *Grevillea berryana*
Shrubs 1-2m	*Acacia ancistrocarpa*, *Acacia bivenosa*, *Acacia adsurgens*, *Eremophila forrestii* subsp. *forrestii, Senna glutinosa* subsp. *glutinosa*
Hummock Grasses	*Triodia pungens*

Broad Floristic Formation	17y. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with High Open Shrubland of *Acacia colei* var. *colei* and *Acacia inaequilatera* over Shrubland of *Acacia colei* var. *colei* and *Acacia ancistrocarpa* in red brown sandy loam on plains
	
Area Mapped	1,664.14 ha
Quadrats Sampled	EMES2-146, H115, H184, H185, JME326, JME333, ME181, ME182, ME184, ME185, ME186, ME187, ME188, PME129, PME130,
Location	Northern end of Study area, maps 53-59
Leaf Litter Cover (%)	<1-3
Bare Ground (%)	15
Soils and Geology	Quartz, granite, chert and ironstone pebbles, outcrops and cobbles with red brown sandy loam
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Livestock, rail line, access tracks, quarry nearby, rail yards
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees <10m	*Corymbia candida*
Tall Shrubs >2m	*Acacia colei* var. *colei*, *Acacia inaequilatera, Acacia ancistrocarpa, Acacia tumida* var. *pilbarensis*
Shrubs 1-2m	*Acacia colei* var. *colei*, *Acacia bivenosa, Acacia ancistrocarpa, Acacia tumida* var. *pilbarensis, Sida rohlenae, Cullen stipulaceum*
Shrubs <1m	*Acacia stellaticeps, Pluchea tetranthera, Cleome viscosa, Senna notabilis, Salsola australis*, *Indigofera monophylla*
Hummock Grasses	*Triodia epactia, Triodia basedowii*, *Triodia lanigera*
Tussock Grasses	*Aristida contorta*

Broad Floristic Formation	17z. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia epactia* with Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* in grey brown sandy loam on sandy plain
	
Area Mapped	91.49 ha
Quadrats Sampled	ME199, H114
Location	Map 59
Leaf Litter Cover (%)	2
Bare Ground (%)	20-30
Soils and Geology	Grey brown sandy loam
Land Form	Sandy plain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, tracks, introduced species
Average Fire Age	Moderate to Old
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus victrix*
Tall Shrubs >2m	*Hakea lorea* subsp. *lorea*
Shrubs <1m	*Acacia colei* var. *colei, Acacia stellaticeps, Indigofera monophylla, Sida cardiophylla, Sida* sp. Pilbara (A. A. Mitchell PRP 1543), *Carissa lanceolata, Corchorus walcottii*
Hummock Grasses	*Triodia epactia*
Tussock Grasses	*Chrysopogon fallax*
Herbs	*Goodenia lamprosperma*

Broad Floristic Formation	17aa. *Triodia* Hummock Grassland
Vegetation Association	Hummock Grassland of *Triodia secunda* and *Triodia longiceps* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in orange sandy clay loam on plains and floodplains
	
Area Mapped	1,588.92 ha
Quadrats Sampled	ME102, ME108, ME134, ME90, ME91, ME93, ME94, EMES2-119, EMES2-126, FMG026F, FMG077, FMG081, H120, JBME78, JME138, JME140JME209, JME210, JME218, JME241, JME243, JME244, JME275, JME287, JME288, JME300, JME302, JME315, PME103, PME115, PME120, PME121, PME33, PME35, PME36, PME40, PME48, PME52, PME72, PME84, WP031,
Location	Plains and floodplains surrounding medium to major drainage lines throughout the Study area, maps 25-51
Leaf Litter Cover (%)	<1
Bare Ground (%)	40
Soils and Geology	Quartz and granite cobbles and pebbles with orange brown sandy clay loam
Land Form	Plains, floodplains and footslopes
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good - Excellent
Disturbances	Rail line, access tracks, fire, bores, soil disturbance, litter, livestock, introduced species
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Shrubs 1-2m	*Acacia ampliceps, Adrianna tomentosa* var. *tomentosa, Grevillea wickhamii*
Shrubs <1m	*Acacia bivenosa, Acacia stellaticeps, Scaevola spinescens, Pluchea rubelliflora, Pluchea ferdinandi-muelleri*, *Pluchea rubelliflora, Pluchea dunlopii, Melaleuca eleuterostachya*
Hummock Grasses	*Triodia secunda*, *Triodia longiceps*
Tussock Grasses	*Eragrostis cumingii*, *Chrysopogon fallax, Sporobolus actinocladus*
Sedges	*Bulbostylis barbata*

Broad Floristic Formation	18a. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia atkinsiana, Acacia marramamba* and *Acacia maitlandii* in brown sandy loam on hill crests and hill slopes
	
Area Mapped	2,075.68 ha
Quadrats Sampled	ME34, ME51, ME53, ME56, ME58, ME59, ME63, EMES2-61, EMES2.57, FMG067, PME08, PME09
Location	Maps 11- 16
Leaf Litter Cover (%)	<3
Bare Ground (%)	70
Soils and Geology	Ironstone pebbles, cobbles and outcropping with brown sandy loam
Land Form	Hillcrests and hillslopes
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good- Excellent
Disturbances	Fence line, rail line, access tracks, fire, donkeys
Average Fire Age	Young
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus leucophloia, Corymbia hamersleyana, Acacia pruinocarpa, Corymbia deserticola*
Tall Shrubs >2m	*Hakea chordophylla, Acacia rhodophloia, Acacia marramamba*

Shrubs 1-2m	*Petalostylis labicheoides, Acacia tumida* var. *pilbarensis, Acacia bivenosa, Acacia ancistrocarpa, Acacia maitlandii, Grevillea wickhamii, Acacia atkinsiana*
Shrubs <1m	*Acacia arida, Acacia ancistrocarpa Gompholobium oreophilum*, *Senna glutinosa* subsp. *glutinosa, Acacia adoxa* var. *adoxa, Acacia hilliana*, *Sida arenicola*
Hummock Grasses	*Triodia basedowii*, *Triodia pungens*, *Triodia* sp. Shovelanna Hill (S. Van Leeuwen 3835), *Triodia brizoides*
Tussock Grasses	*Eriachne lanata, Eriachne mucronata*

Broad Floristic Formation	18b. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* subsp. *leucophloia* and *Corymbia hamersleyana* over Open Shrubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in brown sandy loam on hill slopes and hill crests

Area Mapped	277.84 ha
Quadrats Sampled	ME35, ME67
Location	Map 16
Leaf Litter Cover (%)	<2
Bare Ground (%)	35
Soils and Geology	Ironstone, mudstone and metamorphosed sandstone (purple/grey), pebbles, cobbles and outcropping
Land Form	Hill slopes and crests
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good - Excellent
Disturbances	Fire, rail line, access tracks
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia pyrifolia*
Shrubs 1-2m	*Acacia monticola, Acacia pyrifolia* var. *pyrifolia*
Shrubs <1m	*Indigofera monophylla, Acacia hilliana, Acacia adoxa* var. *adoxa, Ptilotus nobilis, Bonamia rosea, Tephrosia rosea* var. *clementii*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	*Eriachne lanata, Paraneurachne muelleri*

Broad Floristic Formation	18c. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon* sp. Dioicum (A.A. Mitchell PRP1618), *Triumfetta maconochieana* and *Cajanus cinereus* over Very Open Tussock Grassland of *Paspaidium clementii* and **Cenchrus ciliaris* in skeletal brown loamy sand on granite rockpiles
	
Area Mapped	557.63 ha
Quadrats Sampled	ME89, ME96, PME62, PME65, JBME90, JBME91, EMES2-101, H273, H277, PME71, EMES2-76, FMG090, JME147
Location	Granite rock piles in the central parts of the Study area, maps 24-36
Leaf Litter Cover (%)	<1
Bare Ground (%)	45-60
Soils and Geology	Granite outcrops, boulders, pebbles and cobbles with skeletal brown loamy sand
Land Form	Granite rock piles
Priority Ecological Community	None
Rare Flora	*Bulbostylis burbidgeae*
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Fire, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia coriacea* subsp. *pendens, Corymbia hamersleyana, Ficus brachypoda, Mallotus nesophilus, Terminalia canescens*
Tall Shrubs >2m	*Acacia eriopoda, Acacia acradenia, Acacia trachycarpa, Atalaya hemiglauca, Acacia pyrifolia, Grevillea wickhamii*
Shrubs 1-2m	*Abutilon* sp. Dioicum (A.A. Mitchell PRP1618), *Triumfetta maconochieana, Cajanus cinereus*
Hummock Grasses	*Triodia epactia Triodia pungens*

Tussock Grasses	*Paspalidum basicladum, Eragrostis cumingii, *Cenchrus ciliaris, Cymbopogon ambiguus, Aristida burbidgeae, Cymbopogon ambiguus*
Sedges	*Bulbostylis burbidgeae*
Herbs	*Pluchea dunlopii, Streptoglossa viscosa, Cucumis maderaspatanus, Gomphrena cunninghamii*

Broad Floristic Formation	18d. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with Scattered Low Trees of *Corymbia hamersleyana* over Open Shrubland of *Cajanus cinereus* and *Acacia pyrifolia* var. *pyrifolia* in red sandy loam in minor drainge lines

Area Mapped	45.78 ha
Quadrats Sampled	ME173, JME301
Location	Drainage line on map 51
Leaf Litter Cover (%)	3
Bare Ground (%)	60
Soils and Geology	Granite/calcrete - outcrops and scattered cobbles with red sandy loam
Land Form	Minor drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Livestock, rail line, access track
Average Fire Age	Young
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Shrubs 1-2m	*Cajanus cinereus, Acacia pyrifolia* var. *pyrifolia, Acacia tumida* var. *pilbarensis, Acacia trachycarpa*
Shrubs <1m	*Acacia stellaticeps, Pluchea rubelliflora, Corchorus laniflorus*
Hummock Grasses	*Triodia epactia, Triodia basedowii*
Tussock Grasses	*Chrysopogon fallax, Eragrostis cumingii, Themeda triandra, Eragrostis tenellula*
Herbs	*Hybanthus aurantiacus, Stemodia grossa, Dysphania rhadinostachya*

Broad Floristic Formation	18e. *Triodia* Open Hummock Grassland
Vegetation Association	Open Hummock Grassland *of Triodia lanigera* with Low Open Woodland of *Corymbia zygophylla* and *Corymbia hamersleyana* over Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Isotropis atropurpurea, Indigofera monophylla* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) in orange red loamy sand on sand plains
	
Area Mapped	695.00 ha
Quadrats Sampled	JME278, JME296, JME297, ME165, ME171, ME172, PME112,
Location	Maps 49-51
Leaf Litter Cover (%)	<2
Bare Ground (%)	55
Soils and Geology	Scattered quartz cobbles and pebbles with orange/red loamy sand
Land Form	Sand plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Rail line, access track, livestock, fire
Average Fire Age	Young
Vegetation Structure & Floristics	
Trees <10m	*Corymbia zygophylla, Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia inaequilatera, Acacia ancistrocarpa, Acacia sericophylla*
Shrubs <1m	*Indigofera monophylla, Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601), *Isotropis atropurpurea, Bonamia rosea, Ptilotus astrolasius, Corchorus tectus, Streptoglossa ordora, Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Cleome uncifera*
Hummock Grasses	*Triodia lanigera*
Tussock Grasses	*Chrysopogon fallax, Eragrostis eriopoda*
Sedges	*Bulbostylis barbata*
Herbs	*Goodenia muelleriana, Goodenia microptera, Mollugo molluginea*

Broad Floristic Formation	19. *Cenchrus* Closed tummock Grassland
Vegetation Association	Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Woodland of *Corymbia hamersleyana* and *Acacia aptaneura* and Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia ancistrocarpa* in red brown silty loam on floodplains
	
Area Mapped	38.00 ha
Quadrats Sampled	JME10, EMES2.05, H016
Location	Map 2 and 3
Leaf Litter Cover (%)	20
Bare Ground (%)	10
Soils and Geology	Red brown silty loam
Land Form	Floodplains and minor drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger*
Vegetation Condition	Degraded - Good
Disturbances	Introduced species, grazing by livestock, old windmill, tracks, rail line
Average Fire Age	Modereate
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Acacia aptaneura, Acacia pruinocarpa*
Shrubs 1-2m	*Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa, Gossypium robinsonii*
Hummock Grasses	*Triodia basedowii, Triodia pungens*
Tussock Grasses	**Cenchrus ciliaris, *Cenchrus setiger*

Broad Floristic Formation	20. *Astrebla/Eragrostis* Tussock Grassland
Vegetation Association	Tussock Grassland of *Astrebla pectinata, Aristida inaequiglumis* and *Sporobolus australasicus* with Low Open Shrubland of *Sida fibulifera, Corchorus trilocularis* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) and Open Herbs of *Operculina aequisepala* in brown medium clay on basalt plains

Area Mapped	837.54 ha
Quadrats Sampled	ME70, ME36, EMES2.67, FMG058, H286, FMG071
Location	Maps 16-18
Leaf Litter Cover (%)	1
Bare Ground (%)	45-75
Soils and Geology	Basalt pebbles cobbles and boulders with brown medium clay
Land Form	Basalt plains
Priority Ecological Community	Wona Land System - Mitchell Grass plains *(Astrebla* spp.) on gilgai Priority 3(iii) PEC)
Rare Flora	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431)
Introduced (Weed) Species	**Flaveria trinervia, *Malvastrum americanum, *Vachellia farnesiana, *Portulaca oleracea, *Flaveria trinervia*
Vegetation Condition	Good
Disturbances	Grazing, rail line, access track, livestock, weeds, quarry
Average Fire Age	Old
Vegetation Structure & Floristics	
Shrubs <1m	*Sida fibulifera, Corchorus trilocularis, Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601), *Senna artemisioides* subsp. *oligophylla, Corchorus tridens, Streptoglossa bubakii*
Tussock Grasses	*Astrebla pectinata, Aristida inaequiglumis, Sporobolus australasicus, Aristida latifolia, Aristida latifolia, Astrebla elymoides*
Herbs	*Operculina aequisepala, Calocephalus* sp. Wittenoom (A. S. Groge 1082), *Striga curviflora, Operculina aequisepala, Polymeria lanata*

Broad Floristic Formation	21. *Cenchrus* Tussock Grassland
Vegetation Association	Tussock Grassland of **Cenchrus ciliaris* and *Eulalia aurea* with Low Open Woodland of *Corymbia aspera* and *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia tumida* var. *pilbarensis* and *Acacia sclerosperma* subsp. *sclerosperma* in brown sandy loam on major drainage lines

Area Mapped	12.88 ha
Quadrats Sampled	JME179, H259, EME2S-93
Location	Drainage line on map 30
Leaf Litter Cover (%)	15
Bare Ground (%)	35
Soils and Geology	Brown sandy loam
Land Form	Drainage line
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Vachellia farnesiana, *Malvastrum americanum*
Vegetation Condition	Good
Disturbances	Introduced species, rail line, access tracks, fire
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana, Corymbia aspera, Eucalyptus camaldulensis* subsp. *refulgens*
Tall Shrubs >2m	*Acacia trachycarpa, Acacia sclerosperma* subsp. *sclerosperma, Acacia tumida* var *pilbarensis, *Vachellia farnesiana*
Shrubs <1m	*Pluchea ferdinandi-muelleri*
Hummock Grasses	*Triodia lanigera. Triodia longiceps*
Tussock Grasses	**Cenchrus ciliaris, Chloris pectinata*, *Eulalia aurea*
Sedges	*Cyperus vaginatus*

Broad Floristic Formation	22a. *Eriachne* Tussock Grassland
Vegetation Association	Tussock Grassland of *Eriachne benthamii* and *Eriachne flaccida* with Low Woodland of *Eucalyptus victrix* over Hummock Grassland of *Triodia epactia* in brown grey silty loam in drainage depressions

Area Mapped	55.35 ha
Quadrats Sampled	JME367, ME197
Location	Map 59
Leaf Litter Cover (%)	6
Bare Ground (%)	20
Soils and Geology	Brown grey silty loam
Land Form	Drainage depressions
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, livestock, tracks, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Eucalyptus victrix*
Shrubs 1-2m	*Ehretia saligna, Carissa lanceolata*
Hummock Grasses	*Triodia epactia, Triodia lanigera*
Tussock Grasses	*Eriachne benthamii, Eriachne flaccida, Chrysopogon fallax, *Cenchrus ciliaris*

Broad Floristic Formation	22b. *Eriachne* Tussock Grassland
Vegetation Association	Tussock Grassland of *Eriachne benthamii* and *Eulalia aurea* with High Open Shrubland of *Hakea lorea* subsp. *lorea* over Open Shrubland of *Acacia colei* var. *colei* in brown medium clay on clay plains

Area Mapped	3.13 ha
Quadrats Sampled	JME319, JBME145
Location	Small area of clay plains on map 53
Leaf Litter Cover (%)	<1
Bare Ground (%)	65
Soils and Geology	Brown medium clay
Land Form	Clay plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Access track, rail line
Average Fire Age	Old
Vegetation Structure & Floristics	
Tall Shrubs >2m	*Hakea lorea* var. *lorea*
Tall Shrubs 1-2m	*Acacia colei* var. *colei, Sesbania cannabina, Carissa lanceolata*
Hummock Grasses	*Triodia longiceps*
Tussock Grasses	*Eriachne benthamii, Eulalia aurea, Panicum decompositum, Eriachne glauca*
Herbs	*Goodenia lamprosperma, Pluchea rubelliflora, Marsilea hirsuta*

Broad Floristic Formation	23. *Chrysopogon* Open Tussock Grassland
Vegetation Association	Open Tussock Grassland of *Chrysopogon fallax*, *Eulalia aurea* and *Eriachne obtusa* with Low Open Woodland of *Corymbia hamersleyana* and *Corymbia candida* over High Open Shrubland of *Grevillea wickhamii* and *Cajanus cinereus* in red silty loam on floodplains

Area Mapped	125.39 ha
Quadrats Sampled	ME151, JME266, JBME110
Location	Floodplains surrounding medium drainage line on Map 44
Leaf Litter Cover (%)	4
Bare Ground (%)	10
Soils and Geology	Quartz, ironstone and granite scattered cobbles and pebbles with red silty loam
Land Form	Floodplain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Malvastrum americanum, *Portulaca oleracea*
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks, livestock, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees <10m	*Corymbia hamersleyana*, *Corymbia candida, Corymbia flavescens*
Shrubs 1-2m	*Cajanus cinereus, Grevillea wickhamii, Grevillea pyramidalis, Cajanus cinereus*
Shrubs <1m	*Corchorus parviflorus, Cajanus cinereus, Tephrosia rosea* var. *clementii, Pluchea ferdinandi-muelleri , Pluchea tetranthera, Acacia stellaticeps*
Hummock Grasses	*Triodia epactia*
Tussock Grasses	*Chrysopogon fallax, Eriachne obtusa, Eulalia aurea*

Broad Floristic Formation	24. *Eriachne* Open Tussock Grassland
Vegetation Association	Open Tussock Grassland of *Eriachne benthamii*, *Eriachne flaccida* and *Chrysopogon fallax* with Scattered Low Trees of *Corymbia aspera* over High Open Shrubland of *Acacia trachycarpa* and *Acacia colei* var. *colei* in brown loamy sand along minor drainage lines

Area Mapped	32.71 ha
Quadrats Sampled	JME343, JME347, JBME152
Location	Drainage line/zone on maps 55 and 56
Leaf Litter Cover (%)	10
Bare Ground (%)	70
Soils and Geology	Brown loamy sand
Land Form	Minor drainage zone
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Cenchrus setiger, *Citrullus colocynthis*
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks, introduced species
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Corymbia aspera*
Tall Shrubs >2m	*Acacia trachycarpa, Acacia colei* var. *colei, Acacia tumida* var. *pilbarensis*
Tussock Grasses	**Cenchrus ciliaris, Eriachne benthamii, Eriachne flaccida, Chrysopogon fallax*

Broad Floristic Formation	25. *Eulalia* Open Tussock Grassland
Vegetation Association	Open Tussock Grassland of *Eulalia aurea* and *Themeda triandra* with Low Open Woodland of *Acacia coriacea* subsp. *pendens* and *Acacia xiphophylla* over Open Shrubland of *Acacia coriacea* subsp. *pendens, Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* in red brown clay on floodplains

Area Mapped	30.89 ha
Quadrats Sampled	PME13, PME15
Location	Maps 17 and 18
Leaf Litter Cover (%)	<5
Bare Ground (%)	60
Soils and Geology	Riverine gravel and ironstone with red brown clay
Land Form	Floodplains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Vachellia farnesiana*
Vegetation Condition	Very Good
Disturbances	Introduced species, rail line, access track
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia coriacea* subsp. *pendens, Acacia xiphophylla, Corymbia hamersleyana, Acacia sericophylla*
Shrubs 1-2m	*Acacia ancistrocarpa, Acacia tumida* var. *pilbarensis*
Shrubs <1m	*Senna glutinosa* subsp. *glutinosa*
Hummock Grasses	*Triodia basedowii*
Tussock Grasses	*Eulalia aurea, Themeda triandra, Panicum decompositum*

Broad Floristic Formation	M1. Mosaic*: Acacia* Low Open Woodland / *Triodia* Closed Hummock Grassland
Vegetation Association	Mosaic: Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronica* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata;* Closed Hummock Grassland of *Triodia angusta* in red brown sandy clay loam on undulating plains
	
Area Mapped	64.15 ha
Quadrats Sampled	EMES2-22, EMES2-17, EMES2-18, EMES2-21, EMES2-20, EMES2-19
Location	Map 8
Leaf Litter Cover (%)	<2
Bare Ground (%)	60
Soils and Geology	Red brown sandy clay loam
Land Form	Undulating plains
Priority Ecological Community	Occurs adjacent to Freshwater claypans of the Fortescue Valley (Priority 1 PEC) and Fortescue Marsh (Priority 1 PEC); areas within the mosaic likely to be of significance
Rare Flora	*Eremophila spongiocarpa*
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Fire, livestock, introduced species, tracks
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia xiphophylla, Acacia aptaneura*
Tall Shrubs >2m	*Acacia synchronicia, Rhagodia eremaea*
Shrubs <1m	*Acacia synchronicia, Acacia adoxa* var. *subglabra*, *Pluchea ferdinandi-muelleri, Eremophila cuneifolia, Maireana pyramidata*
Hummock Grasses	*Triodia angusta, Triodia basedowii*

Broad Floristic Formation	M2. Mosaic: *Triodia* Hummock Grassland
Vegetation Association	Mosaic: Hummock Grassland of *Triodia secunda* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps* over Scattered Tussock Grasses of *Sporobolus australasicus;* Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera, Acacia ancistrocarpa* and *Acacia colei* var. *colei* in red/orange silty/sandy clay loam on plains
	
Area Mapped	1,891.39 ha
Quadrats Sampled	H183, JME305, JME306, JME308, JME340, ME174, ME175, ME176, ME177, ME178, PME113, PME114, PME116, PME135
Location	Maps 51-55
Leaf Litter Cover (%)	<3
Bare Ground (%)	15-35
Soils and Geology	Quartz and granite scattered pebbles and gravels with red/orange silty/sandy clay loam
Land Form	Plain
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Rail line, access tracks, fence lines, fire, introduced species
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia inaequilatera, Grevillea wickhamii, Acacia ancistrocarpa, Acacia colei* var. *colei, Acacia bivenosa*
Shrubs <1m	*Acacia stellaticeps, Acacia synchronicia*
Hummock Grasses	*Triodia angusta, Triodia epactia, Triodia basedowii, Triodia secunda, Triodia longiceps*
Tussock Grasses	*Eragrostis eriopoda, Sporobolus australasicus*

Broad Floristic Formation	M3. Mosaic: *Acacia* Low Open Woodland / *Acacia* Low Woodland
Vegetation Association	Mosaic: Low Woodland of *Acacia paraneura, Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris;* Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata, Maireana triptera* and *Sclerolaena cuneata* in red loamy sand on plains

Area Mapped	160.80 ha
Quadrats Sampled	ME41
Location	Map 9
Leaf Litter Cover (%)	1
Bare Ground (%)	85
Soils and Geology	Ironstone/chert- pebbly scree with red loamy sand
Land Form	Plains
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Introduced species, rail line, access tracks
Average Fire Age	Old
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Acacia paraneura, Acacia pruinocarpa, Acacia xiphophylla, Acacia ayersiana*
Tall Shrubs >2m	*Acacia synchronicia, Hakea lorea* subsp. *lorea*
Shrubs 1-2m	*Acacia synchronicia, Rhagodia eremaea*
Shrubs <1m	*Eremophila forrestii* subsp. *forrestii, Ptilotus obovatus, Sida platycalyx, Maireana pyramidata, Maireana triptera, Sclerolaena cuneata*
Tussock Grasses	*Sporobolus australasicus, Paraneurachne muelleri, *Cenchrus ciliaris*

Broad Floristic Formation	M4. Mosaic: *Triodia* Open Hummock Grassland / *Triodia* Hummock Grassland
Vegetation Association	Mosaic: Open Hummock Grassland of *Triodia lanigera, Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Low Open Shrubland of *Acacia atkinsiana* and *Acacia bivenos*a in brown sandy loam on hill crests and hill slopes; Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* in brown sandy clay loam in drainage basins and on plains

Area Mapped	999.32 ha
Quadrats Sampled	ME61, ME62, EMES2-52, EMES2-55, PME11, H272
Location	Maps 14 and 16
Leaf Litter Cover (%)	<5
Bare Ground (%)	35
Soils and Geology	Ironstone, dolerite and quartz pebbles and cobbles
Land Form	Hill slope, hill slope, drainage basins and plains
Priority Ecological Community	None
Rare Flora	*Goodenia nuda*
Introduced (Weed) Species	None
Vegetation Condition	Very Good
Disturbances	Fire, rail line, access track nearby
Average Fire Age	Moderate
Vegetation Structure & Floristics	
Trees >10m	*Acacia aptaneura, Eucalyptus leucophloia* subsp. *leucophloia, Acacia ayersiana*
Tall Shrubs >2m	*Acacia bivenosa, Acacia atkinsiana*
Shrubs 1-2m	*Acacia marramamba, Petalostylis labicheoides*
Shrubs <1m	*Gompholobium oreophilum, Acacia ptychophylla, Acacia bivenosa, Acacia atkinsiana*
Hummock Grasses	*Triodia epactia Triodia lanigera, Triodia basedowii*
Tussock Grasses	*Eriachne pulchella*

Broad Floristic Formation	M5. Mosaic: *Triodia* Hummock Grassland / *Acacia* High Open Shrubland
Vegetation Association	Mosaic: Hummock Grassland of *Triodia epactia, Triodia basebowii* and *Trioida wiseana* with High Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis, Aristida contorta* and *Sporobolus australasicus* in skeletal brown sandy loam on granite plateau / sheet outcrops
	
Area Mapped	497.77 ha
Quadrats Sampled	JME240, ME95, ME96
Location	Maps 26 and 40
Leaf Litter Cover (%)	<1
Bare Ground (%)	65-90
Soils and Geology	Granite sheets, outcrops, flakes, pebbles and cobbles with skeletal brown sandy loam
Land Form	Undulating granite hills and granite plateau/sheet outcrops
Priority Ecological Community	None
Rare Flora	*Bulbostylis burbidgeae*
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very Good
Disturbances	Access track, rail line, livestock, rubbish, introduced species, fire
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Terminalia canescens, Ficus brachypoda*
Tall Shrubs >2m	*Acacia orthocarpa, Acacia tumida* var. *pilbarensis, Acacia inaequilatera, Acacia eriopoda, Acacia acradenia*
Shrubs <1m	*Corchorus laniflorus, Pluchea rubelliflora, Euphorbia schultzii*
Hummock Grasses	*Triodia epactia*, *Triodia basedowii, Triodia wiseana*
Tussock Grasses	*Tripogon loliiformis, Aristida contorta*
Sedges	*Bulbostylis barbata, Bulbostylis burbidgeae*

Broad Floristic Formation	M6. Mosaic: *Triodia* Hummock Grassland/ *Acacia* High Open Shrubland
Vegetation Association	Mosaic: Hummock Grassland of *Triodia longiceps, Triodia angusta* and *Triodia wiseana* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis* in skeletal brown sandy loam on granite plateau / sheet outcrops

Area Mapped	894.42 ha
Quadrats Sampled	EMES2-119, H074, H099, JME276, ME158, ME161, ME163, ME164, ME170
Location	Maps 46-50
Leaf Litter Cover (%)	<1
Bare Ground (%)	30-45
Soils and Geology	Granite and quartz slabs, outcrops, pebbles and cobbles with orange brown sandy loam
Land Form	Plain with granite outcrops
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris, *Flaveria trinervia, *Aerva javanica*
Vegetation Condition	Good – Very Good
Disturbances	Rail line, livestock, access tracks, man made rock piles, introduced species
Average Fire Age	Old

Vegetation Structure & Floristics	
Trees >10m	*Corymbia hamersleyana*
Tall Shrubs >2m	*Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa*
Shrubs 1-2m	*Acacia bivenosa, Acacia ancistrocarpa, Acacia orthocarpa*
Shrubs <1m	*Acacia bivenosa, Acacia stellaticeps, Pluchea ferdinandi-muelleri, Pluchea rubelliflora*
Hummock Grasses	*Triodia longiceps, Triodia epactia, Triodia angusta, Triodia wiseana*
Tussock Grasses	*Chrysopogon fallax, Eragrostis cumingii, Tripogon loliiformis*
Sedges	*Fimbristylis dichotoma, Bulbostylis barbata*

Broad Floristic Formation	M7. Mosaic: *Triodia* Hummock Grassland/*Acacia* High Open Shrubland
Vegetation Association	Mosaic: Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps;* High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* (and Very Open Tussock Grassland of *Tripogon loliiformis*) in orange loamy sand on undulating granitic plains with granitic outcrops

Area Mapped	963.82 ha
Quadrats Sampled	FMGBB, FMGBC, H068, H069, H071, H073, H180, JME279, JME284, ME159, PME105, EMES2-120,
Location	Maps 47-50
Leaf Litter Cover (%)	1.5
Bare Ground (%)	20
Soils and Geology	Granite/quartz - outcrops, cobbles and pebbles with orange loamy sand
Land Form	Undulating granitic plains with granite outcrops
Priority Ecological Community	None
Rare Flora	None
Introduced (Weed) Species	**Cenchrus ciliaris*
Vegetation Condition	Very good
Disturbances	Access tracks, livestock, rail line, introduced species
Average Fire Age	Very Old

Vegetation Structure & Floristics	
Trees >10m	*Terminalia canescens, Corymbia hamersleyana, Acacia coriacea* subsp. *pendens, Ficus brachypoda, Acacia pyrifolia*
Tall Shrubs >2m	*Acacia ancistrocarpa, Acacia orthocarpa, Acacia tumida* subsp. *pilbarensis, Grevillea wickhamii* subsp. *aprica, Hakea lorea* subsp. *lorea*
Shrubs 1-2m	*Acacia ancistrocarpa*
Shrubs <1m	*Corchorus incanus, Acacia stellaticeps, Acacia bivenosa*
Hummock Grasses	*Triodia epactia, Triodia lanigera, Triodia basedowii*
Tussock Grasses	*Tripogon loliiformis, *Cenchrus ciliaris*
Sedges	*Fimbristylis dichotoma*

Legend

Vegetation Mapping

Acacia Low Closed Woodland

1a Low Closed Woodland of *Acacia citrinoviridis, Acacia pruinocarpa* and *Acacia aptaneura* over Open Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna glutinosa* subsp. x *luerssenii* in brown clay loam on levee banks of major drainage lines

1b Low Closed Woodland of *Acacia aptaneura* over Very Open Tussock Grassland of *Chrysopogon fallax* and **Cenchrus ciliaris* with Scattered Shrubs of *Psydrax latifolia* and *Eremophila lanceolata*in red/brown clay loam on plains

Acacia Low Open Forest

2a Low Open Forest of *Acacia xiphophylla* and *Acacia aptaneura* over Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Acacia tetragonophylla* and *Acacia synchronicia* over Very Open Tussock Grassland of *Chrysopogon fallax*, *Aristida contorta* and *Sporobolus australasicus* in red brown sandy clay loam on stony plains

2b Low Open Forest of *Acacia aptaneura*, *Acacia aneura* x *ayersiana* and *Acacia pruinocarpa* over Hummock Grassland of *Triodia epactia* and *Triodia* sp. Shovelanna Hill with Open Shrubland of *Eremophila forrestii* subsp. *forrestii, Grevillea berryana* and *Dodonaea petiolaris* in red/brown loamy sand on stony plains

2c Low Open Forest of *Acacia xiphophylla* over Low Scattered Shrubs of *Senna glutinosa* subsp. *glutinosa*, *Streptoglossa bubakii* and *Senna glaucifolia* over Scattered Tussock Grasses of *Astrebla pectinata*, *Eriachne obtusa* and *Eragrostis xerophila* in red brown medium clay on basalt plains

Melaleuca Low Woodland

3 Low Woodland of *Melaleuca argentea*, *Eucalyptus camaldulensis* subsp. *refulgens* and *Eucalyptus victrix* over High Open Shrubland of *Acacia trachycarpa*, *Melaleuca glomerata* and *Acacia coriacea* subsp. *pendens* over Very Open Sedges of *Cyperus vaginatus* in brown sand along major drainage lines

Eucalyptus Low Woodland

4a Low Woodland of *Eucalyptus victrix* and *Acacia corriacea* subsp. *pendens* over Shrubland of *Acacia trachycarpa* and *Acacia pyrifolia* var. *pyrifolia* over Open Hummock Grassland of *Triodia epactia* in orange brown loamy sand along minor and medium drainage lines

4b Low Woodland of *Eucalyptus victrix* and *Corymbia hamersleyana* over High Shrubland of *Acacia tumida* var. *pilbarensis, Acacia trachycarpa* and *Grevillea wickhamii* over Shrubland of *Cajanus cinereus* over Open Tussock Grassland of *Chrysopogon fallax*, *Heteropogon contortus* and *Eulalia aurea* in red brown silty loam along minor drainage lines

Corymbia Low Woodland

5a Low Woodland of *Corymbia hamersleyana* and *Eucalyptus vitrix* over Shrubland of *Acacia pyrifolia* var. *pyrifolia* and *Cajanus cinereus* over Very Open Tussock Grassland of *Chrysopogon fallax* in red/brown silty loam along major drainage lines

5b Low Woodland of *Corymbia candida* and *Corymbia aspera* over Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* over Open Hummock Grassland of *Triodia pungens* (and Very Open Tussock Grassland of **Cenchrus ciliaris* and *Chryopogon fallax*) in brown loamy sand on floodplains

Acacia Low Woodland

6a Low Woodland of *Acacia paraneura, Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris* in red/brown sandy clay loam on plains and floodplains

6b Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Tussock Grassland of *Aristida inaequiglumis, Chrysopogon fallax* and **Cenchrus ciliaris* with Open Shrubland of *Dodonea petiolaris* and *Eremophila forrestii* subsp. *forrestii* in red sandy loam on plains

Eucalyptus Low Open Woodland

7 Low Open Woodland of *Eucalyptus victrix* over Low Open Shrubland of *Pluchea rubelliflora*, *Pluchea ferdinandi-muelleri* and *Atriplex bunburyana* with Scattered Tussock Grasses of *Eragrostis cumingii* in brown silty clay loam on drainage depressions

Acacia Low Open Woodland

8 Low Open Woodland of *Acacia xiphophylla* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata*, *Maireana triptera* and *Sclerolaena cuneata* in red brown sandy clay loam on plains

Acacia Open Scrub

9 Open Scrub of *Acacia tumida* var. *pilbarensis, Acacia ancistrocarpa* and *Acacia colei* var. *colei* over Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along minor and medium drainage lines

Acacia High Shrubland

10a High Shrubland of *Acacia ampliceps, Acacia trachycarpa* and *Acacia coriacea* subsp. *pendens* over Open Tussock Grassland of **Cenchrus ciliaris* and *Eriachne benthamii* with Very Open Sedges of *Cyperus vaginatus* in brown sand along medium drainage lines

10b High Shrubland of *Acacia colei* var. *colei*, *Acacia bivenosa* and *Acacia tumida* var. *pilbarensis* over Open Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps, Pluchea ferdinandi-muelleri* and *Pluchea tetranthera* in orange sand on minor drainage lines and floodplains

Acacia High Open Shrubland

11 High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* over Very Open Hummock Grassland of *Triodia epactia* and Very Open Tussock Grassland of *Tripogon loliiformis, Aristida contorta* and *Sporobolus australasicus* (with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda*) in skeletal brown sandy loam on granite plateaux / sheet outcrops

Acacia Low Open Heath

12a Low Open Heath of *Acacia stellaticeps* with High Shrubland of *Acacia trachycarpa* and *Hakea lorea* subsp. *lorea* and Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* in orange brown sand on floodplains

12b Low Open Heath of *Acacia stellaticeps* over Hummock Grassland of *Triodia schinzii* with High Open Shrubland of *Acacia tumida* var. *pilbarensis*, *Acacia colei* var. *colei* and *Melaleuca lasiandra* in red brown loamy sand on sandplains

12c Low Open Heath of *Acacia bivenosa* and *Acacia synchronicia* over Hummock Grassland of *Triodia secunda*, *Triodia angusta* and *Triodia basedowii* in brown sandy loam on stony lower slopes and plains

Tecticornia Low Open Heath

13 Low Open Heath of *Tecticornia* sp. Dennys Crossing (K.A. Shepherd and J English KS552), *Tecticornia indica* subsp. *bidens* and *Muehlenbeckia florulenta* over Very Open Tussock Grassland of *Eragrostis pergracilis* in brown medium clay on saline flats and marsh

Pluchea Low Shrubland

14 Low Shrubland of *Pluchea ferdinandi-muelleri, Pluchea rubelliflora* and *Carrissa lanceolata* over Open Hummock Grassland of *Triodia angusta* and Very Open Tussock Grassland of *Sporobolus australasicus, Chloris pectinata* and *Panicum decompositum* in grey medium clay on crusting plains

Maireana Low Open Shrubland

15 Low Open Shrubland of *Maireana triptera, Ptilotus obovatus* and *Sclerolaena cuneata* with Scattered Low Trees of *Acacia xiphophylla* and *Acacia synchronicia* and Scattered Tussock Grasses of *Aristida inaequiglumis* and **Cenchrus ciliaris* in red sandy clay loam on wind scalded plains

Triodia Closed Hummock Grassland

16a Closed Hummock Grassland of *Triodia longiceps* and *Triodia pungens* with Shrubland of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia bivenosa* and *Melaleuca glomerata* in brown sandy clay loam on undulating plains

16b Closed Hummock Grassland of *Triodia basedowii* and *Triodia longiceps* with High Shrubland of *Acacia synchronicia, Acacia sclerosperma* and *Eremophila longifolia* and Low Open Woodland of *Acacia aptaneura* in red brown clay loam on plains

Triodia Hummock Grassland

17aa Hummock Grassland of *Triodia secunda* and *Triodia longiceps* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in orange sandy clay loam on plains and floodplains

17a Hummock Grassland of *Triodia wiseana* with Low Open Woodland of *Corymbia deserticola* subsp. *deserticola* over Low Shrubland of *Acacia arrecta, Acacia sibirica* and *Acacia bivenosa* in red loamy sand on hill slopes with Low Open Woodland of *Acacia rhodophloia, Acacia pruinocarpa* and *Acacia aptaneura* on rocky hill crests

17b Hummock Grassland of *Triodia brizoides, Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia acradenia* in brown silty loam on hill slopes

17c Hummock Grassland of *Triodia brizoides* and *Triodia wiseana* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Scattered Low Shrubs of *Acacia bivenosa*, *Ptilotus obovatus* and*Senna glutinosa* subsp. *glutinosa* in brown silty loam on scree slopes

17d Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* and *Grevillea berryana* over Low Open Shrubland of *Gompholobium oreophilum* in sandy clay loam on drainage depressions

17e Hummock Grassland of *Triodia basedowii* with High Open Shrubland of *Hakea lorea* subsp. *lorea*, *Acacia ancistrocarpa* and *Acacia inaequilatera* and Scattered Low Trees of *Corymbia deserticola* subsp. *deserticola* and *Corymbia hamersleyana* in red sand on plains

17f Hummock Grassland of *Triodia basedowii* with Low Open Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia wanyu, Acacia ancistrocarpa* and *Acacia inaequilatera* in orange/red/brown silty loam on stony plains

17g Hummock Grassland of *Triodia basedowii* with Scattered Tall Trees of *Acacia aptaneura* and *Acacia pruinocarpa* over High Open Shrubland of *Acacia ancistrocarpa* in red sand on plains

17h Hummock Grassland of *Triodia basedowii, Triodia epactia, Triodia wiseana* and *Triodia basedowii* over High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* and *Grevillea wickhamii* over Low Open Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia acradenia* (and Scattered Low Trees of *Corymbia hamersleyana*) in red brown silty/sandy loam on undulating low hills and stony plains

17i Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps* in red/orange sandy loam on sandy plains

17j Hummock Grassland of *Triodia lanigera* and *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Acacia ancistrocarpa* and *Acacia bivenosa* in orange loamy sand on sandy plains

17k Hummock Grassland of *Trioida lanigera, Triodia wiseana* and *Triodia epactia* with High Shrubland of *Acacia sericophylla, Acacia tumida* var. *pilbarensis, Acacia eriopoda* and *Acacia colei* in swales with High Open Shrubland of *Acacia inaequilatera* and *Acacia orthocarpa* on rises in red brown silty clay/sandy loam on undulating hills and swales

17l Hummock Grassland of *Triodia longiceps* and *Tridoia epactia* with Low Open Shrubland of *Acacia bivenosa, Acacia stellaticeps* and *Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains

17m Hummock Grassland of *Triodia longiceps* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia ancistrocarpa* and *Acacia acradenia* in brown loamy sand in minor drainage lines

17n Hummock Grassland of *Triodia epactia* and *Triodia basedowii* with High Shrubland of *Petalostylis labicheoides*, *Acacia maitlandii* and *Acacia tumida* var. *pilbarensis* and Scattered Low Trees of *Corymbia hamersleyana* in brown sandy loam along drainage lines and on floodplains

17o Hummock Grassland of *Triodia epactia* with High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia arrecta* in brown sandy loam on low undulating hills

17p Hummock Grassland of *Triodia epactia, Triodia basedowii* and *Triodia wiseana* with High Open Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills

17q Hummock Grassland of *Triodia epactia* and *Trioida lanigera* with Open Shrubland of *Acacia robeorum, Acacia inaequilatera* and *Acacia bivenosa* in brown sandy loam on low dolerite/basalt hills

17r Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon dioicum* ms and *Cajanus cinereus* and Scattered Tall Shrubs of *Grevillea wickhamii* in brown silty loam on dolerite ridges

17s Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Open Shrubland of *Acacia inaequilatera* over Open Tussock Grassland of *Aristida contorta* in red brown sandy clay loam on raised plains and quartz hills

17t Hummock Grassland of *Triodia epactia* and *Triodia wiseana* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera* and *Acacia ancistrocarpa* in red brown sandy loam on granite and quartz hill slopes and footslopes

17u Hummock Grassland of *Triodia pungens, Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Corymbia hamersleyana* over Scattered Tall Shrubs of *Acacia inaequilatera* in brown sandy clay loam on dolerite hill slopes

17v Hummock Grassland of *Triodia pungens* with Low Shrubland of *Indigofera rugosa* and Scattered Low Trees of *Grevillea* pyramidalis in brown sandy loam on quartz and granite hill slopes

17w Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with Low Open Woodland of *Corymbia hamersleyana* over High Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia colei* var. *colei* (and Very Open Tussock Grassland of **Cenchrus ciliaris*) in red/brown loamy sand on levee banks and floodplains

17x Hummock Grassland of *Triodia pungens* with High Open Shrubland of *Acacia aptaneura* and *Grevillea berryana* over Shrubland of *Acacia ancistrocarpa, Acacia bivenosa* and *Acacia aptaneura* in brown loamy sand on low undulating chert hills

17y Hummock Grassland of *Triodia pungens* and *Triodia basedowii* with High Open Shrubland of *Acacia colei* var. *colei* and *Acacia inaequilatera* over Shrubland of *Acacia colei* var. *colei* and *Acacia ancistrocarpa* in red brown sandy loam on plains

17z Hummock Grassland of *Triodia pungens* with Low Woodland of *Eucalyptus victrix* over Low Shrubland of *Acacia colei* var. *colei* and *Acacia stellaticeps* in grey brown sandy loam on sandy plain

Triodia Open Hummock Grassland

18a Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Open Shrubland of *Acacia atkinsiana, Acacia marramamba* and *Acacia maitlandii* in brown sandy loam on hill crests and hill slopes

18b Open Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Open Woodland of *Eucalyptus leucophloia* and *Corymbia hamersleyana* over Open Shrubland of *Acacia monticola* and *Acacia pyrifolia* var. *pyrifolia* in brown sandy loam on hill slopes and hill crests

18c Open Hummock Grassland of *Triodia epactia* with Open Shrubland of *Abutilon dioicum* ms, *Triumfetta maconochieana* and *Cajanus cinereus* over Very Open Tussock Grassland of *Paspaidium clementii* and **Cenchrus ciliaris* in skeletal brown loamy sand on granite rockpiles

18d Open Hummock Grassland of *Triodia epactia* and *Trioida basedowii* with Scattered Low Trees of *Corymbia hamersleyana* over Open Shrubland of *Cajanus cinereus* and *Acacia pyrifolia* var. *pyrifolia* in red sandy loam in minor drainge lines

18e Open Hummock Grassland of *Triodia lanigera* with Low Open Woodland of *Corymbia zygophylla* and *Corymbia hamersleyana* over Open Shrubland of *Acacia inaequilatera* over Low Open Shrubland of *Isotropis atropurpurea, Indigofera monophylla* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) in orange red loamy sand on sand plains

Cenchrus Closed Tussock Grassland

19 Closed Tussock Grassland of **Cenchrus ciliaris* and **Cenchrus setiger* with Low Open Woodland of *Corymbia hamersleyana* and *Acacia aptaneura* and Open Shrubland of *Acacia tumida* var. *pilbarensis* and *Acacia ancistrocarpa* in red brown silty loam on floodplains

Astrebla/Eragrostis Tussock Grassland

20 Tussock Grassland of *Astrebla pectinata, Aristida inaequiglumis* and *Sporobolus australasicus* with Low Open Shrubland of *Sida fibulifera, Corchorus trilocularis* and *Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601) and Open Herbs of *Operculina aequisepala* in brown medium clay on basalt plains

Cenchrus Tussock Grassland

21 Tussock Grassland of **Cenchrus ciliaris* and *Eulalia aurea* with Low Open Woodland of *Corymbia aspera* and *Corymbia hamersleyana* over High Shrubland of *Acacia trachycarpa, Acacia tumida* var. *pilbarensis* and *Acacia sclerosperma* in brown sandy loam on major drainage lines

Eriachne Tussock Grassland

22a Tussock Grassland of *Eriachne benthamii* and *Eriachne flaccida* with Low Woodland of *Eucalyptus victrix* over Hummock Grassland of *Triodia epactia* in brown grey silty loam in drainage depressions

22b Tussock Grassland of *Eriachne benthamii*and *Eulalia aurea* with High Open Shrubland of *Hakea lorea* subsp. *lorea* over Open Shrubland of *Acacia colei* var. *colei* in brown medium clay on clay plains

Chrysopogon Open Tussock Grassland

23 Open Tussock Grassland of *Chrysopogon fallax*, *Eulalia aurea* and *Eriachne obtusa* with Low Open Woodland of *Corymbia hamersleyana* and *Corymbia candida* over High Open Shrubland of *Grevillea wickhamii* and *Cajanus cinereus* in red silty loam on floodplains

Eriachne Open Tussock Grassland

24 Open Tussock Grassland of *Eriachne benthamii, Eriachne flaccida* and *Chrysopogon fallax* with Scattered Low Trees of *Corymbia aspera* over High Open Shrubland of *Acacia trachycarpa* and *Acacia colei* var. *colei* in brown loamy sand along minor drainage lines

Eulalia Open Tussock Grassland

25 Open Tussock Grassland of *Eulalia aurea* and *Themeda triandra* with Low Open Woodland of *Acacia coriacea* subsp. *pendens* and *Acacia xiphophylla* over Open Shrubland of *Acacia coriacea* subsp. *pendens*, *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* in red brown clay on floodplains

Mosaic: Acacia Low Open Woodland/ Triodia Closed Hummock Grassland

M1 Mosaic: Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronica* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata*; Closed Hummock Grassland of *Triodia angusta* in red brown sandy clay loam on undulating plains

Mosaic: Triodia Hummock Grassland

M2 Mosaic: Hummock Grassland of *Triodia secunda* and *Triodia epactia* with Low Open Shrubland of *Acacia stellaticeps* over Scattered Tussock Grasses of *Sporobolus australasicus*; Hummock Grassland of *Triodia epactia* and *Triodia lanigera* with Scattered Low Trees of *Corymbia hamersleyana* over High Open Shrubland of *Acacia inaequilatera, Acacia ancistrocarpa* and *Acacia colei* var. *colei* in red/orange silty/sandy clay loam on plains

Mosaic: Acacia Low Open Woodland/ Acacia Low

M3 Mosaic: Low Woodland of *Acacia paraneura*, *Acacia aptaneura* and *Acacia pruinocarpa* over Open Shrubland of *Acacia synchronicia, Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* over Very Open Tussock Grassland of **Cenchrus ciliaris*; Low Open Woodland of *Acacia xiphophila* over High Open Shrubland of *Acacia synchronicia* and *Rhagodia eremaea* over Low Open Shrubland of *Maireana pyramidata, Maireana triptera* and *Sclerolaena cuneata* in red loamy sand on plains

Mosaic: Triodia Open Hummock Grassland/ Triodia Hummock Grassland

M4 Mosaic: Open Hummock Grassland of *Triodia lanigera*, *Triodia basedowii* and *Triodia epactia* with Scattered Low Trees of *Eucalyptus leucophloia* subsp. *leucophloia* over Low Open Shrubland of *Acacia atkinsiana* and *Acacia bivenosa* in brown sandy loam on hill crests and hill slopes; Hummock Grassland of *Triodia basedowii* and *Triodia pungens* with Low Woodland of *Acacia aptaneura* in brown sandy clay loam in drainage basins and on plains

Mosaic: Triodia Hummock Grassland / Acacia High Open Shrubland

M5 Mosaic: Hummock Grassland of*Triodia epactia*, *Triodia basebowii* and *Trioida wiseana* with High Shrubland of *Acacia orthocarpa* and *Acacia inaequilatera* in brown loamy sand on low undulating granite hills; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis*, *Aristida contorta* and *Sporobolus australasicus* in skeletal brown sandy loam on granite plateau / sheet outcrops

Mosaic: Triodia Hummock Grassland/ Acacia High Open Shrubland

M6 Mosaic: Hummock Grassland of *Triodia longiceps*, *Triodia angusta* and *Triodia wiseana* with Low Open Shrubland of *Acacia bivenosa*, *Acacia stellaticeps* and*Pluchea ferdinandi-muelleri* in brown sandy clay loam on stony calcrete plains; High Open Shrubland of *Acacia tumida* var. *pilbarensis* with Very Open Hummock Grassland of *Triodia epactia* over Very Open Tussock Grassland of *Tripogon loliiformis* in skeletal brown sandy loam on granite plateau / sheet outcrops

Mosaic: Triodia Hummock Grassland/Acacia High Open Shrubland

M7 Mosaic: Hummock Grassland of *Triodia lanigera* with High Open Shrubland of *Acacia ancistrocarpa* over Low Open Shrubland of *Acacia stellaticeps*; High Open Shrubland of *Acacia tumida* subsp. *pilbarensis* with Scattered Low Trees of *Terminalia canescens* and *Ficus brachypoda* over Very Open Hummock Grassland of *Triodia epactia* (and Very Open Tussock Grassland of *Tripogon loliiformis*) in orange loamy sand on undulating granitic plains with granitic outcrops

Other

Disturbed

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VEGETATION MAPPING LEGEND

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Figure: 9 -- 19/10/2013

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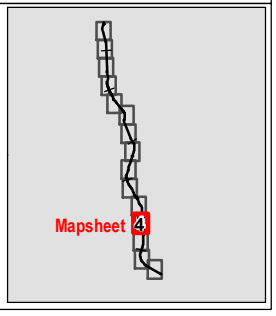

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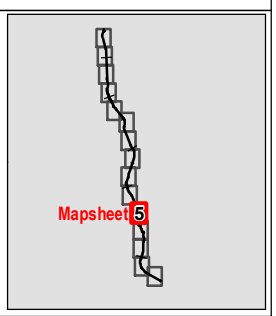

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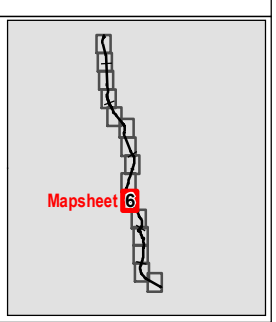

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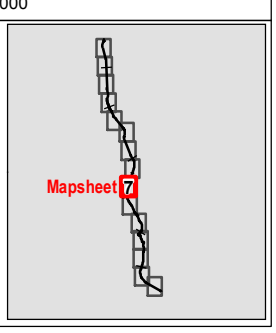

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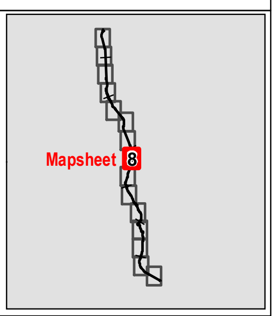

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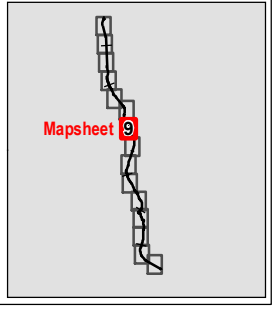

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Projection: MGA Zone 50

ONSHORE

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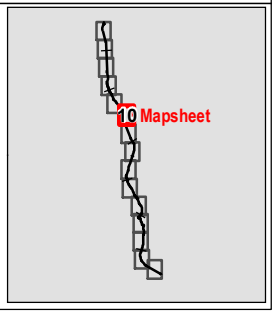
See Legend separate sheet



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7675000 7670000 7665000 7660000

17i M7 10a M7 18c 18c M7 18c 18c 3 3 17i M6 17aa M6 17i 17aa 18c 3 18c 18c 18c 18c 17aa M6 18c 18c 17h 17w 9 17w 3 17h 17h Cleared 5a 9 9 17h 17h 23 17h 4b 23 9 9 17w 17w 23 23 9 17h 17w 17w 17m

N

675000 680000 685000

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BHPBIO MAINLINE

VEGETATION MAPPING MAPSHEET 11

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

Figure:	9	Date:	18/10/2013
Sheet Size:	A3	Status:	Final
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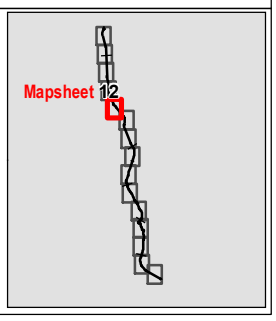
See Legend separate sheet



670000 675000 680000

7690000 7685000 7680000

18e 18d 18c 18e 18e 17r 17r 18c 17r 18c 17i M7 M6 Disturbed 17aa 18c 18c 18c 17i 17i 18c M7 M7 18c 11 18c 18c 18c 18c 18c 18c 18c 18c 18c 18c 18c 11 18c 18c 18c 18c 18c 18c 11 M7 17i Disturbed 17i 18c M7 Cleared M7 18c M7 17i 17aa 17aa 18e 17aa 17w M7 17w 18c 18c Cleared 17w M7 17aa 17w 18c 18c 18c 18c 18c M7 M7 17w 17w 17w 18c 18c M6 17i M6 18c M6 17i Disturbed 17i 10a 10a M6 18c M6 10a 10a 17aa 10a M6 M7 M6 M7 M7 17i 18c 17i M7 10a 3

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VEGETATION MAPPING MAPSHEET 12

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Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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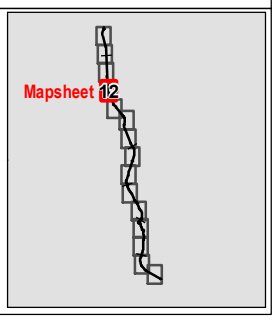

670000 675000 680000

7710000 7705000 7700000 7695000

17w 17w 17i 17y 9 17y 9 17i Disturbed 17y 17i 22b 14 18c 17i 18c 18c 17i 18c 17aa 10b 17w 10b 3 3 17w M2 Cleared 17m 17m M2 17m M2 17m 18c 18d M2 17aa Cleared 18c M2 18c M2 18c 11 11 17aa 18c 11 17i 18e 18e 18d 18e

N

670000 675000 680000

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VEGETATION MAPPING MAPSHEET 13

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Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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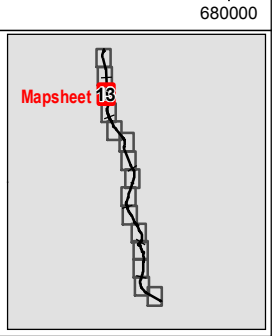

670000
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7725000
7720000
7715000

17i
17i
17s
17l
17l
17l
17s
17s
17s
17i
5b
17s
24
17s
5b
Disturbed
5b
17s
Disturbed
24
5b
17i
17i
Cleared
24
5b
5b
M2
M2
18c
17y
17y
Disturbed
17i
18c
18c
17w
9
17w

N

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Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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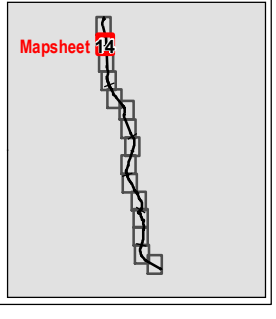

665000 670000 675000

7745000 7740000 7735000 7730000

Disturbed 12b
12b
Disturbed
12b
Disturbed
12b
17z
17z 22a
17y
M2
17i
Cleared
17aa
17i
17aa
17i Disturbed 11
18c
11
18c 11

N

665000 670000 675000

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VEGETATION MAPPING MAPSHEET 15

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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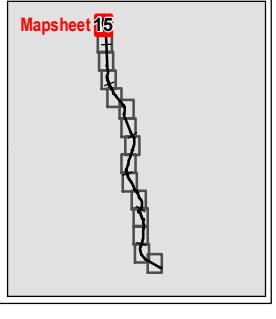

715000 720000 725000

7515000 7510000 7505000

17g 6b 6a 6a 17e 6b 17f 19 17f 16b 15 16b Cleared 17e 17e 6a 6a 15

N

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BHPBIO MAINLINE
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Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

Figure:	9	Date:	25/10/2013
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Drawn by GSM	Requested by DB	Internal Reference Mainline_vegwo_25102013	

See Legend separate sheet

1 Mapsheet

705000 710000

7525000 7520000 7515000

16a Disturbed Disturbed 13 Disturbed 17a 7 M1 Disturbed 16a 17a 17x 1b 1b 15 1b 8 15 15 8 1b 1b 15 6b 17f 6b 17f 17f Cleared 6b 6a 17e 19 17e 6b 19 17e 17f 17f 17f 6b 19 17g 17g 19 6b 6a 6a 17e 17e

N

705000 710000

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BHPBIO MAINLINE
VEGETATION MAPPING MAPSHEET 2

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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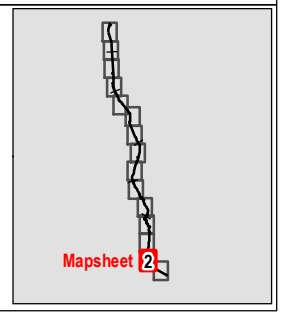

700000 705000 710000

7545000 7540000 7535000 7530000

M4 17n 17d 12c 18a 17d 17c 18a 17c 18a 18a 17n 17n 18a 18a 17n 17n 4a 6b 17n 6b 18a 17n 6b 18a 17n 18a 17n 18a 17n 18a Disturbed 17n Cleared 2b 6b 18a Disturbed Disturbed 1b 1a 2a 2b 6b 1b 6b 4a 1a 6b 6b 1a 1a 6a

2a 2a 17a 17a 17a M2 M3 M3 17a 17a 16a 16a 8 13 16a 13 17a 8

N

700000 705000 710000

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BHPBIO MAINLINE
VEGETATION MAPPING MAPSHEET 3

0 250 500 1,000 1,500 2,000
Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

Figure:	9	Date:	25/10/2013
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Drawn by GSM	Requested by DB	Internal Reference Mainline_vegwo_25102013	

Mapsheet 3

700000 705000 710000

7560000 7555000 7550000 7545000

17u 4a 17t 17v 17o 25 20 2c Cleared 4a 17c 18b 18a 17n 17d M4 1b 12c

N

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0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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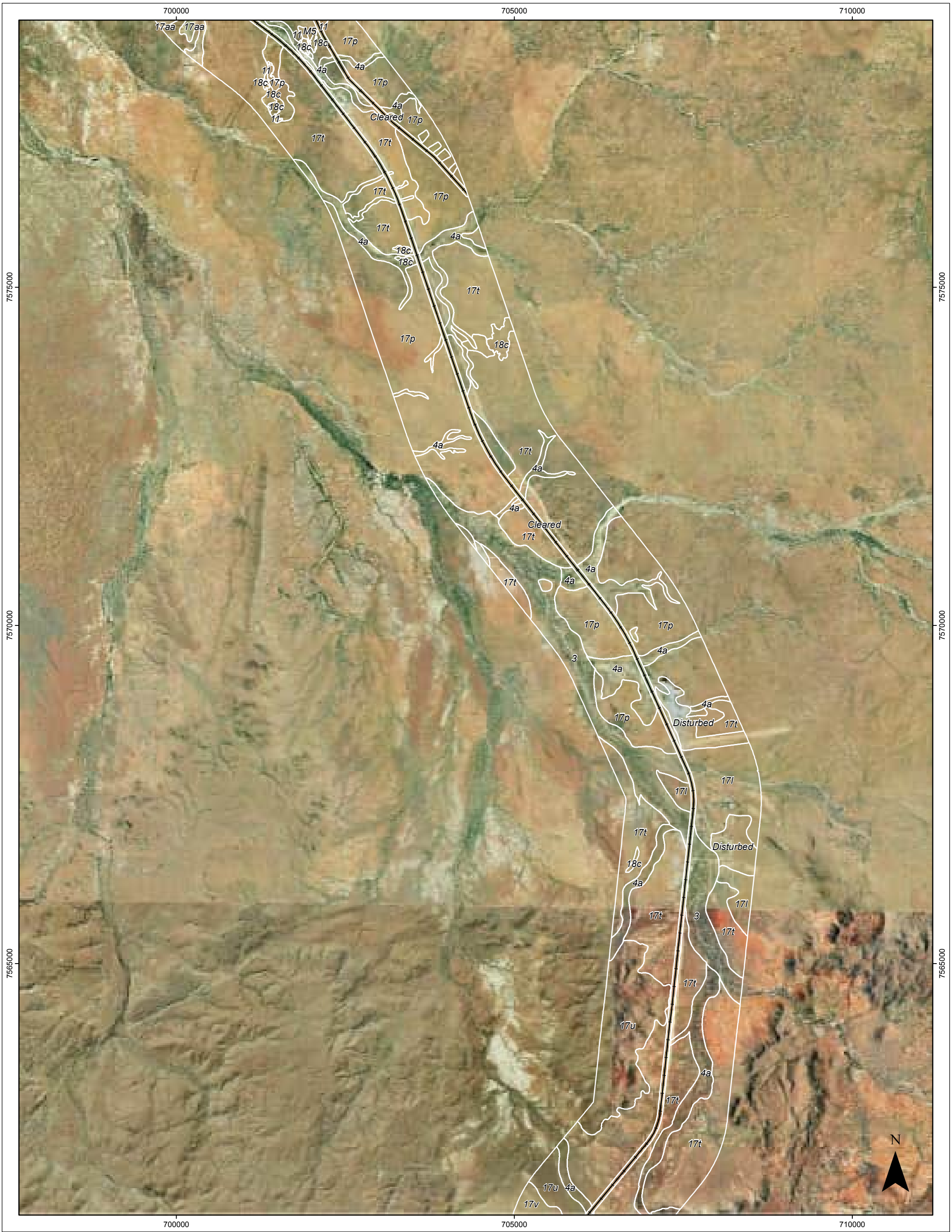
Mapsheet 4



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BHPBIO MAINLINE

VEGETATION MAPPING MAPSHEET 5

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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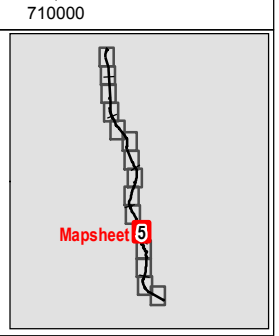

690000 695000 700000

7595000 7590000 7585000 7580000

Cleared 17p 17p 17b 18c 17aa 17b 12a 17p 17aa 17q 17p 17aa 17p 12a 17aa 17p 17q 3 17l 17l 4a 17q 4a 17aa 17aa 17p 17q 4a M5 18c 17aa 17q 18c 18c 18c 18c 18c M5 M5 18c 17q 18c M5 18c 17aa Cleared 18c 17aa 17aa 18c Disturbed 17aa 17m 17m 17h 17p 17p 17p 17aa 18c 4a 17aa 17p 18c 17aa 17aa 3 M5 17aa 18c 17p 4a 18c 11 11 11 17l 17t 18c Cleared 17p 17aa 11 17t 18c 17t 4a

N

690000 695000 700000

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VEGETATION MAPPING MAPSHEET 6

0 250 500 1,000 1,500 2,000
Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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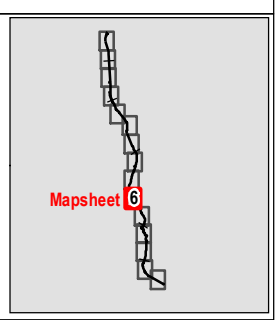

690000 695000 700000

7610000 7605000 7600000

10b 10b 17j 17j 10b 18c 17p 17p 17m 17p 17l 18c 18c 18c 18c 18c 18c 18c 3 18c 17p 3 17p 17p 9 9 Cleared 9 9 9 17l 17p 9 17l Disturbed 17aa 21 17aa 21 17aa 17l 17aa 17p 17l 17p 17l 17aa 17aa 17aa 4a 17aa 17aa 4a 17m 17p 17p 17m 17p 17p 17m 17m 17p 17aa 17m 17m 17p 17m 17p 3 17m 17m 17m Cleared 17aa 17p 3

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690000 695000 700000

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Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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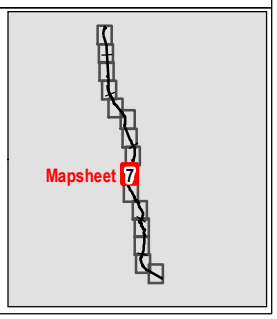

695000 700000 705000

7630000 7625000 7620000 7615000

Cleared 17j 18c 17aa 10b 17l 17k 17r

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BHPBIO MAINLINE
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Meters

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Projection: MGA Zone 50

ONSHORE

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Mapsheet 8

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Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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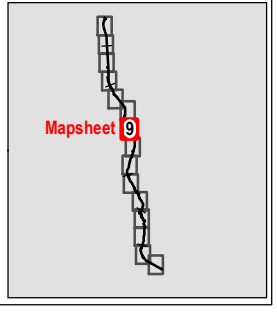

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17w
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17w
17w
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17j
17h
17p
17h
10b
10b
17p
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17h
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17aa
M5
M5
18c
M5
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M5
18c
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11 11
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10a
18c
17h
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17w
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0 250 500 1,000 1,500 2,000
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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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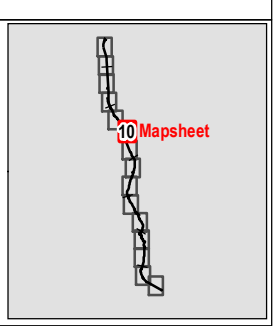

675000 680000 685000

7675000 7670000 7665000 7660000

17i M7 10a M7 18c 18c 18c 18c 3 3 17i M6 17aa M6 17i 17aa 18c 3 18c 18c 18c 18c 17aa M6 18c 17h 17w 9 17w 3 17h 17h Cleared 5a 9 9 17h 17h 23 17h 4b 23 9 9 17w 17w 9 23 23 17h 17w 17w 17m

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VEGETATION MAPPING MAPSHEET 11

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

Figure:	9	Date:	25/10/2013
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Mapsheet 11

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VEGETATION MAPPING MAPSHEET 12

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Meters

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Datum: GDA94
Projection: MGA Zone 50

ONSHORE

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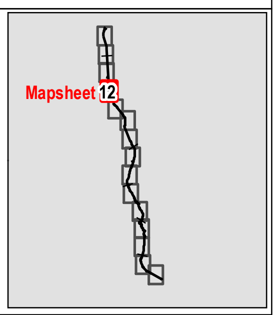

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7695000

18c 17w 17i 17y 17w 17y 9 17y 9 17i Disturbed 17y 17i 22b 14 18c 17i 18c 18c 18c 17aa 10b 17w 10b 3 3 17w M2 Cleared 17m 17m M2 17m M2 17m 18c 18d M2 17aa Cleared 18c M2 18c M2 18c 11 11 17aa 18d 18c 11 17i 18e 18e 18e

N

GRIFFIN SPATIAL & MAPPING	**BHPBIO MAINLINE** **VEGETATION MAPPING** **MAPSHEET 13**
PO Box 7215 EATON WA 6232 admin@griffinspatial.com.au +61 8 9725 3213	0 250 500 1,000 1,500 2,000 Meters 1:50,000 Datum: GDA94 Projection: MGA Zone 50
ONSHORE	Figure: 9 — Date: 25/10/2013 Sheet Size: A3 — Status: Final Drawn by GSM — Requested by DB — Internal Reference Mainline_vegwo_25102013
	Mapsheet 13

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17i
17i
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17l
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17l
17s
17s
17s
17s
17i
5b
24
17s
5b
Disturbed
5b
17s
Disturbed
24
5b
17i
17i
Cleared
24
5b
5b
M2
M2
18c
17y
17y
Disturbed
17i
18c
18c
17w
17w

N

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BHPBIO MAINLINE
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Projection: MGA Zone 50

ONSHORE

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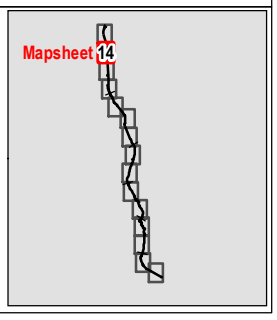

665000 670000 675000

7745000 7740000 7735000 7730000

Disturbed 12b
12b
Disturbed
12b
Disturbed
12b
17z
17z
17y
22a
M2
17i
Cleared
17aa
17i
17aa
17i
Disturbed
11
18c
11
11
18c

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Meters

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Projection: MGA Zone 50

ONSHORE

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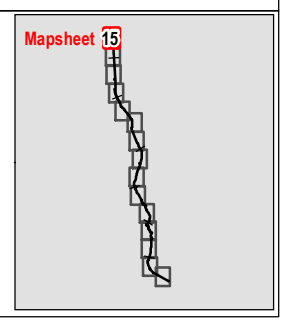


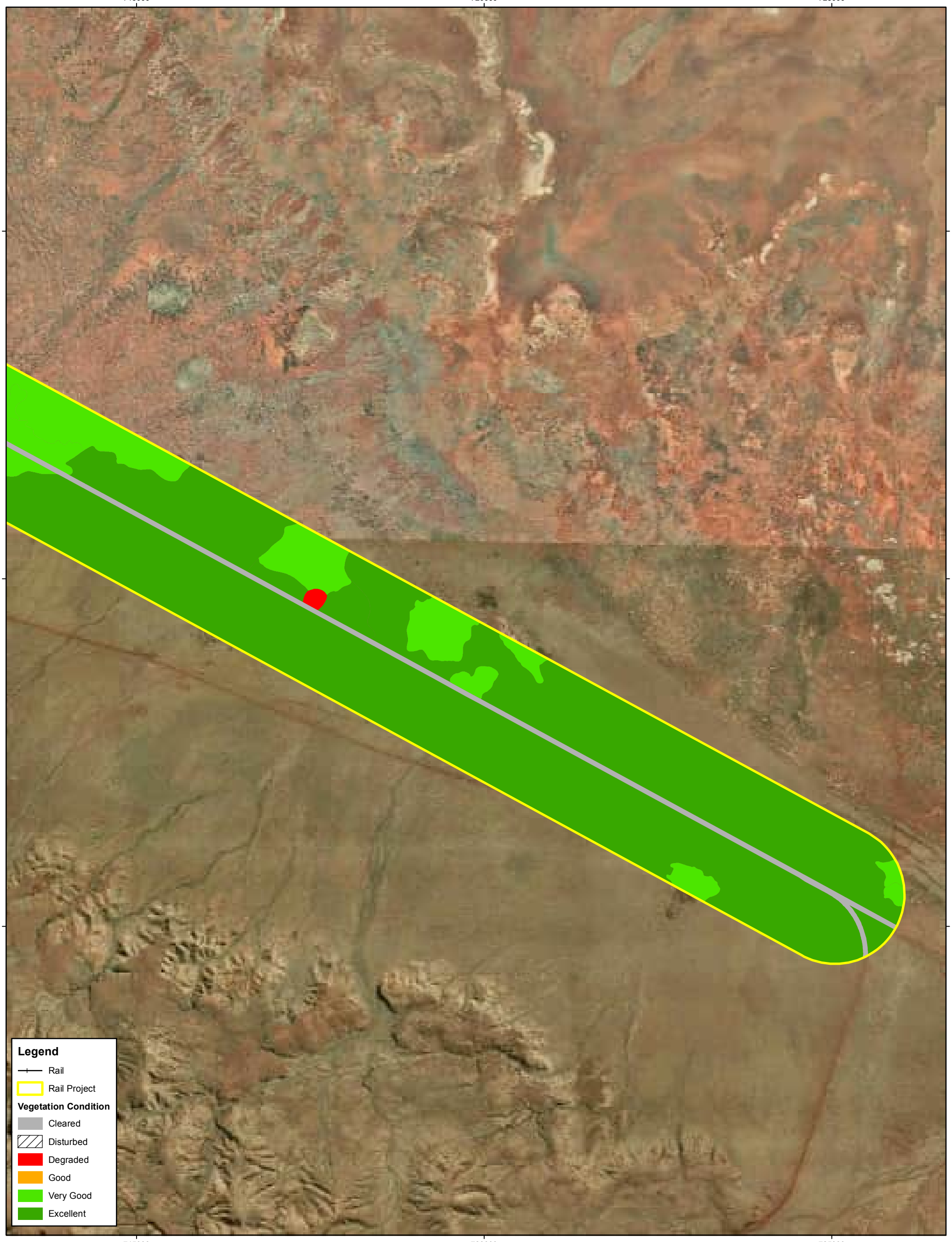
3.6 Vegetation Condition

Vegetation condition for the majority of vegetation associations within the study area was rated as 'Very Good' (71%), with a smaller proportion rated as 'Excellent' (21%), 'Good' (17%) and 'Degraded' (1%) (Figure 10). There were a variety of disturbances recorded during the survey including grazing by domestic cattle, introduction of weeds, station fence lines, linear infrastructure clearing for the existing Mainline Rail and service roads, rock quarries and borrow pits, pastoral and other service tracks, evidence of vermin such as camels and donkeys, and fire.

The most widespread disturbance was related to grazing by domestic cattle and the introduction of weeds. The spread of weeds was facilitated by the existing Mainline Rail and adjacent service roads.

715000 720000 725000

7515000 7510000 7505000



715000 720000 725000

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VEGETATION CONDITION MAPPING

MAPSHEET 1

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

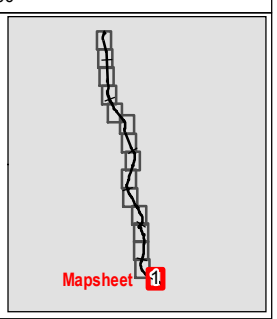
N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50



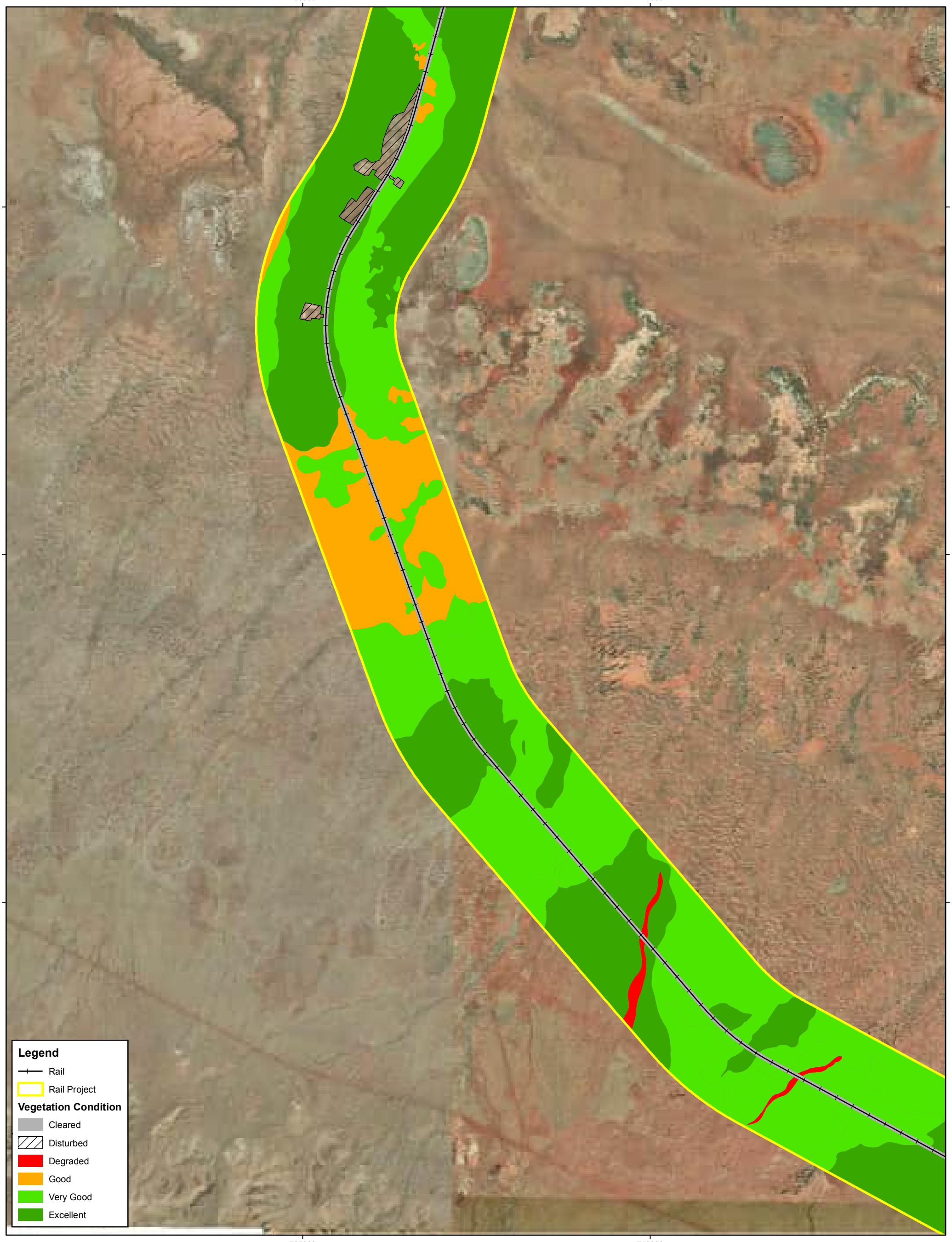
705000

710000

7525000

7520000

7515000



705000

710000

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VEGETATION CONDITION MAPPING

MAPSHEET 2

ONSHORE

Figure:	10	Date:	20/03/14
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

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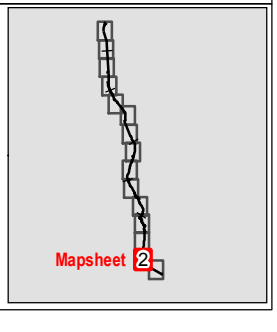
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50



700000 705000 710000

7540000 7535000 7530000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 3

ONSHORE

Figure:	10	Date:	20/03/14
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000
Meters

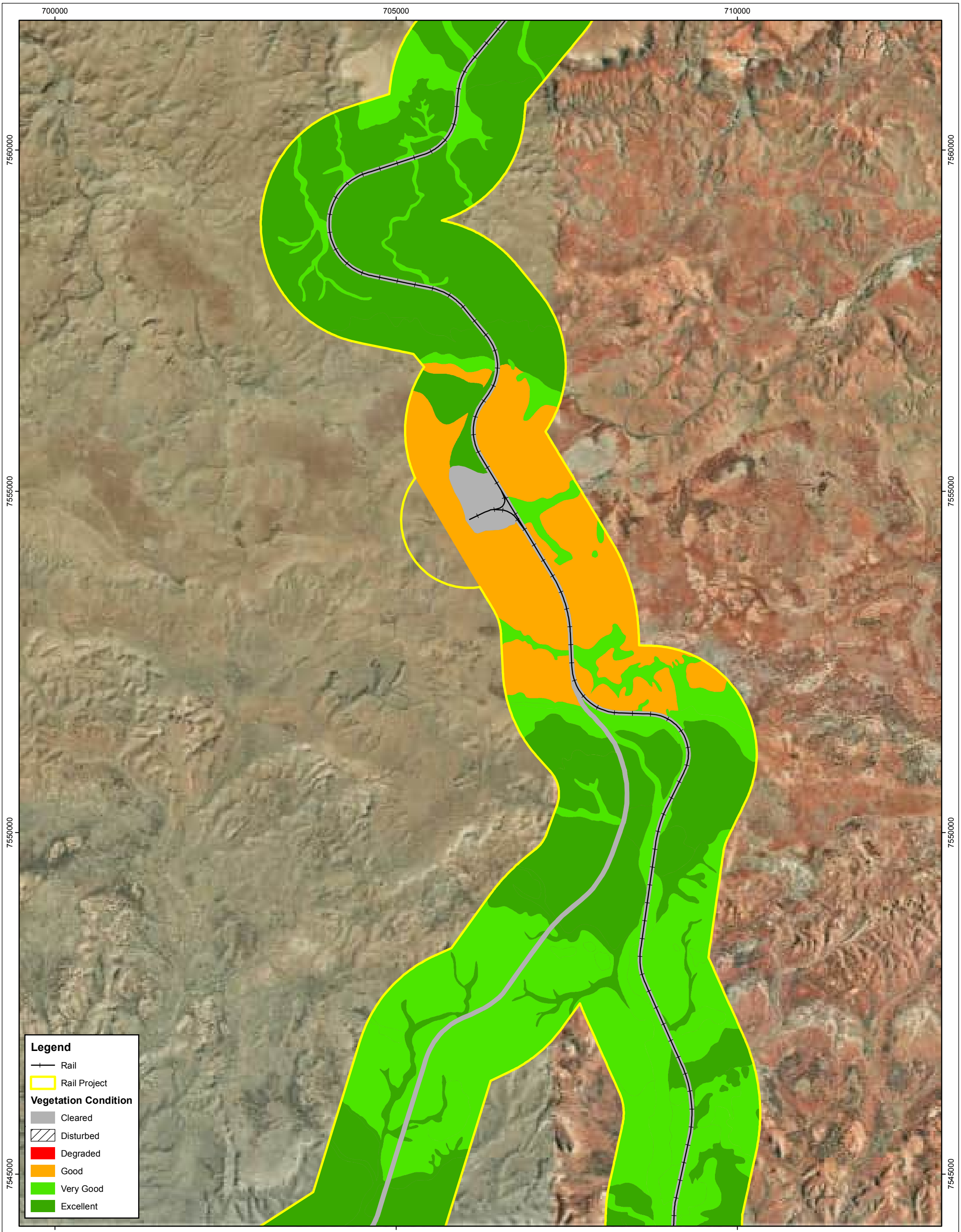
1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 3

700000 705000 710000

7560000 7555000 7550000 7545000



700000 705000 710000

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VEGETATION CONDITION MAPPING

MAPSHEET 4

ONSHORE

Figure:	10	Date:	20/03/14
Sheet Size:	A3	Status:	Final
Drawn by: GSM	Requested by: DB	Internal Reference: Mainline_veg_cond_200314	

N

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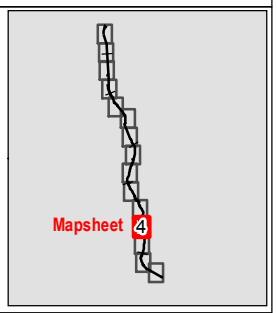
Meters

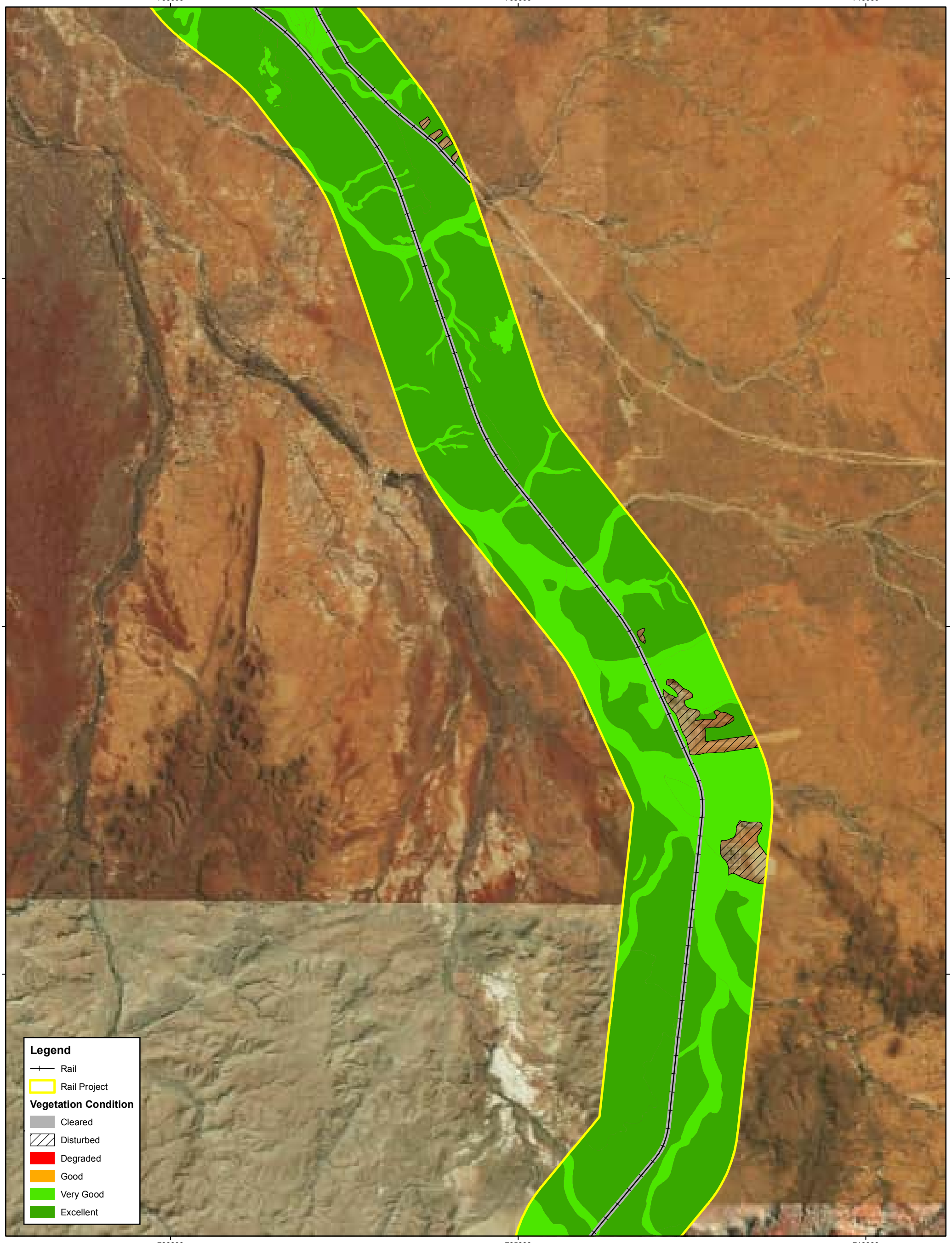
1:50,000

Datum: GDA94
Projection: MGA Zone 50



700000 705000 710000

7575000 7570000 7565000



700000 705000 710000

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VEGETATION CONDITION MAPPING

MAPSHEET 5

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_Veg_cond_200314	

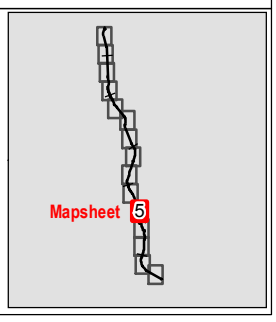
N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50



690000 695000 700000

7595000 7590000 7585000 7580000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 6

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

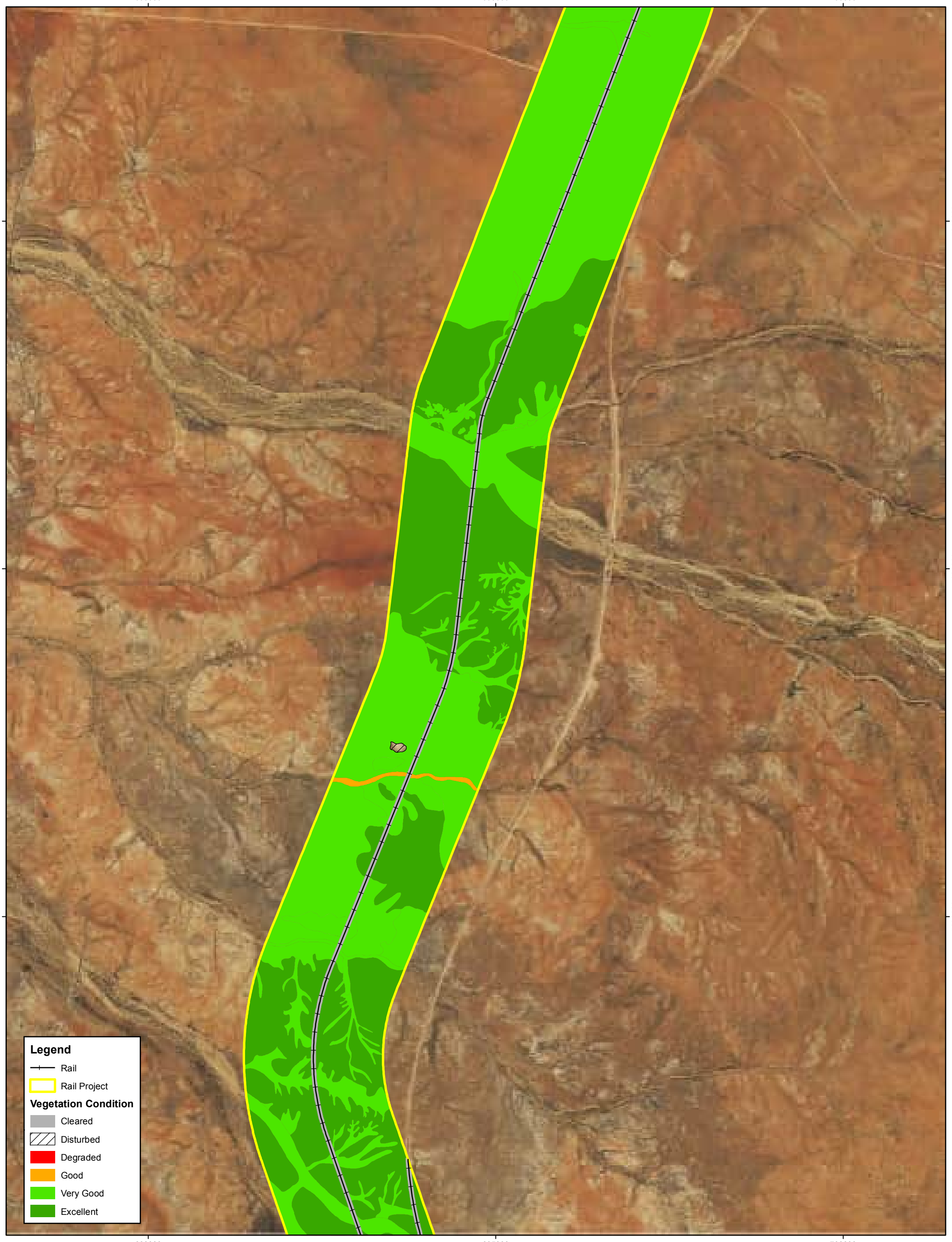
Mapsheet 6

690000 695000 700000

7610000

7605000

7600000



690000 695000 700000

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VEGETATION CONDITION MAPPING
MAPSHEET 7

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
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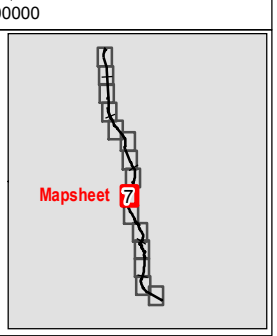
N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50



695000 700000 705000

7630000 7625000 7620000 7615000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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MAPSHEET 8

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 8

690000 695000 700000

7645000 7640000 7635000 7630000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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MAPSHEET 9

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000

Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 9

690000
695000
7660000
7655000
7650000

Legend
Rail
Rail Project
Vegetation Condition
Cleared
Disturbed
Degraded
Good
Very Good
Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 10

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 10

675000 680000 685000

7675000 7670000 7665000 7660000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 11

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
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N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 11

670000 675000 680000

7690000 7685000 7680000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 12

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
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N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 12

670000
675000
7710000
7705000
7700000
7695000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 13

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 13

670000
675000
7725000
7720000
7715000

Legend
Rail
Rail Project
Vegetation Condition
Cleared
Disturbed
Degraded
Good
Very Good
Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 14

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N
0 250 500 1,000 1,500 2,000
Meters
1:50,000
Datum: GDA94
Projection: MGA Zone 50

Mapsheet 14

665000 670000 675000

7745000 7740000 7735000 7730000

Legend

- Rail
- Rail Project

Vegetation Condition

- Cleared
- Disturbed
- Degraded
- Good
- Very Good
- Excellent

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VEGETATION CONDITION MAPPING
MAPSHEET 15

ONSHORE

Figure:	10	Date:	20/03/2014
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Mainline_veg_cond_200314	

N

0 250 500 1,000 1,500 2,000
Meters

1:50,000

Datum: GDA94
Projection: MGA Zone 50

Mapsheet 15

3.7 Significance of Vegetation Associations

3.7.1 Commonwealth Significance

None of the plant taxa recorded from the study area are listed under the EPBC Act, and none of the vegetation associations described and mapped are affiliated with any known Commonwealth listed TECs. However, the Fortescue Marsh is listed as a Wetland of National Significance and is also on the Register of the National Estate. The Fortescue Marsh and associated vegetation associations (13 and 16a) are therefore considered to be of Commonwealth significance (Figure 11).

3.7.2 State Significance

The field survey confirmed that none of the vegetation associations recorded within the study area were affiliated with any know State listed TECs from the Pilbara.

There were five PECs identified within a 90 km radius of the study area, and vegetation associations mapped within the study area were affiliated with three of these PECs, all located at the southern extent of the study area.

1. The western fringe of the Fortescue Marsh PEC (Priority 1) was affiliated with Vegetation associations 13 and 16a;
2. The Priority 1 PEC 'Freshwater claypans of the Fortescue Valley' was mapped and described as Vegetation association 7. A second vegetation association, 'Mosaic 1' was closely affiliated with both the above Priority 1 PECs and is likely to be of conservation significance;
3. A sub-type of the PEC 'Four plant assemblages of the Wona Land System' described as 'Mitchell Grass *(Astrebla* spp.) on gilgai' (Priority 3iii) was described and mapped as Vegetation association 20.

Vegetation associations 7, Mosaic 1, 13, 16a and 20 are therefore considered to be of State significance (Figure 11).

3.7.3 Local Significance

The following vegetation associations were determined to be of local significance owing to their restricted distribution, specific habitat type, and/or support of conservation significant plant taxa.

1. Vegetation associated with granite plateaux, rock piles and sheet outcrops often supporting the Priority 4 flora *Bulbostylis burbidgeae* – Vegetation associations 11, 17v, 18c, M5 and M6.
2. Vegetation occurring along major drainage lines and rivers with deeply incised drainage channels including major tributaries of Turner River and Yule River – Vegetation association 3.
3. Vegetation associated with crusting and cracking clay plains – Vegetation associations 14 and 22b.
4. Vegetation associated with calcrete plains fringing the larger drainage lines – Vegetation association 17l.
5. Vegetation occurring on undulating low hills above the western fringe of Fortescue Marsh, defined by a distinctive rocky dolerite and silcrete surface and dominance of the mid shrub *Acacia arrecta* – Vegetation association 17a.
6. Vegetation occurring on sandplains situated at the northern extent (Port Hedland end) of the study area – Vegetation associations 12b and 18e.

7. Vegetation associated with dolerite hills and ridges - Vegetation associations 17q, 17r and 17u.

Vegetation associations 3, 11, 12b, 14, 17a, 17l, 17q, 17r, 17u, 17v, 18c, 18e, 22b, M5 and M6 are therefore considered of local significance (Figure 11).

610000 620000 630000 640000 650000 660000 670000 680000 690000 700000 710000 720000 730000 740000 750000 760000 770000 780000 790000 800000

7750000 7740000 7730000 7720000 7710000 7700000 7690000 7680000 7670000 7660000 7650000 7640000 7630000 7620000 7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000 7520000 7510000 7500000

N

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

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Vegetation associations of Commonwealth, State and Local Significance within the study area

Fig. 11

0 5 10 20 30 40
Kilometers
1:750,000
Datum: GDA94 Projection: MGA Zone 50

ONSHORE

Figure:	11	Date:	24/01/2013
Sheet Size:	A3	Status:	Final
Drawn by GSM	Requested by DB	Internal Reference Veg_assoc_Signif	

Legend

- Study Boundary

Significant Vegetation Associations

- Local
- State
- Commonwealth

4.0 Summary

A total number of 706 plant taxa (including varieties and subspecies) from 67 families and 229 genera were recorded from the study area. Species representation was greatest among the Fabaceae, Poaceae, Malvaceae, Amaranthaceae, Chenopodiaceae, Asteraceae, Convolvulaceae, Cyperaceae and Goodeniaceae families, which is typical for the Pilbara Bioregion. The most speciose genus was *Acacia* (58 taxa), followed by *Ptilotus* (19 taxa), *Sida* (18 taxa), *Eriachne* (16 taxa), *Corchorus* (16 taxa), *Senna* (16 taxa), *Hibiscus* (15 taxa), *Tephrosia* (13 taxa) and *Eragrostis* (12 taxa).

No plant taxon gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the WC Act or listed under the EPBC Act was recorded from the study area. There were 16 currently listed Priority flora species recorded from a total of 175 point locations distributed across the entire extent of the study area. The Priority flora included six Priority 1 taxa, one Priority 2 taxa, six Priority 3 taxa, and three Priority 4 taxa:

- *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) P1
- *Acacia levata* P3
- *Bonamia* aff. *oblongifolia* P1
- *Bulbostylis burbidgeae* P4
- *Eremophila spongiocarpa* P1
- *Eremophila youngii* subsp. *lepidota* P4
- *Euphorbia clementii* P2
- *Euphorbia stevenii* P3
- *Fimbristylis sieberiana* P3
- *Goodenia nuda* P4
- *Gymnanthera cunninghamii* P3
- *Heliotropium muticum* P1
- *Pterocaulon* cf. *xenicum* P3
- *Tecticornia* sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063) P1
- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) P1
- *Themeda* sp. Hamersley Station (M.E Trudgen 11431) P3

A total of 16 introduced (weed) species were recorded from the study area; one taxon was listed as a Declared Pest under the *Biosecurity and Agriculture Management Act (2007)* (BAM Act), **Calotropis procera.*

There were 73 vegetation associations described and mapped within the study area. These were classified into 25 Broad Floristic Formations on the basis of the dominant vegetation stratum:

1 *Acacia* Low Closed Woodland
2 *Acacia* Low Open Forest
3 *Melaleuca* Low Woodland
4 *Eucalyptus* Low Woodland
5 *Corymbia* Low Woodland
6 *Acacia* Low Woodland
7 *Eucalyptus* Low Open Woodland
8 *Acacia* Low Open Woodland

9 *Acacia* Open Scrub
10 *Acacia* High Shrubland
11 *Acacia* High Open Shrubland
12 *Acacia* Low Open Heath
13 *Tecticornia* Low Open Heath
14 *Pluchea* Low Shrubland
15 *Maireana* Low Open Shrubland
16 *Triodia* Closed Hummock Grassland
17 *Triodia* Hummock Grassland
18 *Triodia* Open Hummock Grassland
19 *Cenchrus* Closed Tussock Grassland
20 *Astrebla/Eragrostis* Tussock Grassland
21 *Cenchrus* Tussock Grassland
22 *Eriachne* Tussock Grassland
23 Chrysopogon Open Tussock Grassland
24 *Eriachne* Open Tussock Grassland
25 *Eulalia* Open Tussock Grassland

Vegetation condition for the majority of vegetation associations within the study area was rated as 'Very Good' (57%), with a smaller proportion rated as 'Very Good to Excellent' (23%) or 'Good to Degraded' (20%). The most widespread disturbance recorded was related to grazing by domestic cattle and the introduction of weeds. The spread of weeds was facilitated by the existing Mainline Rail and adjacent service roads.

None of the plant taxa recorded from the study area are listed under the EPBC Act, and none of the vegetation associations described and mapped are affiliated with any know Commonwealth listed TECs. However, the Fortescue Marsh is listed as a Wetland of National Significance and is also on the Register of the National Estate. The Fortescue Marsh and associated vegetation associations (13 and 16a) are therefore considered to be of Commonwealth significance.

The field survey confirmed that none of the vegetation associations recorded within the study area were affiliated with any know State listed TECs from the Pilbara.

There were five PECs identified within a 90 km radius of the study area, and vegetation associations mapped within the study area were affiliated with three of these PECs, all located at the southern extent of the study area:

1. The western fringe of the Fortescue Marsh PEC (Priority 1) was affiliated with Vegetation associations 13 and 16a.
2. The Priority 1 PEC 'Freshwater claypans of the Fortescue Valley' was mapped and described as Vegetation association 7. A second vegetation association, 'Mosaic 1' was closely affiliated with both the above Priority 1 PECs and is likely to be of conservation significance.
3. A sub-type of the PEC 'Four plant assemblages of the Wona Land System' described as 'Mitchell Grass *(Astrebla* spp.) on gilgai' (Priority 3iii) was described and mapped as Vegetation association 20.

Vegetation associations 7, Mosaic 1, 13, 16a and 20 are therefore considered to be of State significance.

The following vegetation associations were determined to be of local significance owing to their restricted distribution, specific habitat type, and/or support of conservation significant plant taxa:

1. Vegetation associated with granite plateaux, rock piles and sheet outcrops often supporting the Priority 4 flora *Bulbostylis burbidgeae* – Vegetation associations 11, 17v, 18c, M5 and M6.
2. Vegetation occurring along major drainage lines and rivers with deeply incised drainage channels including major tributaries of Turner River and Yule River – Vegetation association 3.
3. Vegetation associated with crusting and cracking clay plains – Vegetation associations 14 and 22b.
4. Vegetation associated with calcrete plains fringing the larger drainage lines – Vegetation association 17l.
5. Vegetation occurring on undulating low hills above the western fringe of Fortescue Marsh, defined by a distinctive rocky dolerite and silcrete surface and dominance of the mid shrub *Acacia arrecta* – Vegetation association 17a.
6. Vegetation occurring on sandplains situated at the northern extent (Port Hedland end) of the study area – Vegetation associations 12b and 18e.
7. Vegetation associated with dolerite hills and ridges - Vegetation associations 17q, 17r and 17u.

Vegetation associations 3, 11, 12b, 14, 17a, 17l, 17q, 17r, 17u, 17v, 18c, 18e, 22b, M5 and M6 are therefore considered of local significance.

5.0 Study Team

The Level 2 flora and vegetation survey of the study area was planned, coordinated and executed by the following personnel:

Onshore Environmental Consultants P/L
ABN 41 095 837 120
PO Box 227
YALLINGUP WA 6282
pf 08 9756 6206 m 0427 339 842
email onshoreenv@westnet.com.au

Project Staff

Dr Darren Brearley	PhD	Project Manager
Dr Jerome Bull	PhD	Senior Botanist
Ms Ellen Palmer	BEnvSc (Hons)	Senior Botanist
Ms Jessica Waters	BSc	Botanist
Mr Peter Sweeny	BSc	Botanist
Mr Daniel Roberts	BSc	Botanist
Mr Todd Griffin		GIS Specialist
Mr Russell Smith		Statistician
Mrs Kerry Keenan		Data Analyst

Licences

The field survey was conducted under the authorization of the following licences issued by the Department of Parks and Wildlife:

- Darren Brearley, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009578
- Jerome Bull, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009579
- Ellen Palmer, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009564
- Jessica Waters, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009562
- Peter Sweeny, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009563
- Daniel Roberts, Onshore Environmental Consultants 'Licence to take flora for scientific & other prescribed purposes' Licence No. SL009561

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