



## Pilbara Iron Ore Project – Blacksmith Flora and Vegetation Survey

Flinders Mines Ltd



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Pilbara Iron Ore Project – Blacksmith Flora and Vegetation Survey

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Shaun Grein, Grein Environmental, undertook the technical review of the draft report.

## summary

Flinders Mines Ltd commissioned Worley Parsons Service Pty Ltd to coordinate pre-feasibility surveys for its approximately 10,870 hectare mineral exploration tenement in the Hamersley Ranges known as Blacksmith. In turn, WorleyParsons have appointed Ecoscape to conduct the flora and vegetation assessment required for environmental approval.

Exploration has identified five main areas of inferred and indicated resources known as 'Ajax', 'Blackjack', 'Champion', 'Delta' and 'Eagle', and two smaller areas known as 'Paragon' and 'Badger'.

The desktop assessment for this project was conducted by WorleyParsons. The desktop assessment has determined that:

- the study area is in the Pilbara bioregion and Hamersley sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA), described as being a mountainous area south of the Fortescue Valley consisting of sedimentary ranges and plateaux with Mulga (*Acacia aneura*) low woodland in valleys and Snappy Gum (*Eucalyptus leucophloia*) over *Triodia* on the ranges
- the study area is located within the Hamersley Basin, with the geology comprising of Brockman Iron Formation and McRae Shale intruded by mafic sills and dykes
- the targeted geology is the Channel Iron Deposit (CID) and Bedded Iron Deposit (BID) in the lower-lying valley floors
- the drainage of surface water is to the Fortescue River via Weelumurra and Caliwingina Creeks
- there are no permanent waterways or rivers in the study area, however there is a permanent waterhole in 'Ajax'
- Beard (WA Herbarium & DEC 1980) described the area as being within the Fortescue Botanical District of the Eremaean Botanical Province, with the vegetation typically consisting of *Acacia* or Eucalypt woodland and *Triodia* hummock grassland
- there are no known Environmentally Sensitive Areas (ESAs) within or adjacent to the study area
- the study area is within a DEC 'Schedule 1' area based on its location within a water supply area and therefore vegetation clearing must be approved under Part IV of the Environmental Protection Act, Programme of Work or native vegetation clearing permit.

The flora and vegetation of the Blacksmith tenement was assessed by Ecoscape at Level 2 according to the EPA's *Guidance for the Assessment of Environmental Factors No 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* (EPA 2002). Field surveys were conducted between May 25 – June 3 2010, August 26 – 30 2010 and March 25 – 28 2011. The data collected was used to:

- describe and map the vegetation types and indicate the distribution and relative abundance of each to help to define units of particular conservation value
- document the vascular flora of the area and provide a measure of the overall floristic richness
- identify species of particular conservation significance and introduced plant species.

Prior to the field surveys, DEC database search requests identified:

- the *vulnerable* Threatened Ecological Community (TEC) ‘*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)’ within 50 km of the study area, with the 28 km administrative buffer applied by the DEC overlapping the south-eastern third of the Blacksmith study area
- Priority 3 Priority Ecological Community (PEC) ‘Four Plant Assemblages of the Wona Land System’, north of the study area in the Chichester Ranges
- 31 conservation significant flora species (DRF and Priority Listed Flora) occurring within 50 km of the study area.

During the field surveys, 50 floristic quadrats measuring 50 m x 50 m were assessed twice, recording vegetation descriptions, site characteristics and a floristic inventory from each quadrat. The vegetation types were mapped and opportunistic searches for conservation significant flora species were conducted.

The vegetation surveys identified:

- that approximately 80% of the study area had been burnt in February 2010 and could not be assessed, however sufficient unburnt vegetation remained to characterise the area
- 10 vegetation types from the unburnt areas, determined from a combination of field survey and floristic analysis conducted on the quadrat data. These vegetation types were:
  - o *Acacia maitlandii* Shrubland, on rocky hillsides and stony valleys in the north-eastern portion of the study area
  - o *Acacia orthocarpa* (atypical form) Shrubland, on lower slopes and hill spurs in ‘Ajax’
  - o *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland, in gorges and deep gullies
  - o *Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland, in the broad floodplain and outwash areas associated with the major drainage channel in ‘Ajax’ and part of ‘Champion’
  - o *Eucalyptus gamophylla/Corymbia hamersleyana/Eucalyptus leucophloia* Low Woodland, from valley floors throughout the study area
  - o *Eucalyptus leucophloia* Low Open Woodland, from hills throughout the study area
  - o *Eucalyptus victrix* Open Woodland, associated with the major drainage channel in ‘Ajax’
  - o *Triodia epactia* Hummock Grassland, in valley floors
  - o *Triodia* aff. *melvillei* Hummock Grassland, on low hills and rises in the northern and western portions of the study area



- o *Triodia wiseana* Hummock Grassland, on lower slopes and low rises in the valley floors in the eastern portion of the study area
- there were no TECs or PECs.

Due to burnt extent of the vegetation, any conclusions in relation to local representativeness of vegetation are preliminary only.

Of the vegetation types identified from the study area, *Acacia maitlandii* Shrubland, *Acacia orthocarpa* (atypical form) Shrubland, *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland, *Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland and *Eucalyptus victrix* Open Woodland are considered to have local conservation significance due to either their small local extent or localised occurrence, being restricted to specific landforms that occupy only a small proportion of the area, no similar vegetation being recorded in other Pilbara surveys, or their extent being under threat .

*Acacia orthocarpa* (atypical form) Shrubland is considered to be the vegetation type with the highest local conservation significance. *Eucalyptus victrix* Open Woodland can be considered to be included in the 'Ecosystem at Risk' 'All major ephemeral water courses', and is thus also of conservation significance.

Floristic analysis conducted on the quadrat data using PATN© delineated four major floristic groups from the Blacksmith tenement, including floristic groups associated with riparian areas, floodplain and outwash areas, valley floors and uplands. The floristic group corresponding with upland vegetation was interpreted to belong to a number of vegetation types based on dominant and characteristic species.

Regional floristic analysis determined that most of the floristic groups included in Griffin and Trudgen's 600-group that were identified from the Blacksmith tenement are restricted to the central Hamersley Range, where most are locally common or moderately common.

Except for a small area (0.03% of the total area) in Good condition (assessed using the Trudgen vegetation condition scale), all other unburnt areas were in Very Good or Excellent condition. Approximately 80% of the study area was burnt in February 2010: subsequently the vegetation condition of the burnt areas could not be assessed as the area was devoid of vegetation in 2010 and had immature growth in 2011. The fires were not considered a form of degradation as they were not caused by human activities.

The flora assessment resulted in 269 taxa being identified from the study area, however 21 of these (7.8%) could not be identified to species level due to lack of diagnostic reproductive material.

Forty one families and 117 genera were recorded in the study area, represented by Fabaceae (including the former Mimosaceae, Caesalpiniaceae and Papilionaceae, up to 61 taxa), Poaceae (up to 41 taxa), Malvaceae (up to 36 taxa) and Amaranthaceae (16 taxa). *Acacia* (24 taxa), *Senna* (up to 15 taxa) and *Ptilotus* (10 taxa) were the most commonly represented genera.

Five Priority Listed flora species were located during the field surveys. *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (P3), *Goodenia nuda* (P4), and *Rhynchosia bungarensis* (P4). No Declared Rare Flora species were recorded.

As a result of the extent of burnt vegetation, the following recommendations are made:

- areas identified for infrastructure should be surveyed for conservation significant species, particularly if they are located in upland areas (upper slopes and hilltops), riparian or burnt areas
- additional floristic quadrats should be established in the riparian area of 'Ajax' and in 'Eagle' when the areas have recovered sufficiently from fire (2013)
- map the vegetation of the remainder of the tenement when it has recovered from fire.

# 1.0 introduction

## 1.1 Project Overview

Flinders Mines Limited has commissioned WorleyParsons Service Pty Ltd to conduct the pre-feasibility study of its mineral exploration tenement E47/882, known as Blacksmith. Subsequently WorleyParsons appointed Ecoscape to coordinate the flora and vegetation assessment to support the environmental approvals process.

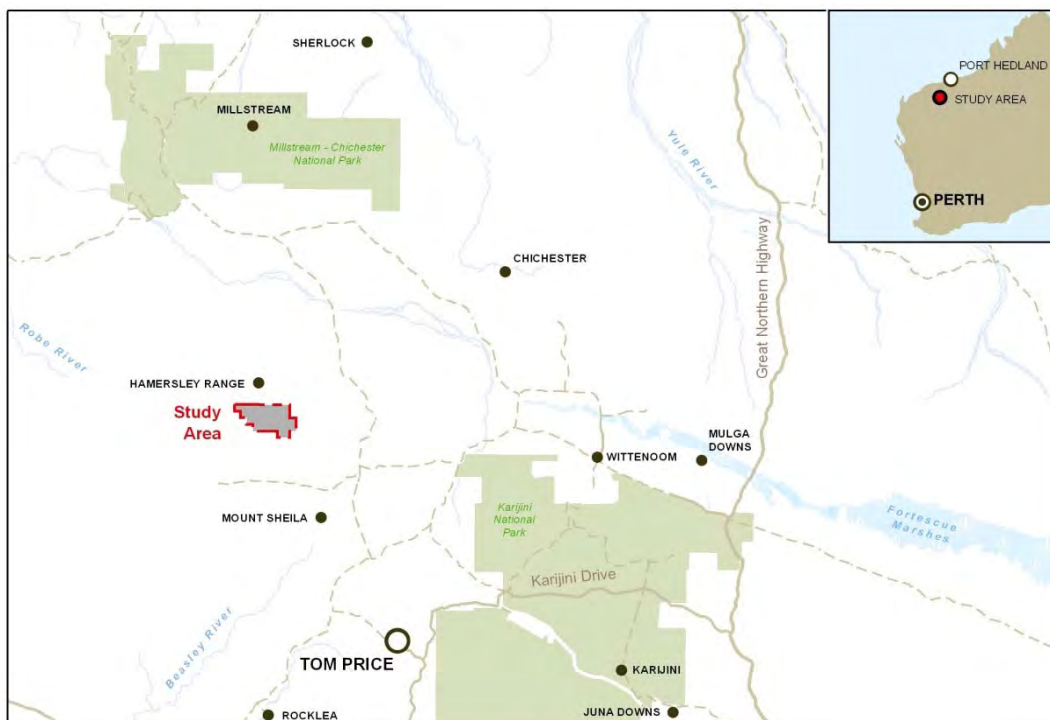
Exploration has identified five main areas of inferred and indicated iron ore resources in the Blacksmith tenement, known as 'Ajax', 'Blackjack', 'Champion', 'Delta' and 'Eagle', with 'Delta' likely to be the first area to be developed. Two smaller areas within the tenement, known as 'Paragon' and 'Badger', were also included in the field survey.

This assessment will be used as supporting documentation for the environmental impact assessment of the proposal by the Environmental Protection Authority (EPA).

### 1.1.1 STUDY AREA LOCATION

The Blacksmith tenement is location within the Mt Sheila locality in the Shire of Ashburton, approximately 70 km north-north-west of Tom Price, in the Pilbara region.

The location of the Blacksmith tenement (the study area) is shown in **Figure 1**.



**Figure 1: Regional location of Flinders Blacksmith Tenement**

## 1.2 Project Objectives

A Level 2 Flora and Vegetation survey in accordance with Ecoscape's interpretation of Environmental Protection Authority (EPA) *Guidance Statement No. 51* (2004), of the Blacksmith tenement and subsequent reporting requires:

- a flora and vegetation desktop assessment, including database and literature reviews
- a flora and vegetation survey, resulting in an understanding of the flora species and vegetation communities present and their representation over a broader area
- targeted searches for significant flora species and vegetation, including threatened flora, Threatened Ecological Communities (TECs), Declared Rare Flora (DRF), Priority Ecological Communities (PECs) and Declared weeds
- an environmental impact assessment report including background information, details of database searches and literature reviews, methodology, survey results and discussion, and advice on potential environmental impacts
- figures showing quadrat locations, significant flora species, introduced flora species, vegetation assemblages/communities and vegetation condition.

The assessment was conducted over two survey seasons (autumn and winter). Fifty floristic quadrats were established in May-June 2010, the vegetation of the unburnt extent was mapped and opportunistic searches for conservation significant flora species were conducted. In August 2010, the floristic quadrats were rescored, the vegetation mapping was ground truthed and additional opportunistic searches for conservation significant flora species were conducted.

## 1.3 Previous Botanical Surveys

Previous botanical surveys in the Pilbara, reviewed to reference flora and vegetation information, included:

- Ecoscape (2010) *Level Two Flora and Vegetation Assessment, Firetail Mining Area*, Unpublished report for Fortescue Metals Group Limited
- Coffey Environments (2010a) *Flora and Vegetation Assessment, Solomon Project and Investigator*, Unpublished report for Fortescue Metals Group Ltd
- Coffey Environments (2010b) *Flora and Vegetation Assessment, Solomon Rail Project Volume 1*, Unpublished report for Fortescue Metals Group Ltd
- Coffey Environments (2007) *Supplementary Vegetation and Flora Surveys of the Port Hedland to Cloud Break Rail Corridor and Associated Borrow Pits and Infrastructure*, Unpublished report for Fortescue Metals Group Ltd
- Matiske (2005) *Flora and Vegetation on the Cloud Break and White Knight Leases*, Unpublished report for Fortescue Metals Group Ltd
- Biota Environmental Sciences (2004a) *Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor*, Unpublished report for Fortescue Metals Group Ltd

- Biota Environmental Sciences (2004b) *Vegetation and Flora Survey of the Proposed Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas and Mindy Mindy Mine Areas*, Unpublished report for Fortescue Metals Group Ltd.

Additional reports referenced during this assessment are included in the 'references' section.

## 2.0 method

The flora and vegetation assessment methodology used was developed to comply with Ecoscape's interpretation of the requirements of a Level 2 survey based upon the EPA's *Guidance for the Assessment of Environmental Factors No 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (2004) and *Terrestrial Biological Surveys as an Element of Biodiversity Protection Position Statement No. 3* (EPA 2002). Prior to the survey commencing, Ecoscape and Flinders Mines met with Dr Stephen van Leeuwen, DEC's Biogeography Program Leader & Partnerships Manager, to discuss the survey.

Based on information in *Guidance Statement No. 51*, a Level 2 flora survey is required for the Blacksmith tenement, as the extent of native vegetation loss or habitat loss is considered to be high impact.

Level 2 surveys incorporate background research and a reconnaissance survey as preparation for a more intensive and detailed survey. This requires one or more visits in the main flowering season followed by visits in other seasons. Level 2 surveys also involve replication of the survey, greater coverage than a Level 1 survey and displacement of plots over the target areas.

In order to determine the overall value of the vegetation and flora of the study area, data collected during the field survey was used to:

- describe and map the vegetation types of the Blacksmith tenement to indicate the distribution and relative abundance of each vegetation unit and to help to define units of particular conservation value
- document the vascular flora of the area and provide a measure of the overall floristic richness of the area
- identify species of particular conservation significance and introduced plant species.

The vegetation and floristic data was collected and described from 50 quadrats, 50 m x 50 m in dimension or equivalent area if linear (eg along a drainage line), and floristic, biological and physical data was collected and recorded from each of these quadrats. The flora records provided the names used in the vegetation descriptions and contributed to the flora species lists and frequency of occurrence data. Several parameters relating to the individual quadrats were used to assist in both the description of vegetation types and the determination of flora distribution, particularly in terms of defining associated landforms.

### 2.1 Desktop Assessment

The background research (desktop assessment) was undertaken by WorleyParsons and is included in **Appendix One**.

Results of additional desktop assessments including updated DEC Threatened Flora and Ecological Community database search requests, conducted using a 50 km buffer, are included in **Section 3.1**.

The DEC Threatened Flora results consist of data from validated populations of Declared Rare and some Priority flora from the Threatened Flora Database (DEFL), specimens in the Western Australian Herbarium (WAHERB) and the DEC Declared Rare Flora and Priority Flora Database (Access database).

Threatened Ecological Communities (TECs) are categorised at both State level (DEC 2010a) and Commonwealth level (Australian Government 1999), while Priority Ecological Communities (PECs) are also classed at State level (DEC 2010a). The status of the State and Commonwealth ratings are summarised in **Table 12** and **Table 13, Appendix Two**.

A search of Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) online database was also conducted to identify potential nationally significant areas within 10 km of the study area. The results of this search are reproduced in **Appendix Three**.

Communities identified from either of these database searches were specifically targeted during the vegetation survey, according to potential areas of shared landform, geological and habitat characteristics within the study area. Any vegetation types encountered during the field surveys exhibiting floristic or structural affinities with identified TECs/PECs, based upon available descriptions, were highlighted for further analysis.

Recent rainfall data for the Wittenoom Bureau of Meteorology (BoM) site is included in **Section 2.3.1**. The Wittenoom site was the closest site with complete data; nearer sites (eg Hamersley Station) included unverified 'null' data.

## 2.2 Reconnaissance Survey

A reconnaissance survey was undertaken by Lyn Atkins and Hayley Hughes on May 25, 2010 to select locations of floristic quadrats. Floristic quadrats were spatially distributed over the study area, within representative, replicated vegetation types (where possible) and throughout the landscape. Quadrats were entirely located within one vegetation type (not including an ecotone) to assist with interpretation of floristic data. Quadrats were not located in Aboriginal Heritage areas, and not in areas considered likely to be affected by imminent exploration activities.

## 2.3 Floristic Surveys

Three floristic surveys were conducted by Lyn Atkins (flora licence SL008869), Hayley Hughes (SL008943) and Jared Nelson (SL008870), assisted by Richard Daniel, Claudia McHarrie, Casey Murphy and Gemma Greig. Survey teams consisted of two people.

The first survey was conducted over eight days during May 26th – June 2nd, 2010, when the following tasks were carried out:

- a total of 50 floristic quadrats were established in the ‘Delta’ (14 quadrats), ‘Champion’ (11 quadrats), ‘Blackjack’ (four quadrats), ‘Ajax’ (10 quadrats), ‘Eagle’ (two quadrats), ‘Paragon’ (seven quadrats) and ‘Badger’ (two quadrats) resource areas
- preliminary mapping of vegetation units, including mapping burnt and unburnt areas
- targeted searches for conservation significant species.

Quadrat locations were spatially distributed over the study area in unburnt areas.

The quadrats were numbered FL (representing Flinders Mines), 10 (representing the year the quadrats were established, 2010) and xx (representing the quadrat number). Except for quadrats associated with riparian areas and gorges, all quadrats were 50 m x 50 m in size and orientated north-south and east-west. Where it was not possible to establish quadrats 50 m x 50 m in dimension, a comparable quadrat area of 2,500 m<sup>2</sup> was maintained as this size gives a good sample of flora presence in the Pilbara, and is in line with the DEC’s Draft Botanical Survey Requirements for the Pilbara Region (Department of Conservation and Land Management 2003) and EPA Guidance Statement *No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).

The second survey was conducted over five days during August 26 – 30<sup>th</sup>, 2010. The following tasks were undertaken:

- a reassessment of the previously established quadrats
- vegetation mapping types and boundaries were confirmed
- additional targeted searches for conservation significant species.

As 2010 was a poor year in terms of rainfall, a third survey was conducted over four days during March 25 – 28, 2011. During this survey the quadrats were rescored.

### **2.3.1 TIMING OF SURVEYS**

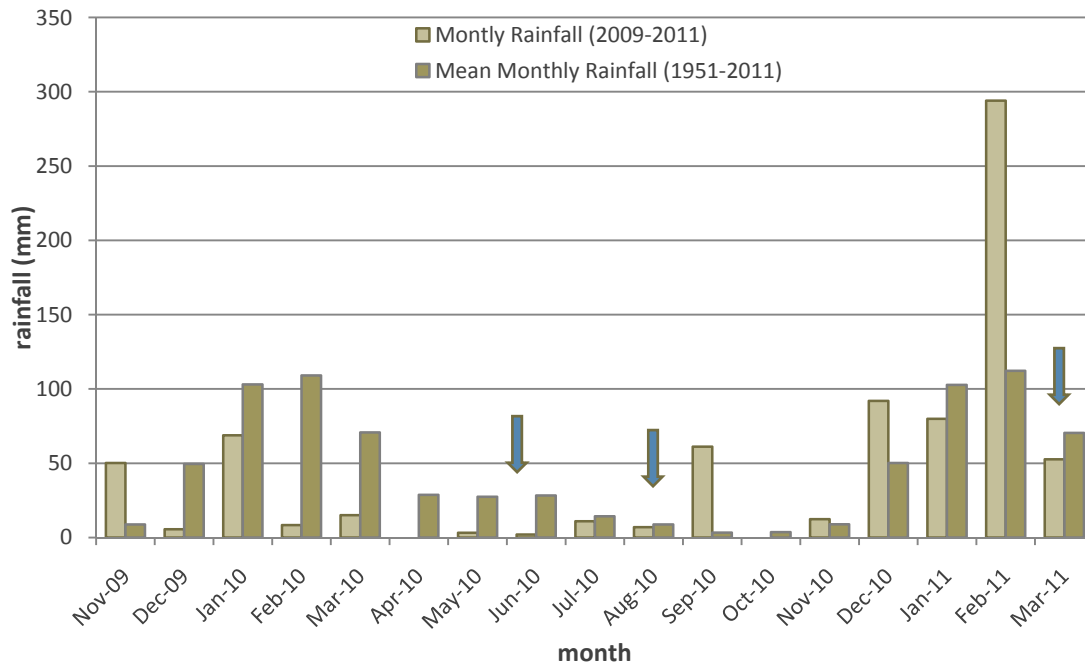
The first two floristic surveys were conducted during autumn (May-June), when grasses are generally flowering and therefore identifiable following summer/early autumn (usually cyclonic) rainfall, and in winter (August) when ephemeral species are generally flowering, in 2010.

Seasonal conditions during the 2010 surveys were considered to be poor for the collection of ephemeral flora and flowering grasses. The region had received 148.1 mm of rain for the November 2009 - April 2010 period, which is approximately 40% of the summer average. The two previous years rainfall, 451.3 mm in 2009 and 434.0 mm in 2008, were close to the mean annual rainfall of 457.6 mm (Bureau of Meteorology (BoM) 2011).



January and February 2011 rainfall (79.9 and 294.0 mm respectively) was approximately 174% of the mean rainfall for these months (102.7 and 112.2 mm) (BoM 2011) and therefore seasonal conditions were considered to be good.

**Figure 2** outlines monthly rainfall totals recorded at the BoM Wittenoom site during the November 2009 to March 2011 period, compared with long term averages.



**Figure 2: Annual and mean monthly rainfall totals for the Wittenoom BoM site. The timing of the field surveys are indicated by the blue arrows.**

Data collected during 2010 resulted in fewer than anticipated flora species being recorded, and difficulty interpreting the floristic data analysis. An additional survey in March 2011, following good summer rainfall, was undertaken to supplement the data.

**Plate 1** illustrates the poor seasonal conditions in 2010. **Plate 2** illustrates the good seasonal conditions in 2011.

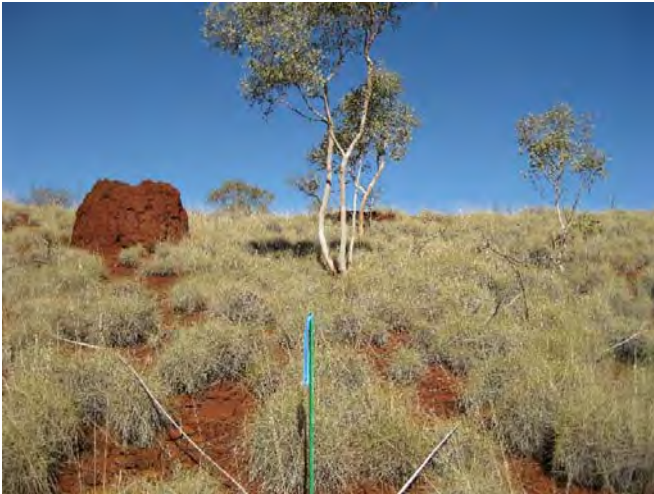


Plate 1: Quadrat FL1008 in May 2010



Plate 2: Quadrat FL1008 in March 2011

### 2.3.2 VEGETATION DESCRIPTION AND MAPPING

Two standard vegetation classification and description systems were used during the vegetation surveys. Descriptions were defined using the height and estimated cover of dominant species of each stratum and the framework of Muir (1977) and Aplin (1979), which is a modification of the vegetation classification system of Specht (1970) to include a hummock grassland category (**Table 1**). Subsequent advice from the DEC determined that National Vegetation Inventory System (NVIS, National Heritage Trust 2003) complaint descriptions, recorded at a minimum of Level V, were required (**Table 2**). These were recorded during the March 2011 field survey. Both descriptions are included in the report.

Floristic data and vegetation structural characteristics collected from each of the 50 quadrats were used to develop vegetation descriptions. These descriptions were then grouped to arrive at vegetation units that were defined on the basis of shared structural, disturbance and floristic (species, abundance and cover) data. These units were also linked to the main landform/habitat types in which they were found to occur. Where possible, a minimum of three quadrats were sampled per vegetation type (as recognised during the field survey) from across the study site. Quadrat locations were determined on the basis of topography/landform, field observations of vegetation structure and composition, interpretation and ground truthing of aerial photography, and spatial representation.

Floristic analysis was conducted using both the 2010 and complete (2010 and 2011) data. Regional floristic analysis was conducted using the complete data.

**Table 1: Vegetation structural classes (modified from Muir (1977) and Aplin (1979))**

Stratum	Canopy Cover				
	70%-100%	30%-70%	10%-30%	2%-10%	<2%
<b>Trees over 30m</b>	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland	Scattered Tall Trees
<b>Trees 10-30 m</b>	Closed Forest	Open Forest	Woodland	Open Woodland	Scattered Trees
<b>Trees under 10 m</b>	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland	Scattered Low Trees
<b>Shrubs over 2 m</b>	Tall Closed Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland	Scattered Tall Shrubs
<b>Shrubs 1-2 m</b>	Closed Heath	Open Heath	Shrubland	Open Shrubland	Scattered Shrubs
<b>Shrubs under 1 m</b>	Low Closed Heath	Low Open Heath	Low Shrubland	Low Open Shrubland	Scattered Low Shrubs
<b>Hummock Grasses</b>	Closed Hummock Grassland	Mid-dense Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Scattered Hummock Grasses
<b>Grasses, Sedges and Herbs</b>	Closed Tussock Grassland/ Sedgeland/ Herbland	Tussock Grassland/ Sedgeland/ Herbland	Open Tussock Grassland/ Sedgeland/ Herbland	Very Open Tussock Grassland/ Sedgeland/ Herbland	Scattered Tussock Grasses/ Sedges/ Herbs

**Table 2: NVIS information hierarchy (National Heritage Trust 2003)**

Level	Description	NVIS structure/floristic components required
1	Class	Dominant growth form for the ecologically dominant stratum
2	Structural Formation	Dominant growth form, cover and height for the ecologically dominant stratum
3	Broad Floristic Formation	Dominant growth form, cover, height and broad floristic code usually dominant land cover genus for the upper most or dominant stratum
4	Sub-Formation	Dominant growth form, cover, height and broad floristic code usually dominant genus and family for the three traditional strata (upper, mid and ground)
5	Association	Dominant growth form, cover, height and species (3 species) for the three traditional strata (upper, mid and ground)
6	Sub-Association	Dominant growth form, cover, height and species (5 species) for all layers/strata

Vegetation condition was assessed using a rating scale that was developed based on a scale devised by Trudgen (1991), which the DEC has previously advised as the most appropriate for assessing vegetation condition in the Pilbara region (Coffey Environments 2007). This rating scale is outlined in **Table 3**.

**Table 3: Vegetation condition rating scale (Trudgen 1991)**

Condition Rating	Description
<b>E=Excellent</b>	Pristine or nearly so; no obvious signs of damage caused by activities of European man.
<b>VG= Very Good</b>	Some relatively slight signs of damage caused by activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as <i>*Ursinia anthemoides</i> or <i>*Briza</i> spp., or occasional vehicle tracks.
<b>G=Good</b>	More obvious signs of damage caused by activities of European man, including some obvious signs of impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as <i>*Ehrharta</i> spp.
<b>P=Poor</b>	Still retains basic vegetation structure or ability to regenerate to it after very obvious activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some aggressive ones such as <i>*Ehrharta</i> spp.
<b>VP=Very Poor</b>	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.
<b>D=Degraded</b>	Areas that are completely or almost completely without native species in the structure of their vegetation; ie areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

To collect spatial information, 1:15 000 scale rectified and geo-referenced aerial images were marked up with vegetation type boundaries. These hand drafted vegetation boundaries were then digitised and attributed in ArcGIS Version 10.

### 2.3.3 FLORA SURVEY

The flora survey involved the sampling of floristic quadrats, with the following parameters recorded at each quadrat:

- MGA coordinates recorded in GDA 94 datum using a hand-held Global Positioning System (GPS), to an accuracy usually within 5 m
- broad vegetation description based on the height and estimated cover of dominant species
- an inventory of all species, with estimated maximum height and percent foliage cover
- description of landform and habitat
- broad description of surface soil type and stony surface mantle
- percentage of litter cover and depth
- percentage of bare ground
- evidence of grazing, mining exploration activities, weed invasion, frequent fires etc. Fire effects were only considered a negative impact if they were caused by repeated burning eg for pastoral purposes.

Photographs of the vegetation at each site were taken from the north-west corner of each quadrat using a digital camera.

Flora species were also opportunistically recorded on traverses between quadrat locations. To supplement the list of species recorded from the flora survey sites, specific searches of habitats likely to support flora species with sporadic or restricted distributions (eg drainage lines, rock piles and cracking clay areas) were also undertaken.

Voucher specimens of all species were collected, assigned a unique number to facilitate tracking of data, and pressed in the field. Specimens collected were dried and treated in accordance with the requirements of the West Australian Herbarium. These voucher specimens were identified by ME Trudgen, using appropriate publications, and/or comparison with pressed specimens housed at the West Australian Herbarium, but have not yet been submitted to the Herbarium.

Nomenclature was checked against the current listing of scientific names recognised by the Western Australian Herbarium and listed on FloraBase (Western Australian Herbarium & DEC 2010) and updated as necessary.

All raw site data was entered into a Microsoft Access database, with species names entered following formal identification of the collected specimens.

### **Conservation Significant Flora**

Flora species are classified as Declared Rare Flora (DRF) or listed as Priority Flora where populations are geographically restricted or threatened by local processes. The DEC enforces regulations under Government of Western Australia's *Wildlife Conservation Act* (1950) to conserve DRF and protect significant populations. Rare flora species are gazetted under Sub-section 2 of Section 23F of the *Wildlife Conservation Act*, thereby making it an offence to remove or damage rare flora without Ministerial approval.

There are six categories covering DRF and Priority listed species (DEC 2010b; Western Australian Herbarium & DEC 2010), which are outlined in **Table 14, Appendix Two**. DRF species may also be listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Australian Government). Definitions of the Commonwealth (DSEWPC) categories are also provided in **Table 15, Appendix Two**.

Prior to the survey, an initial review of previous flora and vegetation survey reports from the region, in conjunction with interrogation of the DEC Threatened (Declared Rare) and Priority Listed Flora database (search request) was undertaken to identify conservation significant flora known to occur within 50 km of the Blacksmith study area. The search identified the list of species indicated in **Table 16, Appendix Four**.

A review of the DSEWPC online databases (Protected Matters Search Tool and Species Profile and Threats Database) was also conducted to identify any additional threatened flora with

Commonwealth protection nearby. The results of the Protected Matters Search are reproduced in **Appendix Three**.

Due to the size of the study area, no systematic grid search of the study area for conservation significant flora was undertaken. However, when traversing between sites, every opportunity was taken to search for threatened species, especially where preferred habitats were encountered. The search spacing between surveyors was approximately 20-30 m (ie when walking between sites, the two surveyors walked parallel lines, searching either side of the walked line for species identified by the DEC database search), but varied largely due to topographic features. Additional targeted searches were also conducted within gorge areas.

## 2.4 Floristic Analysis

Floristic analysis on the quadrat data, using PATN©, was undertaken on two levels:

1. To determine the floristic groups within the study area (undertaken by Ecoscape)
2. To compare the quadrat data to a regional dataset (undertaken by Griffin and Trudgen).

### 2.4.1 STUDY AREA FLORISTIC ANALYSIS

PATN© software (Belbin & Collins 2006) was used to undertake statistical analysis and generate floristic groups using the data collected from the floristic quadrats. PATN© analysis has been used for several local floristic analyses including Gibson *et al* (1994) for the Swan Coastal Plain, Markey (1997) for the northern Darling Scarp, initially by Craig *et al* (2008) for the Ravensthorpe Ranges, and by Ecoscape for the Geraldton Regional Flora and Vegetation Survey (Department of Planning & Ecoscape (Australia) Pty Ltd 2010).

PATN© is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes), and classifies the objects into groups and condenses the information and displays the patterns in the data graphically.

PATN© offers a choice of data transformations prior to multivariate analysis. In this case, because the analysis used presence / absence data, the Kulczynski similarity coefficient was the appropriate association to use as it has proven to be a good estimation of association for ecological applications (Belbin & Collins 2006). This was followed by Flexible UPMGA (Un-weighted Pair Group Using Arithmetic Averaging) fusion to produce clusters of related objects (species); these are the floristic groups that are displayed as a dendrogram.

Further interpretation of these purely floristic groups was required to identify recognisable and mappable on-ground vegetation units. This interpretation was largely based on dominant species from several strata, from quadrats that were closely spaced on the dendrogram.

## 2.4.2 REGIONAL FLORISTIC ANALYSIS

Floristic quadrat data from the Blacksmith tenement was compared with the quadrat data from other surveys in the Pilbara to provide a regional assessment of the vegetation types in the study area. DEC advised that only surveys from the Hamersley Range were required for regional floristic analysis.

Griffin and Trudgen use the numerical classification package PATN© (Belbin 1987) as their experience has been that the resulting classification of datasets can be interpreted to give an understanding of the floristic variations and to make assessments in relation to the importance of these variations.

PATN© provides a classification of vegetation quadrat data into groups of sites with similar floristic composition (that is, groups of quadrats with similar lists of species in the quadrats are placed together). Results need to be interpreted with care as floristic groups are not directly comparable with plant communities based on structure and dominance, or the broader groupings of vegetation associations or vegetation formations.

Floristic quadrat data from the current project and earlier nearby Pilbara projects (the Pilbara dataset) are imported and 'queries' (short programs used to carry out the analysis) incorporated into a Microsoft Access database. Plant species names were reconciled to ensure that nomenclature is compatible over time, there was less likely to be confusion in relation to infrataxa, some taxa combined where there may have been misidentification, and omitting ambiguous records.

The analysis is undertaken using presence / absence data; cover values are not used. The ASO (calculation of similarity matrix), FUSE (classification), DEND (representation of classification) and SSH (a form of ordination) modules of PATN© are used in the analysis, using the default parameters. The output from the analyses include an ASO matrix, used to determine similarity, and a dendrogram, showing groups of sites (quadrats).

A second statistical analysis, 'nearest neighbour' analysis, was then conducted to find sites with the most similar flora list to infer the most likely floristic group.

Limitations for this process are listed in the floristic analysis report (**Appendix Nine**).

## 3.0 results

### 3.1 Desktop Assessment

#### 3.1.1 DATABASE SEARCHES

##### Ecological Communities

The DEC Ecological Community database search request identified two potential significant communities:

1. The *vulnerable* TEC 'Themeda grasslands on cracking clays (Hamersley Station, Pilbara)' was identified during the DEC database search as occurring within 50 km of the study area. The administrative buffer applied by the DEC around this TEC, within which the DEC must be notified of any proposed impacts, overlaps the south-eastern third of the Blacksmith study area (**Map 1, Appendix Five**).

There were, however, no vegetation types or soil types matching the description of this TEC in the study area, and therefore the TEC does not occur in the Flinders tenement.

Additionally, as the surface and subsurface drainage from the study area is northwards towards the Fortescue River rather than southwards towards the TEC, there are likely to be no impacts on the TEC from activities in the Finders tenement.

2. The Priority 3 PEC 'Four Plant Assemblages of the Wona Land System', occurring within 50 km of the study area.

The Wona Land System does not occur in the study area therefore by definition the PEC does not occur in the study area. Additionally there is no vegetation matching the descriptions of the floristic assemblages of the PEC in the study area.

The PEC occupies an area north of the Fortescue River and upstream of the study area, thus there are unlikely to be any downstream impacts on the PEC by activities on the Flinders tenement.

##### Conservation Significant Flora Species

Thirty conservation significant flora species were identified from the DEC database search as occurring within 50 km of the Blacksmith study area (**Table 16, Appendix Four**). **Map 1, Appendix Five** illustrates the locations of species closest to the study area.



## 3.2 Vegetation Survey

Approximately 80% of the Flinders Blacksmith tenement had been burnt by fires ignited by lightning strikes in February 2010, prior to the flora and vegetation survey. Floristic quadrats were established on unburnt areas (although some had a very small proportion of their extent burnt) and vegetation mapping was only conducted on unburnt areas. Vegetation type mapping was not conducted on burnt areas (eg **Plate 3**) as vegetation types could not be ground truthed with certainty.



**Plate 3: Recently burnt area**

### 3.2.1 VEGETATION TYPES

The field survey and subsequent floristic analysis and interpretation identified 11 vegetation types from the study area. These vegetation types and their extents are summarised below in and their distribution is illustrated in **Map 2**. Vegetation descriptions associated with each quadrat are included in **Appendix Six**.

**Table 4: Extents of each vegetation type in the study area**

Code	Vegetation Type	Area (ha)	Proportion	Proportion of unburnt area
B	Burnt	8 633.24	80.08%	-
AmS	<i>Acacia maitlandii</i> Shrubland	17.87	0.17%	0.83%
AoS	<i>Acacia orthocarpa</i> (atypical form) Shrubland	24.53	0.23%	1.14%
CfLW	<i>Corymbia ferritcola</i> / <i>Eucalyptus leucophloia</i> Low Open Woodland	5.69	0.05%	0.26%
ChEgLO W	<i>Corymbia hamersleyana</i> / <i>Eucalyptus gamophylla</i> Low Open Woodland	16.21	0.15%	0.75%
EgChEIL W	<i>Eucalyptus gamophylla</i> / <i>Corymbia hamersleyana</i> / <i>E. leucophloia</i> Low Woodland	442.88	4.11%	20.62%
ELOW	<i>Eucalyptus leucophloia</i> Low Open Woodland	1 243.99	11.54%	57.91%
EvOW	<i>Eucalyptus victrix</i> Open Woodland	7.46	0.07%	0.35%
TeHG	<i>Triodia epactia</i> Hummock Grassland	230.00	2.13%	10.71%
TmHG	<i>Triodia aff. melvillei</i> Hummock Grassland	105.06	0.97%	4.89%
TwHG	<i>Triodia wiseana</i> Hummock Grassland	54.28	0.50%	2.53%
<b>TOTAL</b>		<b>10 781.22</b>	<b>100.00%</b>	<b>100.00%</b>

Most areas had discrete vegetation boundaries, with little merging between adjacent vegetation types. Therefore vegetation type boundaries could usually be accurately determined by interpreting aerial imagery.

The vegetation types determined to occur in the unburnt portion of the study area are described on the following pages.

**AmS: *Acacia maitlandii* Shrubland**

**Vegetation type description:** *Acacia maitlandii* Shrubland to scattered shrubs over *Triodia wiseana* and *T. epactia* Open to Mid-dense Hummock Grassland, with *Corymbia hamersleyana* or *Eucalyptus leucophloia* Low Open Woodland to scattered trees. *T. epactia* and *C. hamersleyana* occurred on the valley floor sites and *T. wiseana* occurred on hillsides and at a lower density on valley floors, with *E. leucophloia* occurring largely on hillsides. Other common species include *Acacia adoxa* var. *adoxo*, *A. pyrifolia*, *A. retivenea*, *A. tenuissima*, *Dodonaea coriacea*, *Eriachne mucronata*, *Indigofera monophylla*, *Jasminum didymum* subsp. *lineare*, *Ptilotus astrolasius* and *Senna* spp.

U ^*Corymbia hamersleyana*, *Eucalyptus leucophloia*^tree\6\r; M ^*Acacia maitlandii*^shrub\3\i;G+ ^*Triodia wiseana*, *T. epactia*^hummock grass\2\i;

*Acacia maitlandii* Shrubland occupied approximately 17.87ha or 0.17% of the study area (0.83% of the unburnt extent), occurring on rocky hillsides and stony valley floors in the north-eastern corner of the study area ('Paragon'). The vegetation was assessed as being largely in Excellent condition.

Three quadrats were sampled in this vegetation type (FL1018, FL1019 and FL1021). **Plate 4** illustrates *Acacia maitlandii* Shrubland.



**Plate 4: *Acacia maitlandii* Shrubland (near quadrat FL1018)**

**AoS: *Acacia orthocarpa* (atypical form) Shrubland**

**Vegetation type description:** *Acacia orthocarpa* (atypical form) Shrubland to Low Open Shrubland over *Triodia wiseana* and *T. epactia* Open to Mid-dense Hummock Grassland, with *Corymbia hamersleyana* and *Eucalyptus leucophloia* scattered trees. All occurrences were on areas with exposed sheet rock, on lower slopes and hill spurs. Other common species include *Corchorus lasiocarpus*, *Cymbopogon ambiguus* and *Waltheria virgata*.

U ^*Corymbia hamersleyana*, *Eucalyptus leucophloia*^tree\6\r;M ^*Acacia orthocarpa* (atypical form)^shrub\3\i;G+ ^*Triodia wiseana*, *T. epactia*^hummock grass\2\i;

*Acacia orthocarpa* (atypical form) Shrubland occupied approximately 24.53 ha or 0.23% of the study area (1.14% of the unburnt extent), largely in the far north-western portion, with an outlying area in the central western area (all in 'Ajax'). The vegetation was assessed as being in Excellent condition.

Due to the extent of burnt vegetation it was not possible to determine if it occurred in other areas.

Three quadrats were sampled in this vegetation type (FL1039, FL1040 and FL1042). **Plate 5** illustrates *Acacia orthocarpa* (atypical form) Shrubland.



**Plate 5: *Acacia orthocarpa* (atypical form) Shrubland (quadrat FL1042)**

**CfLW: *Corymbia ferritcola*/*Eucalyptus leucophloia* Low Open Woodland**

**Vegetation type description:** *Corymbia ferritcola* and *Eucalyptus leucophloia*, occasionally with *Ficus brachypoda* and *Brachychiton acuminatus*, Low Woodland to Low Open Woodland over *Acacia monticola*, *A. pruinocarpa*, *Flueggea virosa* and *Gossypium robinsonii* Tall Open Shrubland over *Triodia epactia* and occasionally *T. wiseana* Hummock Grassland, and *Cymbopogon ambiguus*, *Themeda* spp. *Eulalia aurea*, *Enneapogon lindleyanus*, *Eriachne mucronata* and *Eragrostis* aff. *eriopoda* Open Tussock Grassland. Other common species include *Astrotricha hamptonii*, *Capparis spinosa* and *Rhagodia eremaea*.

U ^*Corymbia ferritcola* subsp. *ferritcola*, *Eucalyptus leucophloia* subsp. *leucophloia*^tree\7\r;M ^*Acacia monticola*, ^*A. pruinocarpa* and ^*Gossypium robinsonii*^shrub\2\c;G+ ^*Triodia epactia*, *Themeda* sp. Mt Bruce, *Cymbopogon ambiguus*^hummock grass, tussock grass\3\c;

*Corymbia ferritcola*/*Eucalyptus leucophloia* Woodland occupied approximately 5.69 ha or 0.05% of the study area (0.26% of the unburnt extent), and was confined to gorges and deep gullies. The vegetation was assessed as being in Very Good or Excellent condition.

There is probably more of this vegetation type however, due to fire, it is not possible to ground truth these.

Three quadrats were sampled in this vegetation type (FL1026, FL1027 and FL1035). **Plate 6** illustrates *Corymbia ferritcola*/*Eucalyptus leucophloia* Woodland.



**Plate 6: *Corymbia ferritcola*/*Eucalyptus leucophloia* Woodland (quadrat FL1026)**

### **ChEgLOW: *Corymbia hamersleyana*/*Eucalyptus gamophylla* Low Open Woodland**

**Vegetation type description:** *Corymbia hamersleyana* and *Eucalyptus gamophylla* Low Open Woodland over *Eulalia aurea*, *Paraneurachne muelleri* and *Themeda* spp. open tussock grassland and *Triodia epactia* hummock grassland with scattered *Acacia pyrifolia* var. *pyrifolia* and *Gossypium robinsonii* tall shrubs.

U ^*Corymbia hamersleyana*, *Eucalyptus gamophylla*\6\r;M ^*Acacia pyrifolia* var. *pyrifolia*, *Gossypium australe*\3\bi;G+ ^*Eulalia aurea*, *Triodia epactia*, *Paraneurachne muelleri*\^tussock grass, hummock grass\2\c

*Corymbia hamersleyana*/*Eucalyptus gamophylla* Low Open Woodland occupied approximately 16.21 ha or 0.15% of the study area (0.75% of the unburnt extent), occupying broad floodplain and outwash areas associated with the major drainage channel in 'Ajax' and in an area of converging streams in 'Champion'.

Two quadrats were recorded in this vegetation type. One unburnt but heavily grazed quadrat was located and sampled in this vegetation type during the field survey (FL1043); the other quadrat (FL1031) was identified during the floristic analysis, with review of aerial imagery confirming the similarity of landform and enabling mapping of the area. All other areas that would have been mapped as this vegetation type had been burnt, with the landform and associated vegetation only occurring in the 'Ajax' area in the western portion of the Blacksmith tenement, and the mapped area in 'Champion'. **Plate 7** illustrates *Corymbia hamersleyana* Open Woodland.



**Plate 7: *Corymbia hamersleyana* Open Woodland (quadrat FL1043)**

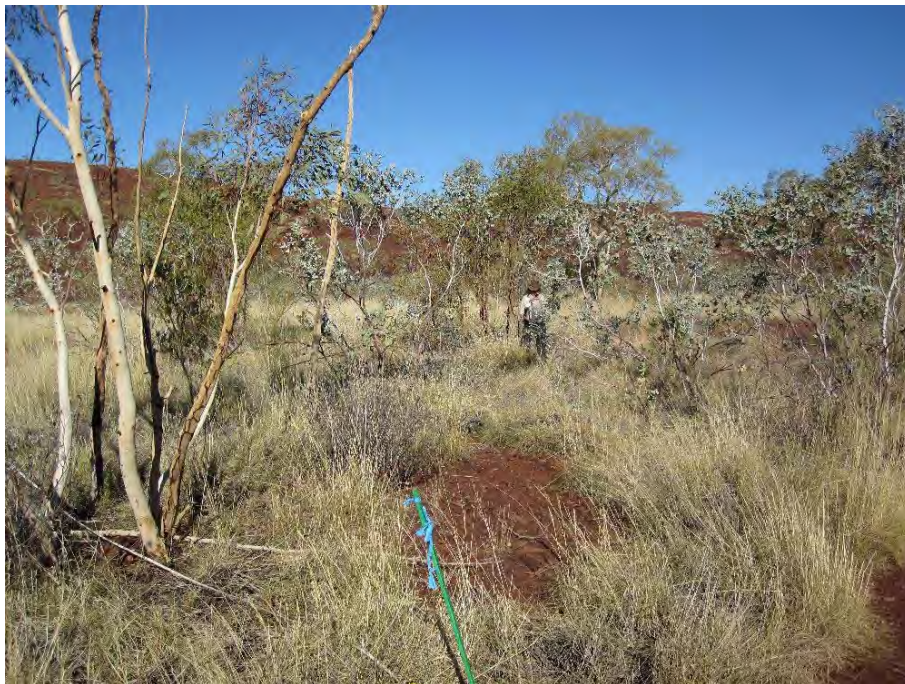
**EgChELW: *Eucalyptus gamophylla*/*Corymbia hamersleyana*/*E. leucophloia* Low Woodland**

**Vegetation type description:** *Eucalyptus gamophylla* and *Corymbia hamersleyana* and *Eucalyptus leucophloia* Low Open Woodland to Open Woodland over *Acacia* spp. Tall Open Shrubland over *Triodia epactia* Open to Mid-dense Hummock Grassland, with *Aristida holathera* var. *holathera* and other Poaceae spp. Very Open Tussock Grassland. *Acacia* species include *Acacia dictyophleba*, *A. pyrifolia*, *A. elachantha*, *A. retivenea*, *A. monticola*, *A. atkinsiana* and *A. tumida* var. *pilbarensis*. Other common species include *Paraneurachne muelleri*, *Themeda* sp., *Ptilotus astrolasius*, *Acacia adoxa* var. *adoxo*, *Gossypium australe*, *Jasminum lineare*, *Bonamia rosea* and *Senna artemisioides* subsp. *oligophylla*.

U ^*Eucalyptus gamophylla*, *Corymbia hamersleyana*, *Eucalyptus leucophloia*^tree\6\r;M ^*Acacia* spp. \shrub\4\i;G+ ^*Triodia epactia*, *Aristida holathera* var. *holathera*^hummock grass, tussock grass\2\i

*Eucalyptus gamophylla*/*Corymbia hamersleyana*/*E. leucophloia* Low Woodland occupied approximately 442.88 ha (4.11%) of the study area (20.62% of the unburnt extent), occupying valley floors throughout the study area. The vegetation was assessed as being in Very Good or Excellent condition.

Nine quadrats were sampled in this vegetation type (FL1006, FL1007, FL1009, FL1011, FL1012, FL1023, FL1029, FL1030, FL1049). **Plate 8** illustrates *Eucalyptus gamophylla*/*Corymbia hamersleyana* Low Woodland.



**Plate 8: *Eucalyptus gamophylla*/*Corymbia hamersleyana*/*E. leucophloia* Low Woodland (quadrat FL1023)**

### **ELOW: *Eucalyptus leucophloia* Low Open Woodland**

**Vegetation type description:** *Eucalyptus leucophloia* and *Corymbia hamersleyana* Low Open Woodland to scattered trees over *Triodia wiseana* and occasionally *T. epactia* Open to Mid-dense Hummock Grassland over occasional *Cymbopogon ambiguus* and *Eriachne mucronata* Open Tussock Grassland usually associated with rock outcrops. Minor gullies associated with this vegetation type included *Grevillea pyramidalis* subsp. *leucadendron*, *G. wickhamii* subsp. *hispidula* and *Acacia maitlandii*. Other common species include *Acacia melleodora*, *Acacia tenuissima*, *Hakea chordophylla*, *Jasminum didymum* subsp. *lineare*, *Senna glutinosa* subsp. *glutinosa*, *Acacia monticola*, *Corchorus lasiocarpus* and *Dampiera candicans*.

U ^*Eucalyptus leucophloia*, *Corymbia hamersleyana*\^tree\6\r;G+ ^*Triodia wiseana*, *T. epactia*, *Cymbopogon ambiguus*\^hummock grass, tussock grass\2\c

*Eucalyptus leucophloia* Low Open Woodland occupied approximately 1,243.99 ha or 11.54% of the study area (57.91% of the unburnt extent), and occurred on hillslopes and hilltops throughout the study area. The vegetation was assessed as being in Excellent condition.

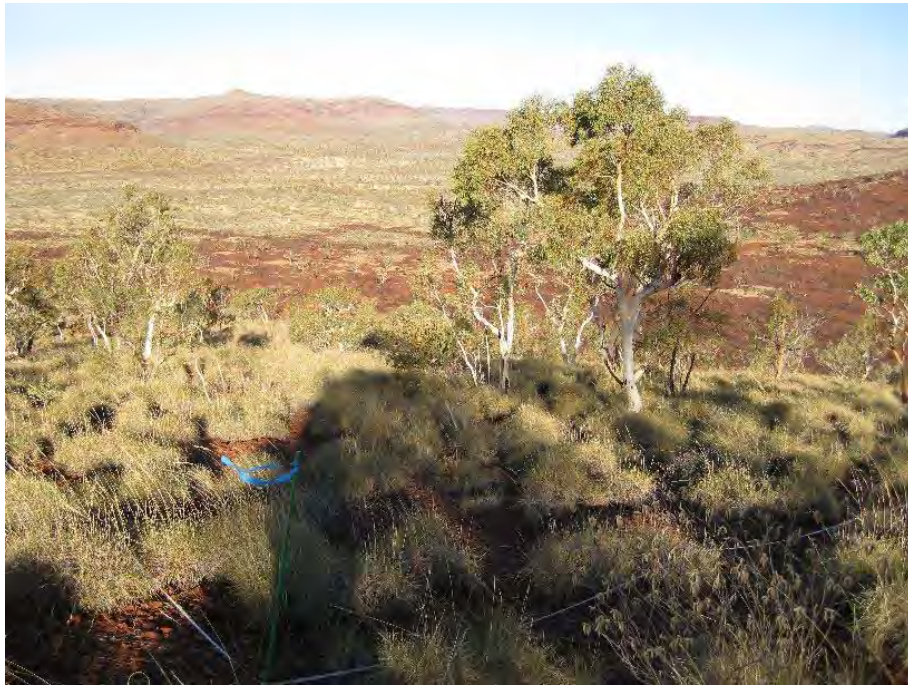
Fifteen quadrats were sampled in this vegetation type (FL1001, FL1002, FL1003, FL1004, FL1008, FL1010, FL1015, FL1016, FL1017, FL1025, FL1028, FL1033, FL1034, FL1047, FL1050). Quadrats were located throughout the catenary sequence from lower slopes to hilltops, however mesa tops could not be accessed for assessment and have been interpreted to be included as this vegetation type.

**Plate 9** and **Plate 10** illustrate *Eucalyptus leucophloia* Low Open Woodland.



**Plate 9: *Eucalyptus leucophloia* Low Open Woodland (quadrat FL1001; midslope)**





**Plate 10: *Eucalyptus leucophloia* Low Open Woodland (quadrat FL1016; upper slope)**

### EvOW: *Eucalyptus victrix* Open Woodland

**Vegetation type description:** *Eucalyptus victrix* Open Woodland over *Acacia monticola*, *Dodonaea lanceolata* var. *lanceolata* and *Gossypium robinsonii* Tall Shrubland over *Stemodia grossa* Low Open Shrubland over *Triodia epactia* Hummock Grassland over *Eulalia aurea*, *Themeda* sp. and *Eriachne mucronata* open tussock grassland. *Ficus brachypoda*, *Eucalyptus leucophloia* and *Rhynchosia bungarensis* were also common. It is possible that *Eucalyptus camaldulensis* also occurred along the major drainage channel, however areas that were likely to have this species were burnt (eg **Plate 11**) and not included in the assessment.

U ^*Eucalyptus victrix*\^tree\6\r;M ^*Acacia monticola*, *Dodonaea lanceolata* var. *lanceolata*, *Gossypium robinsonii*\^shrub\4\c;G+ ^*Triodia epactia*, *Eulalia aurea*, *Themeda* sp.\^hummock grass, tussock grass\2\i



**Plate 11: Burnt riparian area**

*Eucalyptus victrix* Open Woodland occupied approximately 7.46 ha or 0.07% of the study area (0.35% of the unburnt extent), occurring along the major drainage channel (riparian area) through the western portion of the study area ('Ajax') and as a disturbed (grazed) and partly burnt small area on the far south-eastern corner of 'Eagle'. The unburnt vegetation was assessed as being in Very Good condition.

Only one quadrat was sampled in this vegetation type (FL1045) as all other areas had been recently burnt or heavily grazed. **Plate 12** and **Plate 13** illustrate *Eucalyptus victrix* Open Woodland.



**Plate 12: *Eucalyptus victrix* Open Woodland (quadrat FL1045, north-western end)**



**Plate 13: *Eucalyptus victrix* Open Woodland (quadrat FL1045, south-eastern end)**

**TeHG: *Triodia epactia* Hummock Grassland**

**Vegetation type description:** *Triodia epactia* Closed to Open Hummock Grassland. *Triodia wiseana* is occasionally included, and there are often emergent *Corymbia hamersleyana*, *C. deserticola* or *Eucalyptus gamophylla* or *E. leucophloia* scattered trees or *Acacia melleodora*, *A. tumida*, *A. ancistrocarpa*, *A. pyrifolia*, *A. tenuissima*, *A. maitlandii* or *Grevillea wickhamii* scattered shrubs. Other common species include *Aristida holathera* var. *holathera*, *Eriachne mucronata*, *Ptilotus astrolasius* and *Senna glutinosa* subsp. *glutinosa*.

U ^*Corymbia hamersleyana*, *C. deserticola* or *Eucalyptus gamophylla*\^tree\6\r;M ^*Acacia melleodora*, *A. tumida*, *A. ancistrocarpa*\shrub\3\r;G+ ^*Triodia epactia*, *T. wiseana*\^hummock grass\2\|d

*Triodia epactia* Hummock Grassland occupied approximately 230 ha or 2.13% of the study area (10.71% of the unburnt extent), occurring on valley floors throughout much of the study area. The vegetation was assessed as being in Very Good or Excellent condition.

Four quadrats were sampled in this vegetation type (FL1014, FL1020, FL1022 and FL1036). **Plate 14** illustrates *Triodia epactia* Hummock Grassland.



**Plate 14: *Triodia epactia* Hummock Grassland (quadrat FL1036)**

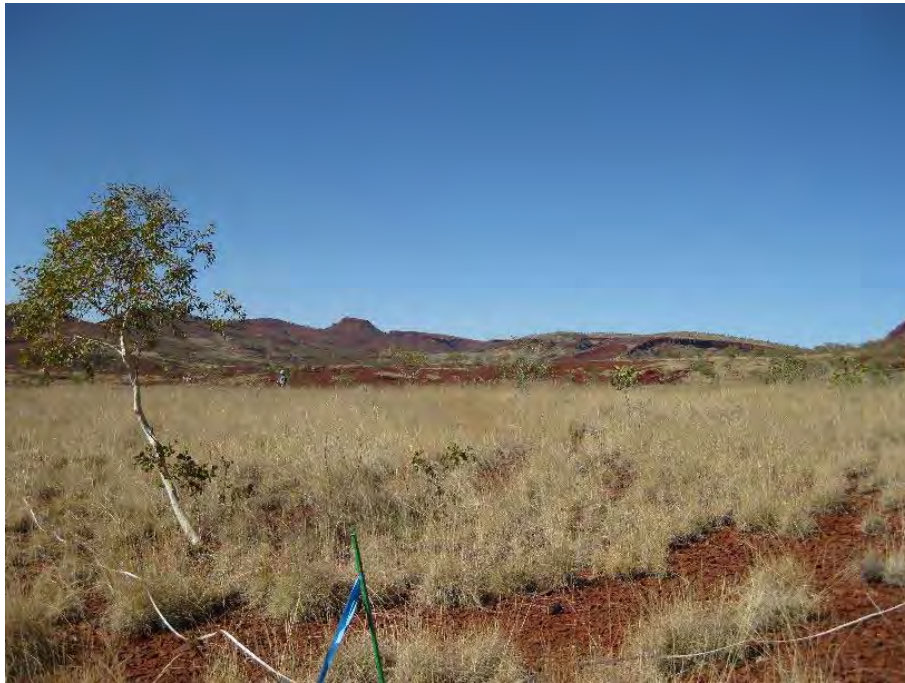
**TmHG: *Triodia aff. melvillei* Hummock Grassland**

**Vegetation type description:** *Triodia aff. melvillei* Hummock Grassland to Mid-dense Hummock Grassland, occasionally with *T. wiseana*, at times with *Corymbia hamersleyana* scattered trees. Other common species include *Goodenia stobbsiana*, *Hakea chordophylla* and *Acacia adoxa* var. *adoxo*.

U ^*Corymbia hamersleyana*^\tree\6\r;G+ ^*Triodia aff. melvillei*, *T. wiseana*^\hummock grass\1\c

*Triodia aff. melvillei* Hummock Grassland occupied approximately 105 ha or 0.97% of the study area (4.89% of the unburnt extent), occurring on low hills and rises in valley floors in the northern and western portions of the study area. The vegetation was assessed as being in Excellent condition.

Six quadrats were sampled in this vegetation type (FL1024, FL1032, FL1037, FL1038, FL1044 and FL1046). **Plate 15** illustrates *Triodia aff. melvillei* Hummock Grassland.



**Plate 15: *Triodia aff. melvillei* Hummock Grassland (quadrat FL1046)**

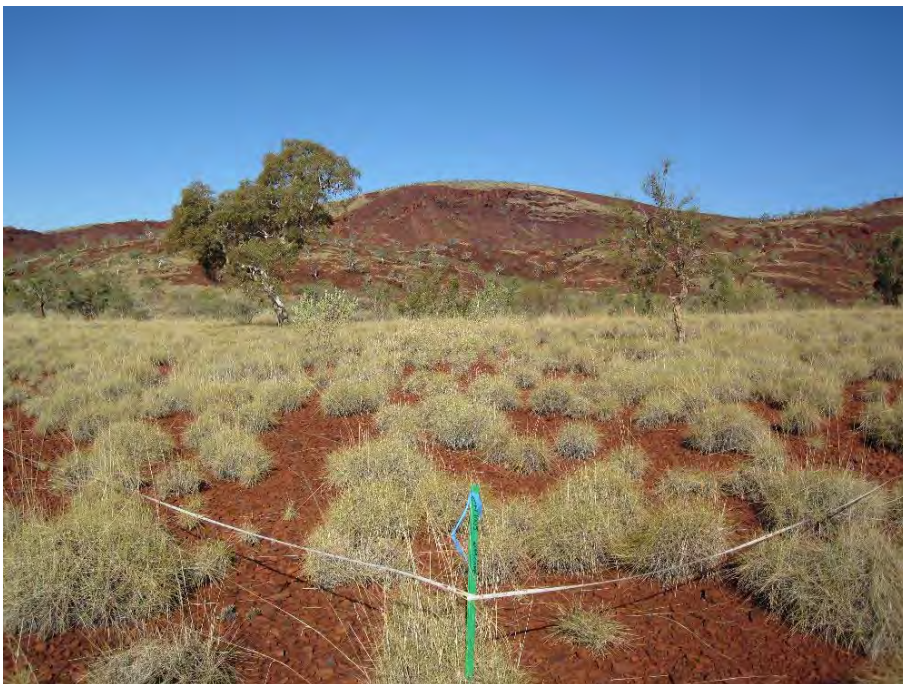
**TwHg: *Triodia wiseana* Hummock Grassland**

**Vegetation type description:** *Triodia wiseana* Hummock Grassland to Mid-dense Hummock Grassland, with emergent *Corymbia deserticola* scattered trees and occasionally *C. hamersleyana* and *Eucalyptus leucophloia* and emergent *Acacia melleodora*, *Hakea chordophylla* and *Senna glutinosa* subsp. *glutinosa* scattered shrubs. Other common species include *Acacia adoxa* var. *adoxo*, *A. elachantha*, *A. retivenea*, *A. tenuissima*, *Cymbopogon ambiguus*, *Dodonaea coriacea*, *Gompholobium* sp. Pilbara (N.F. Norris 908) and *Senna* spp.

U ^*Corymbia deserticola*, ^*C. hamersleyana*, *Eucalyptus leucophloia* subsp. *leucophloia* ^tree\6\r;M ^*melleodora*, *Hakea chordophylla* and *Senna glutinosa* subsp. *glutinosa* ^shrub\4\r;G+ ^*Triodia wiseana* ^hummock grass\1\c

*Triodia wiseana* Hummock Grassland occupied approximately 54.28 ha or 0.5% of the study area (2.53% of the unburnt extent), occurring on lower slopes and low rises in the valley floors in the eastern portion of the study area. The vegetation was assessed as being in Very Good or Excellent condition.

Three quadrats were sampled in this vegetation type (FL1005, FL1013 and FL1048). **Plate 16** and **Plate 17** illustrate *Triodia wiseana* Hummock Grassland.



**Plate 16: *Triodia wiseana* Hummock Grassland (quadrat FL1005)**



Plate 17: *Triodia wiseana* Hummock Grassland (quadrat FL1048)

### 3.2.2 VEGETATION CONDITION

The vegetation condition in the floristic quadrats was recorded using the Trudgen (1991) scale (Table 3).

Vegetation condition varied from Good (in one quadrat), to Very Good (12 quadrats) and Excellent (37 quadrats). The vegetation condition of the quadrats is considered representative of the area in which they are located. Cattle grazing appeared to be largely confined to the valley floors and was most obvious through the valley floor and riparian areas of the western portion of the study area ('Ajax'). In areas other than 'Ajax', grazing does not appear to have been recent and impacts are not apparent. The extent of each vegetation condition is included in Table 5.

Table 5: Extents of areas assessed as each vegetation condition

Condition Rating	Extent (ha)	Proportion (%)
Burnt (not assessed)	8633.24	80.08
Excellent	1958.78	18.17
Very Good	185.84	1.72
Good	3.37	0.03
Poor	0	0
Very Poor	0	0
Degraded	0	0
<b>TOTAL</b>	<b>10781.22</b>	<b>100.00</b>

No vegetation was assessed as Poor, Very Poor or Degraded condition. It is anticipated that at least two years are required to allow vegetation to recover from the fire before further condition

assessments are possible in burnt areas, and impacts of livestock grazing, especially in 'Ajax', become measurable. Livestock grazing in the riparian area appears to be intensive and it is likely that vegetation will not recover fully from the fire as a result.

Tracks and drill pads are also considered to be in Degraded condition as there is no vegetation remaining. These have not been mapped.

### **3.2.3 CONSERVATION SIGNIFICANCE OF VEGETATION**

Discussion in relation to conservation significance of vegetation types within the Blacksmith tenement should be considered as preliminary only, due to the extent of burnt vegetation. Proportions of each vegetation type relate only to unburnt extents, and as vegetation recovers, more accurate mapping and extent calculations will be possible.

#### **3.2.3.1 Threatened or Priority Ecological Communities**

No vegetation similar to any known TECs or PECs were recorded from the study area, and there are expected to be no impacts on nearby TECs or PECs as a result of activities on the Flinders tenement.

#### **3.2.3.2 Other Conservation Significant Vegetation Types**

##### **'Ecosystems at Risk'**

'Ecosystems at Risk' do not have any statutory protection. They were identified by regional ecologists and others as part of the then Department of Conservation and Land Management's (CALM, now DEC) *Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002* (CALM 2002).

The DEC considers 'Hilltop floras, Hamersley Range' as a *vulnerable* 'Ecosystem at Risk' due to frequent fires preventing regeneration and deliberate burning (Kendrick 2002). The resource areas within the Blacksmith tenement are associated with valley floors, therefore future development will have little direct impact on hilltops. However, indirect impacts may include habitat fragmentation, changes to fire regimes and dust.

It is not possible to quantify impacts on different vegetation types at this stage as development plans have not progressed to the stage of identifying locations of infrastructure, although proposed mining areas have been defined.

'All major ephemeral water courses' is also identified as an 'Ecosystem at Risk' in Kendrick (2002). The only major ephemeral water course in the study area is in 'Ajax', which is already threatened by cattle grazing. Buffel grass (*Cenchrus ciliaris*) invasion is a recognised threatening process, however none was observed in 'Ajax' in 2010, although this may have been due to poor seasonal conditions and heavy grazing rather than its general absence. Degradation of the riparian area in 'Ajax' has occurred due to a combination of fire, poor seasonal conditions and heavy grazing.



Other nearby 'Ecosystems at Risk' listed in Kendrick (2002) include 'Valley floor Mulga', and 'Lower slopes Mulga'. No vegetation containing Mulga (*Acacia aneura* sens lat) occurs in the study area and there have been no surveys off-tenement to determine if valley floor mulga occurs downstream from the Flinders tenement. If it does, impacts will be restricted to the effects of changes to surface and subsurface water flow as a result of activities in the study area.

### Other Measures of Vegetation Type Significance

In EPA *Guidance Statement No. 51* (2004), the EPA list several reasons why vegetation may be considered to be significant in addition to its listing as a TEC or PEC or because the extent is below a minimum threshold. These reasons, which may apply at a number of scales but are not defined in detail, include:

- scarcity
- unusual species
- novel combinations of species
- role as a refuge
- role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species
- being representative of the range of a unit (particularly a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extension or isolated outliers of the main range)
- restricted distribution.

The Blacksmith tenement was largely burnt in February 2010. As a consequence, discussions in relation to local significance should be considered as being of a preliminary nature only, as further surveys will change extents of vegetation types and may alter the vegetation type descriptions.

Locally significant vegetation, unless it is a TEC, do not have any form of statutory protection.

Vegetation types that are poorly represented (in this case, defined as <1% of total unburnt area) within the study area and immediate environs may be considered to have local significance (*Acacia maitlandii* Shrubland, *Acacia orthocarpa* (atypical form) Shrubland, *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland, *Corymbia hamersleyana/Eucalyptus gamophylla* Low Woodland, *Eucalyptus victrix* Open Woodland, *Triodia* aff. *melvillei* Hummock Grassland and *Triodia wiseana* Hummock Grassland). Some of these vegetation types are restricted to specific areas (eg *Acacia maitlandii* Shrubland is confined to 'Paragon' and *Acacia orthocarpa* (atypical form) Shrubland is confined to 'Ajax'), landforms or landscape positions (eg *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland, *Corymbia hamersleyana/Eucalyptus gamophylla* Low Woodland and *Eucalyptus victrix* Open Woodland are confined to drainage lines in valley floors or gorges) and occupy only a small proportion of the study area. As such, these vegetation types may be considered to have 'restricted distribution' but do not have any statutory protection.

*Acacia orthocarpa* (atypical form) Shrubland may also be considered as potentially significant due to the characteristic species being an atypical form that does not appear to occur elsewhere. The typical form of this species is widespread, and also occurs on the Blacksmith tenement.

*Eucalyptus gamophylla/Corymbia hamersleyana* Low Woodland, *Eucalyptus leucophloia* Low Open Woodland, *Triodia epactia* Hummock Grassland, *Triodia* aff. *melvillei* Hummock Grassland and *Triodia wiseana* Hummock Grassland are not considered to have specific significance as they are widespread within the study area and represented elsewhere in the Pilbara.

Potentially significant vegetation types are discussed below, in both local and regional contexts.

### ***Acacia maitlandii* Shrubland**

*Acacia maitlandii* Shrubland was recorded from only the north-eastern portion of the tenement, and occupied only 0.83% of the unburnt extent.

Astron Environmental Services (2010) identified two vegetation types with similar characteristics from their reconciliation of vegetation mapping in West Pilbara Iron (WPI) Ore holdings, west of the Blacksmith tenement:

- HBr47 *Eucalyptus leucophloia* scattered low trees over *Acacia maitlandii* open shrubland over *Triodia wiseana*, *T. sp.* Robe River (M.E. Trudgen MET 12,369) open hummock grassland
- HBr44 *Corymbia hamersleyana* scattered low trees over *Acacia maitlandii* high open shrubland over *Triodia wiseana*, *T. sp.* Robe River (M.E. Trudgen MET 12,369) very open hummock grassland.

Astron identified HBr47 as a vegetation association with a High Conservation Risk Rating due to its restricted habitat (mesas), having Priority Listed flora, and its occurrence within the disturbance footprint. Whilst mesas, in the form as on the WPI area, do not occur in the Blacksmith tenement, local mesas were not assessed in this survey due to inaccessibility. No Priority Listed flora were recorded from within this vegetation type, however the restricted extent of *Acacia maitlandii* Shrubland in the Blacksmith tenement indicate that this vegetation type may have local significance due to scarcity and a novel combination of species.

### ***Acacia orthocarpa* (atypical form) Shrubland**

*Acacia orthocarpa* (atypical form) Shrubland was assessed as occupying 1.14% of the study area. Whilst the characteristic species, *Acacia orthocarpa*, is not considered to be threatened, it is possible that the atypical form has some taxonomic significance (see **Section 3.3.3**). *Acacia orthocarpa* has rarely been identified in other nearby surveys (eg Coffey Environments 2010a; Trudgen & Casson 1998), and has only been identified as a characteristic and dominant species in surveys to the west and north (eg the FMG rail corridor from Port Hedland to Cloudbreak, Coffey Environments 2007), and not in a similar floristic combination.

Therefore, due to its restricted extent within the Blacksmith tenement (scarcity), highly localised occurrence (restricted distribution of atypical form and near range extent of species) and lack of similar vegetation recorded from other areas (novel combination of species), *Acacia orthocarpa* (atypical form) Shrubland may be considered to have local significance.

#### ***Corymbia ferriticola/Eucalyptus leucophloia* Low Open Woodland**

*Corymbia ferriticola/Eucalyptus leucophloia* Low Open Woodland was recorded from 0.26% of the unburnt extent of the Blacksmith tenement. It was restricted to gorges and gullies.

Similar vegetation has been recorded from the FMG Solomon area (Coffey Environments 2010b; Ecoscape 2010; ENV Australia 2010) and elsewhere in the Pilbara (eg Trudgen & Casson 1998). However it is restricted to specific landforms (gorges and gullies) and is considered to have local significance due to its restricted distribution. It also has significance due to its role as a refuge for plant and animal species.

#### ***Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland**

*Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland occupied 0.75% of the unburnt extent of the Blacksmith tenement. It was restricted to the floodplain and outwash areas of the main drainage through the 'Ajax' resource area and to a small area in 'Champion', however it is likely that it would have occupied a larger extent in 'Ajax' if the area had not been burnt and the vegetation was able to be mapped. Similar vegetation has been observed elsewhere on similar landforms (eg Ecoscape 2010, in the Firetail mining area), and has not been considered to have local significance.

#### ***Eucalyptus victrix* Open Woodland**

*Eucalyptus victrix* Open Woodland occupied 0.35% of the unburnt extent of the study area. It was associated with the major drainage channel through the 'Ajax' resource area with a small occurrence in the south-east ('Eagle'), however it is likely to have occupied a larger extent if the tenement had not been largely burnt.

Similar vegetation has been recorded from drainage channels throughout much of the Pilbara (eg Astron Environmental Services 2010; ENV Australia 2010; Trudgen & Casson 1998) and have been identified as having conservation significance (eg Ecoscape 2010; Trudgen & Casson 1998) due to their restricted extent.

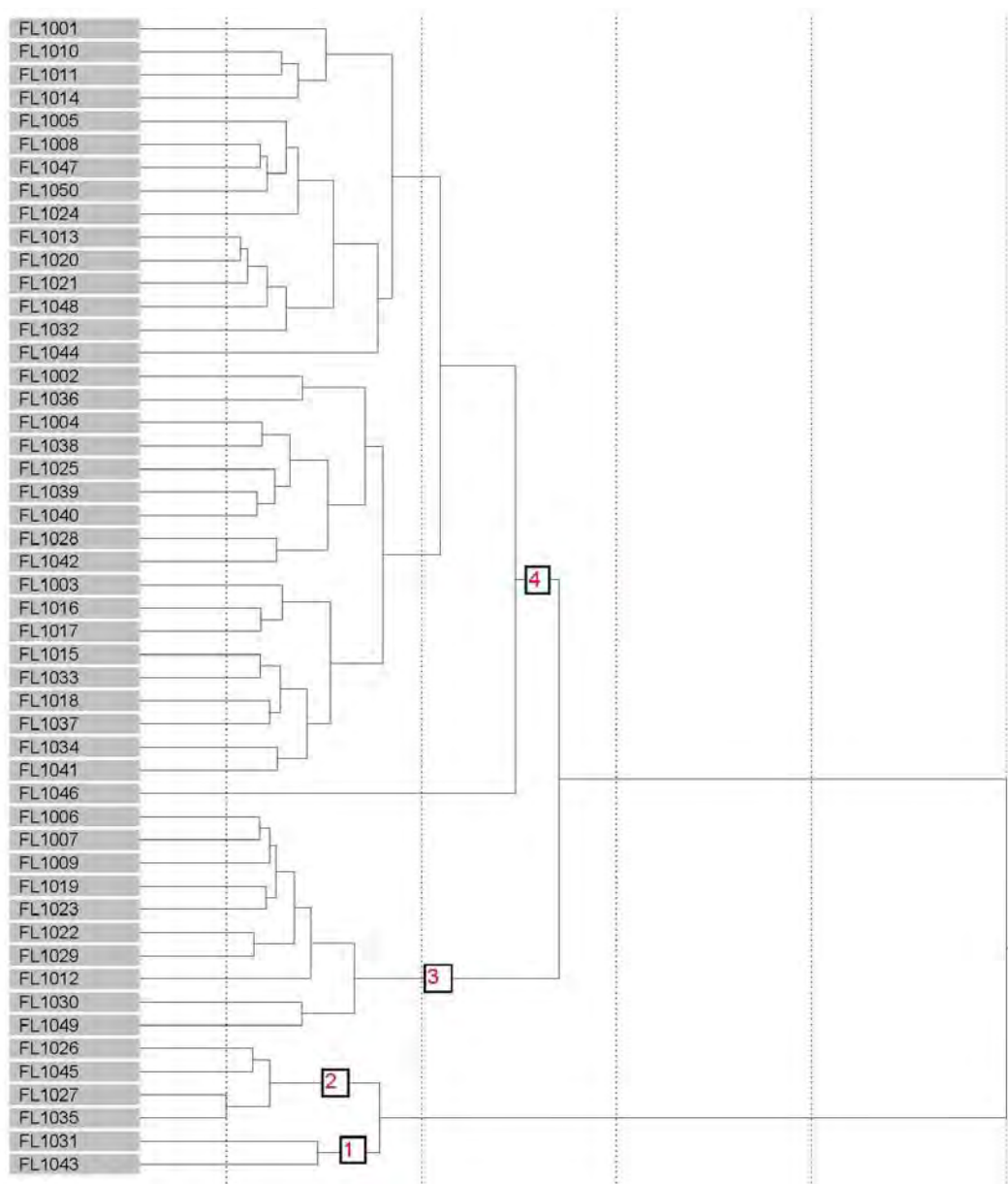
This vegetation type is of local significance due to its restricted distribution and its role as a refuge, largely for fauna as it is associated with riparian areas, including water holes.

### **3.2.4 FLORISTIC ANALYSIS**

#### **3.2.4.1 Study Area Floristic Analysis**

Ecoscape's floristic analysis was conducted using the quadrat data to assist with identifying floristic units within the study area.

The dendrogram from of the analysis is included as **Figure 3**.



**Figure 3: Floristic analysis dendrogram for the study area**

**Figure 3** shows three clear floristic groups.

The most distinctive group is the group of six quadrats located at the bottom of the dendrogram ('1' and '2'). The quadrats included in this group represent the vegetation of the floodplain and outwash areas ('1', corresponding with *Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland) and vegetation of the riparian areas ('2'). Based on dominant species, interpretation of group '2' has determined two vegetation types from this floristic group; *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland (FL1026, FL1027 and FL1035) and *Eucalyptus victrix* Open Woodland (FL1045).

Group '3' represents vegetation from the valley floors, combined to form vegetation type *Eucalyptus gamophylla/Corymbia hamersleyana/E. leucophloia* Low Woodland. Additional quadrats from group '4' have been interpreted as included in this vegetation type based on dominant species, and one quadrat (FL1019) has been interpreted to be included in a different vegetation type based on dominant species, although the quadrat was located on the valley floor and had other species characteristic of *Eucalyptus gamophylla/Corymbia hamersleyana/E. leucophloia* Low Woodland.

Group '4' represents vegetation from slopes, rises and some valley floor areas. A separate analysis was undertaken on this group, however it did not indicate any groups corresponding with dominant or characteristic species and this group has therefore been interpreted as being included in different vegetation types based on the dominant species and dominant stratum. The vegetation types interpreted from this floristic group are:

- woodlands; *Eucalyptus leucophloia* Low Open Woodland occurring on slopes
- shrublands; *Acacia maitlandii* Shrubland on hillsides and occasionally in valleys downslope from hillside occurrences, and *Acacia orthocarpa* (atypical form) Shrubland in 'Ajax' on slopes and undulating valley floors
- grasslands; *Triodia epactia* Hummock Grassland mostly from lower slopes and valley floors, *Triodia* aff. *melvillei* Hummock Grassland from valley floors and rises within valleys, and *Triodia wiseana* Hummock Grassland from slopes.

#### 3.2.4.2 Regional Floristic Analysis

Regional floristic analysis indicated that virtually all of the new sites (quadrats) were floristically similar to the adjacent Fortescue Metals Group (FMG) Serenity Mining Area, within the Central Pilbara Project Area (formerly included in the Solomon Project Area).

Within the dendrogram, the quadrats that were not similar to other nearby sites are either scattered through the dendrogram or clumped together as an individual group.

Interpretation indicates that the clumped group largely includes the same quadrats identified from the study area floristic analysis as groups '1' and '2' that were associated with riparian areas (floodplains, outwash areas, drainage lines and gorges). Regionally, these quadrats have been interpreted, through 'nearest neighbour' analysis, as being most similar to the Griffin and Trudgen 600-group '301', that has been identified from the FMG Solomon Mining area (east of the Blacksmith tenement) and in areas further to the southwest of the Blacksmith tenement.

Three of the scattered quadrats occur on low hill or valley floor rises, and are dominated by *Triodia* aff. *melvillei*, and have been interpreted as belonging in the same vegetation type. Through 'nearest neighbour' analysis these have been interpreted to have the greatest affinity with the three separate 600-groups, two of which ('277' and '300') are known to include *Triodia* aff. *melvillei*. Two of the

600-group are considered to have only local occurrences ('293' and '300'), whereas '277' is known from the FMG Solomon mining area and the Chichester Ranges to the north.

The remaining scattered quadrat (FL1014) is not structurally different to or have characteristically different dominant species than others from valley floors in the study area. 'Nearest neighbour' analysis indicates that it is most similar to 600-group '293', which is the most common floristic group in the Blacksmith tenement, and was previously known only from the FMG Serenity Mining Area immediately adjacent to the Blacksmith tenement.

The regional distribution of the 600-groups (Griffin & Trudgen 2009) inferred from the Blacksmith tenement area:

- '171', known from alluvial and colluvial soils, restricted to the central Hamersley Range where it is considered to be uncommon (FL1043)
- '174', known from alluvial and colluvial soils, restricted to the western and central Hamersley Range where it is considered to be locally moderately common (FL1029, FL1031)
- '277', known from colluvial soil, basalt, Brockman Iron Formation and Pisolite, known from the FMG Solomon mining area and the Chichester Ranges to the north and is considered to be moderately uncommon (FL1044)
- '293', known from colluvium and the Brockman Iron Formation, has a very localised occurrence, being formerly only recorded from the FMG Serenity Mining Area, but is considered to be locally common (13 quadrats)
- '298', known from colluvial soil, has been previously recorded from the FMG Serenity Mining Area and FMG Solomon Project Area, and is considered to be locally common (seven quadrats)
- '299', known from colluvium and the Brockman Iron Formation, has a very localised occurrence, being formerly only recorded from the FMG Serenity Mining Area but is locally moderately common (11 quadrats)
- '300', known from colluvium and the Brockman Iron Formation, has a localised occurrence, being formerly only recorded from the FMG Solomon Project Area where it is considered to be locally moderately common (FL1015, FL1018, FL1033, FL1046)
- '301', also known from the FMG Solomon Project Area and southwest of the Blacksmith tenement (FL1026, FL1027, FL1035, FL1045)
- '321', known from alluvial and colluvial soils and aeolian sand, largely from the adjacent FMG Serenity Mining Area but also scattered further to the east, and is considered to be locally common (seven quadrats).

'Quadrat' FL\_RIP (600-group '257) was accidentally included in the data supplied for the regional floristic analysis. Any interpretation from this 'quadrat' should be disregarded as the data is incomplete due to recent fire.

In general, most floristic groups inferred from the Blacksmith tenement are considered to be regionally restricted to the area close to the tenement. There are few similarities with floristic groups known from areas away from the central Hamersley Range.

### 3.3 Flora Survey

Fifty floristic quadrats were established and recorded in May-June 2010, and reassessed in August 2010 and March 2011. Co-ordinates of the north-west, or nearest equivalent, corner of each quadrat are provided in

**Table 6.** Quadrat details are included in **Appendix Six** and shown in **Map 2, Appendix Five**.

**Table 6: Blacksmith floristic quadrat co-ordinates**

Quadrat	Peg Position	Co-ordinates (GDA 94)		Quadrat	Peg Position	Co-ordinates (GDA 94)	
		mE	mN			mE	mN
FL1001	NW	552929	7550690	FL1026	NW	543646	7552563
FL1002	NW	552736	7551272	FL1027	NW	545943	7550995
FL1003	NW	552100	7551360	FL1028	NW	545794	7551114
FL1004	NW	552618	7551648	FL1029	N	546729	7555427
FL1005	NW	550529	7551527	FL1030	NW	546037	7553764
FL1006	NW	552113	7551703	FL1031	NW	547187	7555490
FL1007	NW	550653	7551357	FL1032	NW	546473	7555271
FL1008	NW	550407	7551905	FL1033	NW	542220	7554810
FL1009	NW	550768	7551888	FL1034	NW	543044	7554621
FL1010	NW	550324	7552724	FL1035	N	543198	7553516
FL1011	NW	551298	7551968	FL1036	NW	542990	7554070
FL1012	NW	549664	7551917	FL1037	NW	536737	7554553
FL1013	NW	551028	7553232	FL1038	NW	536918	7555188
FL1014	NW	551590	7552884	FL1039	NW	536628	7554785
FL1015	NW	550589	7554901	FL1040	NW	537258	7555579
FL1016	NW	551132	7555132	FL1041	NW	537550	7555689
FL1017	NW	550653	7555642	FL1042	NW	540889	7552849
FL1018	NW	551312	7555785	FL1043	NW	539402	7553285
FL1019	NW	550839	7556114	FL1044	NW	540110	7552145
FL1020	NW	551126	7556102	FL1045	NW	540092	7551408
FL1021	NW	550942	7556057	FL1046	NW	538582	7552891
FL1022	NW	545209	7553086	FL1047	NW	553318	7549876
FL1023	NW	544588	7552188	FL1048	NW	553223	7549170
FL1024	NW	546104	7552984	FL1049	NW	550810	7547584
FL1025	NW	543599	7552496	FL1050	NW	550930	7548095

#### 3.3.1 FLORA INVENTORY

The flora inventory, using species recorded from the floristic quadrats in all three surveys and opportunistic observations, is included in **Appendix Seven**. Plant identification was conducted by Trudgen to infrataxa (subspecies, variety or affinity) level where possible. Names were checked against FloraBase (WA Herbarium & DEC 2011) and are listed using current taxonomy or Trudgen's phrase names where there is no traceable equivalent.

Including opportunistic observations, 269 taxa were identified from the Blacksmith tenement from the combined surveys in May-June and August 2010 and March 2011. Of these, 17 were identified only to genus level, three only to family level and one was not able to be identified to any level, totalling approximately 7.8% of specimens. These may represent taxa already included in the inventory but they could not be identified further due to lack of reproductive material.

Forty one identified families and 117 identified genera are represented in the study area. The most commonly represented families are:

- Fabaceae (including the former Mimosaceae, Caesalpiniaceae and Papilionaceae); 61 taxa, although two taxa are not identified to species level and may represent duplication
- Poaceae; 41 taxa, although four taxa are not identified to genus or species level and may represent duplication
- Malvaceae; 36 taxa, although eight taxa are not identified to genus or species level and may represent duplication
- Amaranthaceae; 16 taxa.

The most commonly represented genera are *Acacia* (24 taxa), *Senna* (15 taxa, one of which is not identified to species level and may represent duplication) and *Ptilotus* (10 taxa).

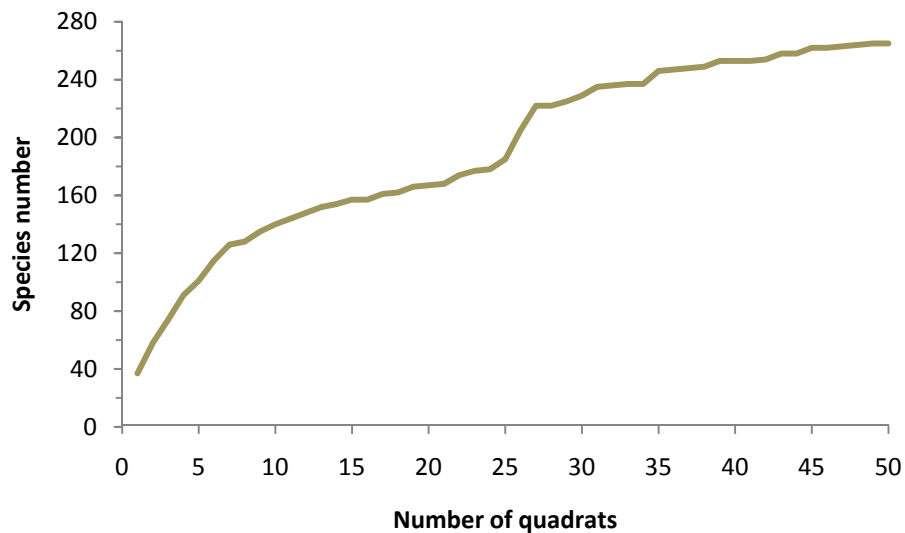
Almost no ephemeral species were recorded in 2010 and many short-lived plants were dead (eg Malvaceae, Solanaceae). However the 2011 survey, which followed above average summer rainfall, recorded significant numbers of additional species, including annual species that were absent in 2010.

### 3.3.2 ADEQUACY OF SAMPLING

The species accumulation curve (**Figure 4**) indicates that the number of quadrats was adequate to collect most species occurring within the unburnt portion of the study area, although a significant proportion (approximately 35%) could not be definitely identified. Further, only six additional species were recorded opportunistically in the study area.

It is anticipated that if there was a larger unburnt extent, especially in the riparian areas of 'Ajax' and in the wide valley floor of 'Eagle', additional species and vegetation types would have been recorded, altering the species accumulation curve. The species accumulation curve would also have been different under better seasonal conditions, when a greater proportion of plants could have been identified as they would have had reproductive material, and more annual and ephemeral species would have been recorded.





**Figure 4: Species accumulation curve**

In terms of sampling representative vegetation, Ecoscape considers that 50 floristic quadrats have adequately sampled the common landforms and vegetation types of the unburnt portion of the study area. Although approximately 80% of the Blacksmith tenement had been recently burnt, sufficient areas remained unburnt to characterise the area. Where possible, at least two quadrats were recorded from each vegetation type and quadrats were spatially distributed throughout the study area. The exceptions were:

- the only major drainage line in the study area that was located in the 'Ajax' resource area within the Platform Land System, which was largely burnt
- the tops of tall hills and mesas, which were largely burnt and/or inaccessible due to the steep topography and many vertical escarpments
- the 'Eagle' resource area, which was almost completely burnt.

Of these, only the lack of sampling of the riparian vegetation of the major drainage line and lack of sampling of the broad valley of 'Eagle' are considered to provide significant limitations to the survey.

Adequacy of sampling can also be assessed using a comparison of the number of taxa recorded per unit area ( $\text{km}^2$ ) in nearby areas. The taxa area curve including the Flinders tenement data (included as both the total area of the tenement and the unburnt area that was assessed) is shown in **Figure 5**, with references listed in **Table 7** (points shown as '0' area did not have the project area listed in the reference).

The graph shows that the Flinders tenement data is within the range of number of species recorded per square kilometre for a number of nearby surveys. The surveys with the highest number of species per square kilometre are linear (rail) surveys that traverse many different land systems and

geological units, and would expect a larger number of species per unit area than surveys conducted in a more regularly shaped survey area.

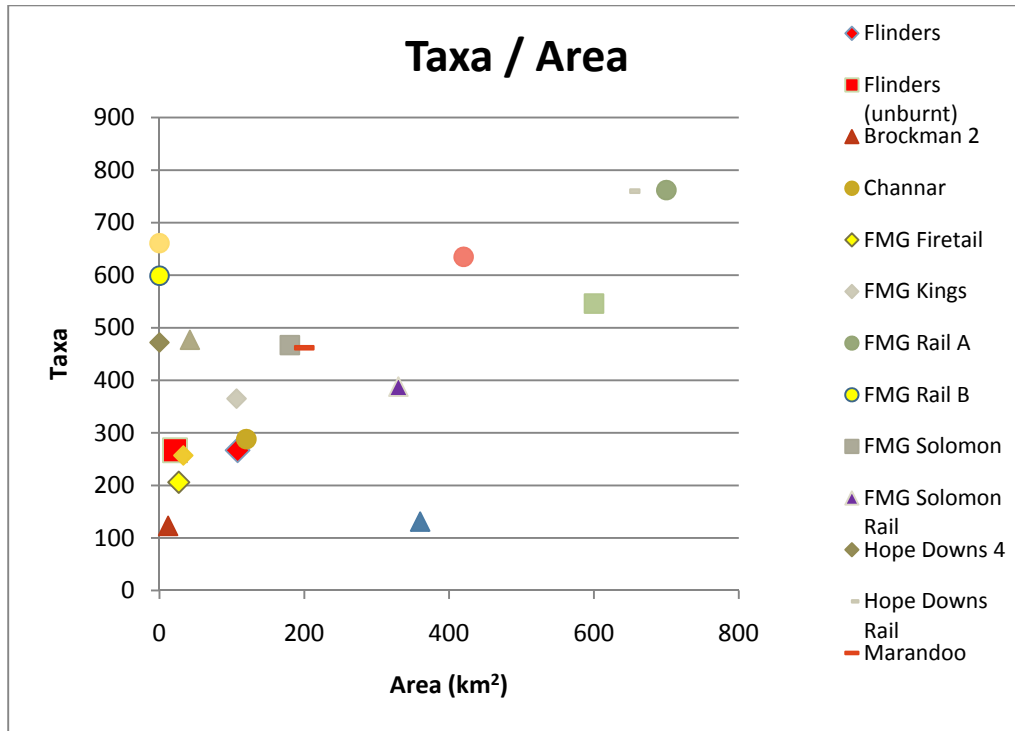


Figure 5: Taxa area curve

**Table 7: Taxa numbers recorded from various Pilbara surveys**

Survey	Area (km <sup>2</sup> )	Taxa	Reference
Flinders (total survey area and unburnt survey area)	107.81/21.48	269	This report
Brockman 2 Detritals	12	123	(Mattiske EM & Associates 1989) in (Coffey Environments 2010b)
Channar Survey Area	120	288	(Mattiske E M & Associates 1986) in (Coffey Environments 2010b)
FMG Firetail	26.7	206	(Ecoscape 2010)
FMG Kings	106.45	365	(ENV Australia 2010)
FMG Stage A Rail Corridor	700	762	(Biota Environmental Sciences 2004a) in (Coffey Environments 2010b)
FMG Stage B Rail Corridor		599	(Biota Environmental Sciences 2004b)
FMG Solomon and Investigator Project Areas	180	467	(Coffey Environments 2010a)
Solomon Rail Project	330	388	(Coffey Environments 2010b)
Hope Downs 4		472	(Mattiske Consulting Pty Ltd 2008)
Hope Downs Rail Corridor	650	760	(Biota Environmental Sciences & Trudgen 2002) in (Coffey Environments 2010b)
Karijini National Park	5000	481	(1991 data, Coffey Environments 2010b)
Marandoo	200	462	(Mattiske EM & Associates 1991) in (Coffey Environments 2010b)
Mesa A & Mesa B	33	257	(Biota Environmental Sciences Pty Ltd 2005)
Port Hedland to Cloudbreak Rail, Borrow Pits & Infrastructure Area	600	546	(Coffey Environments 2007) in (Coffey Environments 2010b)
Roy Hill Borefield	360	131	(G&G Environmental Pty Ltd 2009)
Roy Hill 1	42	477	(Ecologia Environment 2009)
West Angelas Survey Area	420	635	(Trudgen & Casson 1998) in (Coffey Environments 2010b)
West Pilbara Iron Ore Reconciliation		661	(Astron Environmental Services 2010)

### 3.3.3 CONSERVATION SIGNIFICANT FLORA

#### Environmental Protection and Biodiversity Conservation Act 1999

At a Commonwealth level, flora is protected under the Commonwealth *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*. This lists threatened species that are considered Critically Endangered, Endangered, Conservation Dependant, Extinct, or Extinct in the Wild.

No plant taxon recorded in the study area is listed as Threatened pursuant to Schedule 1 of the *EPBC Act (1999)*.

#### Wildlife Conservation Act

The DEC enforces regulations under the Government of Western Australia's *Wildlife Conservation Act (1950)* to conserve DRF and protect significant populations. Rare flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act*, thereby making it an offence to remove or damage rare flora without Ministerial approval, obtained on each occasion for each population.

No plant taxon recorded in the survey is gazetted as a DRF pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act (1950)*.

### Priority Flora

The DEC also maintains a list of flora taxa which are considered to be poorly known, uncommon, or under threat, but for which there is insufficient justification on the basis of known distribution and population sizes to be included on the DRF schedule. These are classified as Priority Flora.

The Priority Flora recorded from the study area are listed below. The coordinates of their locations are included in **Table 8**. Threatened and Priority Flora Report Forms are included in **Appendix Eight**.

**Table 8: Coordinates of Priority Flora species**

Species	Cons. Code	GDA mE	GDA mN
<i>Goodenia nuda</i>	P4	538879	7552705
<i>Goodenia nuda</i>	P4	538977	7552753
<i>Goodenia nuda</i>	P4	543890	7552414
<i>Indigofera</i> sp. Bungaroo Creek	P3	540092	7551408
<i>Indigofera</i> sp. Bungaroo Creek	P3	539402	7553285
<i>Indigofera</i> sp. Bungaroo Creek	P3	543599	7552496
<i>Indigofera</i> sp. Bungaroo Creek	P3	543198	7553516
<i>Indigofera</i> sp. Bungaroo Creek	P3	543044	7554621
<i>Indigofera</i> sp. Bungaroo Creek	P3	545943	7550995
<i>Rhynchosia bungarensis</i>	P4	540103	7551393
<i>Rhynchosia bungarensis</i>	P4	540046	7551480
<i>Rhynchosia bungarensis</i>	P4	543156	7553605
<i>Rhynchosia bungarensis</i>	P4	543197	7553487
<i>Rhynchosia bungarensis</i>	P4	543183	7553481
<i>Rhynchosia bungarensis</i>	P4	540092	7551408
<i>Rhynchosia bungarensis</i>	P4	543198	7553516
<i>Rhynchosia bungarensis</i>	P4	545943	7550995
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	543198	7553516
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	P3	545943	7550995
<i>Sida</i> sp. Barlee Range	P3	543198	7553516

Information on each of the Priority Flora species recorded in the survey area are included below.

Except for *Goodenia nuda*, the preferred habit of the Priority Flora species recorded in the study area is gorges and drainage lines. As these areas were largely burnt, there is a high possibility that these species would also have been found in the burnt area.

#### ***Goodenia nuda* (P4)**

Three individual *Goodenia nuda* (Priority 4) were recorded in the study area, none from within floristic quadrats. Priority 4 species are rare but not threatened (Smith 2010). *Goodenia nuda* is an annual or short-lived (ephemeral) herb, often associated with disturbance. It is considered to be sparsely distributed throughout much of the Pilbara bioregion and into the Little Sandy Desert.

Twenty collections listed on FloraBase (Western Australian Herbarium and DEC 2010) although more are likely to have been identified to DEC through their Threatened and Priority Flora reporting procedures.

It is unlikely that activities in the Flinders tenement will have a significant impact on this species. *Goodenia nuda* has recently been downgraded from the Priority 3 taxa to Priority 4, indicating that DEC considers that it has been adequately surveyed and, whilst rare, is not considered threatened.

#### ***Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (Priority 3 (P3))**

Six individual P3 *Indigofera* sp. Bungaroo Creek were recorded during the surveys all of which were recorded in floristic quadrats.

*Indigofera* sp. Bungaroo Creek is an undescribed species with eight records included on FloraBase (WA Herbarium & DEC 2011). It is described as a tall shrub to 2.3 m high, with red or purple/violet pea flowers, and is found in rocky drainage lines, gorges and on alluvial flats. All records on FloraBase are from the Hamersley Range.

Priority 3 species are considered to be poorly known taxa with several populations, some of which are not currently endangered. They are considered to be in need of further survey (Smith 2010).

It is unlikely that development of the Flinders tenement will have a significant impact on this species, as the targeted ore bodies are generally not associated with gorges or the main drainage line in 'Ajax'.

#### ***Rostellularia adscendens* var. *latifolia* (P3)**

Two P3 *Rostellularia adscendens* var. *latifolia* were recorded in floristic quadrats, both located in gorges.

*Rostellularia adscendens* var. *latifolia* has 12 records listed on FloraBase and is described as a herb or shrub to 0.3 m high, with blue, purple or violet flowers in April-May. It has been recorded from creeks and rocky hills in the Newman and Hamersley Range area, including Karijini National Park, in the Pilbara, and from the north-eastern Pilbara near the Oakover River.

Priority 3 species are considered to be poorly known taxa with several populations, some of which are not currently endangered. They are considered to be in need of further survey (Smith 2010).

It is unlikely that development of the Flinders tenement will have a significant impact on this species, as the targeted ore bodies are generally not associated with gorges.

### ***Sida* sp. Barlee Range (P3)**

One P3 *Sida* sp. Barlee Range was recorded from a floristic quadrat in a gorge.

*Sida* sp. Barlee Range has 21 records listed on FloraBase, from both the Pilbara and Gascoyne bioregions. It is described as a spreading shrub to 0.5 m high, with yellow flower and is usually associated with skeletal soils, often in gorges and gullies.

Priority 3 species are considered to be poorly known taxa with several populations, some of which are not currently endangered. They are considered to be in need of further survey (Smith 2010).

It is unlikely that development of the Flinders tenement will have a significant impact on this species, as the targeted ore bodies are generally not associated with gorges.

### ***Rhynchosia bungarensis* (P4)**

*Rhynchosia bungarensis* (P4) was recorded from eight locations, including three floristic quadrats in gorges and drainage lines. The other records from the study area are from opportunistic searches of small gorges.

*Rhynchosia bungarensis* has 55 records listed on FloraBase from the Carnarvon, Gascoyne and Pilbara bioregions. It is described as a sticky compact prostrate shrub, sometimes as a creeper, to 0.5 m high, with yellow flowers. It is usually associated with gullies and drainage lines.

Priority 4 taxa are considered to have been adequately surveyed, and whilst rare, they are not considered to be under threat (Smith 2010). Development of the Flinders tenement is unlikely to impact on this species because of its relatively wide distribution in Western Australia and its locations, in the study area, that are not associated with the targeted ore bodies.

### **Other Significant Species**

As part of the Coffey Environments (2010a) assessment of the FMG Solomon mining area, expert Pilbara taxonomist Malcolm Trudgen considers *Triodia* aff. *melvillei*, an undescribed species, as being a 'species of scientific interest'. However, it is common in the Hamersley Range.

The most common form, and characteristic dominant shrubland species in parts of 'Ajax', was identified by Malcolm Trudgen and confirmed by Bruce Maslin, who is acknowledged as a taxonomic expert for this genus, as *Acacia orthocarpa*. World Wide Wattle (Shire of Dalwallinu, DEC & CSIRO 2010) describes the typical form of *A. orthocarpa* as slender, diffuse and often weeping, but it is also known to be bushy and low spreading. However, the form of *A. orthocarpa* in 'Ajax' is a tall (up to 1.7 m high) rounded shrub with dense foliage, which is considered to be atypical. The typical wispy form of *A. orthocarpa* was recorded from quadrat FL1004 in 'Delta', therefore we have differentiated between the two forms and considered them to be different taxa. The dense shrub form of *A.*

*orthocarpa* in 'Ajax' is denoted as '*A. orthocarpa* (atypical form)'; the usual form is denoted simply as '*A. orthocarpa*'.

*A. orthocarpa* is on the southern extent of its usual distribution (Shire of Dalwallinu, DEC & CSIRO 2010; WA Herbarium & DEC 2011). The atypical form of this species in 'Ajax' suggests it may have some taxonomic significance although it is unlikely to have conservation significance.

The as yet unidentified *Josephinia* sp. recorded from floristic quadrat FL1027 is considered by Trudgen to be significant as it is either an unidentified species or a range extension.

No other species recorded in the study area have any particular significance.

### 3.3.4 SPECIES RANGE EXTENSIONS

A number of species are not within their usual extents, and are range extensions. These include:

- *Mitrasacme connata*, that is approximately 100 km west of the nearest FloraBase record, although it has also been collected from the Fortescue Metals Group (FMG) Solomon (Central Pilbara) project area, east of the Blacksmith tenement
- *Mnesithea formosa* has largely been collected from the Kimberley, with only two FloraBase records from the Pilbara; the nearest record is approximately 70 km south-east of the Blacksmith tenement, although it, too, has also been collected from the FMG Solomon (Central Pilbara) project area
- *Polycarpea involucreta* is approximately 230 km south-west of the nearest FloraBase record.

### 3.3.5 INTRODUCED FLORA

No introduced flora species were recorded during the 2010 surveys, however the following species were recorded during the 2011 surveys:

- *Bidens pinnata*, from nine quadrats
- *Cenchrus ciliata*, from one quadrat
- *Cucumis melo* subsp. *agrestis*, from eight quadrats
- *Portulaca oleracea*, from one quadrat
- *Sigesbeckia orientalis*, from one quadrat.

According to the DEC *Pilbara Region – Environmental Weed List* (DEC 2011), none of the introduced species have *high* ecological impact. The ratings of each introduced species for potential and current distribution, ecological impact, invasiveness and feasibility of control is included in **Table 9**.

Introduced species have also been ranked according to the *Environmental Weed Strategy of Western Australia (EWSWA)* (Department of Conservation and Land Management 1999). Of the introduced species recorded from the Blacksmith tenement, only *Cenchrus ciliaris* has a high risk rating in Western Australia. Introduced species (weeds) identified as *high* risk are those that have the ability to invade bushland in Good to Excellent condition, have a wide current or potential distribution, and

have the ability to change the structure, composition and function of an ecosystem, in particular to form a monoculture.

*Cucumis melo* subsp. *agrestis* is not included in the *Pilbara Region – Environmental Weed List*, and is not rated in the *EWSWA*.

None of the introduced species are listed as *Declared Plants* under the Government of Western Australia’s *Agriculture and Related Resources Protection (ARRP) Act (1976)*, nor as *Weeds of National Significance* (Weeds Australia 2008).

Whilst it is generally not feasible to control introduced species on a broad scale, localised control along roads and around infrastructure should be considered as a high priority. Preventing spread of introduced species should also be considered a high priority.

**Table 9: Weed ratings (DEC Department of Conservation and Land Management 1999; DEC 2011)**

Species	Potential Distribution	Current Distribution	Ecological Impact	Invasiveness	Feasibility of Control	EWSWA Risk Rating
<i>Bidens pinnata</i>	H	H		R	L	Unrated
<i>Cenchrus ciliata</i>	H	L	M	R	L	High
<i>Portulaca oleracea</i>			L			Low
<i>Sigesbeckia orientalis</i>	M	M	U	R-M	L	Moderate

**Table 9** legend descriptors:

Potential Distribution: area of potential habitat in the Region that could be occupied or the area at risk of invasion by the weed. H = high, M = moderate.

Current Distribution: Area of habitat in the Region currently occupied by the weed. H = high, M = moderate, L = limited (localised).

Ecological Impact: Impact of species within the Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure, composition and function of ecosystems). L = low impact species, M = medium impact species, U = unknown.

Invasiveness: Rate of spread of a weed in native vegetation, encompassing factors of establishment, reproduction (time to seeding, seed production, vegetative reproduction) and dispersal (wind, water, flying animals, ground animals, deliberate human spread, accidental human spread, vehicles, produce contaminant). M = moderate, R = rapid.

Feasibility of Control: The longer a coordinated control program takes to achieve its desired goal, the more expensive and less feasible it becomes. Key factors to consider include how widespread a



weed is, ease of finding infestations, cost of controlling infestations, difficulty of limiting the weed's dispersal, willingness of landholders and governments to control the weed, and commercial use of the plant. L = low feasibility infestation.

EWSWA: Introduced species are scored on their invasiveness, distribution and environmental impacts, and are rated as *high* (scoring 'yes' for all three criteria), *moderate* (scoring 'yes' for two criteria), *mild* (scoring 'yes' for one criteria) and *low* (scoring none of the criteria), indicating priority of control.

Note: *Cucumis melo* subsp. *agrestis* is not included in the *Pilbara Region – Environmental Weed List*, and is not rated in the EWSWA.

### 3.1 Botanical Limitations

**Table 10: Statement of Botanical Limitations**

Possible Limitations	Constraints (Yes/No); Significant, Moderate or Negligible	Comments
Competency/experience of the consultant botanist	No constraints	Lead field survey staff have relevant recent experience surveying in the Pilbara region. Most plants were identified by Malcolm Trudgen.
Proportion of the flora identified	Negligible	269 taxa were identified from the surveys, with only 21 (7.8%) of these not identifiable to species level, with none likely to be DRF or Priority-listed species.
Sources of information (historic/recent or new data)	Negligible	Adequate information was available from previous surveys.
Proportion of the task achieved and further work that may need to be undertaken	Moderate – Significant	The resource and access areas were adequately surveyed, with 50 floristic quadrats assessed (approximately 0.46 quadrats per square kilometre in the tenement, but 2.33 quadrats per km <sup>2</sup> in the unburnt area). Approximately 80% of the tenement was burnt in early 2010 and provided significant constraints on vegetation mapping, however there were sufficient unburnt areas to characterise the flora and vegetation, except the major drainage line (riparian area) through the 'Ajax' resource area that was the only representative of this landform/vegetation type, and the wide valley floor of 'Eagle' that is anticipated to have had different shrubland vegetation types.
Timing/weather/season/cycle	Negligible	The timing of the field surveys and weather during the surveys were optimal to identify plant species. Seasonal conditions in 2010 were poor, however conditions were considered good in March 2011.
Intensity of survey	Negligible	The study area was surveyed at sufficient intensity to describe the flora and vegetation in most areas.
Completeness (eg was relevant area fully surveyed)	Moderate	The resource areas were adequately surveyed, except for the riparian area in the 'Ajax' that was largely burnt. Additional surveys will be required to adequately characterise and map the burnt areas.
Resources (eg degree of expertise available for plant identification)	Negligible	Sufficient resources were available, including the assistance of Malcolm Trudgen for plant identification.
Remoteness and/or access problems	Negligible	The resource areas were readily accessible.
Availability of contextual (eg bioregional) information for the study area	Negligible	Adequate information was available.

## 4.0 impact assessment

### 4.1 Conservation Significant Flora Species

Five Priority Listed flora species, *Goodenia nuda* (Priority 4), *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3) and *Rhynchosia bungarensis* (P4), were identified from the Blacksmith tenement. *Goodenia nuda* was identified in scattered locations in the study area; this species is not considered to be threatened. The other species were associated with drainage lines (gorges and riparian areas).

Recent exploration has delineated the ore-bodies in the tenement and determined that there is little overlap between the ore bodies and the locations of these Priority Listed flora. It is unlikely that future activities in the Blacksmith tenement will have a significant impact on the known populations of these species within the tenement and overall. Except for *Goodenia nuda*, which is found in scattered locations and not considered threatened, future activities are unlikely to have a significant impact on the known habitat of these species.

Due to approximately 80% of the study area having been recently burnt, it is highly likely that there are greater numbers of the recorded Priority Listed species in the Blacksmith tenement. However, the preferred habitat of most of these species (gorges and riparian areas) are not likely to be highly impacted by proposed mining activities.

It is also possible that there are other Priority Listed flora species occurring within the study area that were not recorded as a result of recent fire. Priority 3 species are considered to be poorly known and Priority 4 species are not considered threatened, however Priority 1 and Priority 2 species have higher conservation significance. Review of the results of the DEC database search request indicates the following P1 and P2 species are known from within 50 km of the Blacksmith tenement. These species, and their known habitat, are:

- *Brachyscome* sp. Wanna Munna Flats (S. van Leeuwen 4662) (P1), recorded from clay flats and clay pans in the Pilbara (10 records listed on FloraBase (WA Herbarium & DEC Western Australian Herbarium & Department of Environment and Conservation 2010))
- *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P1), recorded as occurring on clay and calcrete soil in the Pilbara, mostly near Newman (14 records on FloraBase)
- *Helichrysum oligochaetum* (P1), recorded as occurring on clay soils and rocky creeks on alluvial plains in the Pilbara, Gascoyne and Carnarvon bioregions (seven records on FloraBase)
- *Scaevola* sp. Hamersley Range basalts (S. van Leeuwen 3675) (P2), recorded from hilltops in the Hamersley Range (four records on FloraBase)

- *Sida* sp. Hamersley Range (K. Newbey 10692) (P1), recorded from cliffs, gorges and steep slopes in the Hamersley Range (six records on FloraBase)
- *Spartothamnella puberula* (P2), recorded from gorges and gullies in the Hamersley Range and also near Mt Gibson in the south-west (10 records on FloraBase).

Two DRF species are also known from within 50 km of the Blacksmith tenement. These, and their known habitats, are:

- *Lepidium catapycnon*, recorded from skeletal soils mainly high in the landscape in the Pilbara (12 records on FloraBase)
- *Thryptomene wittweri*, recorded from upper slopes in the Hamersley Range and also from Mt Augustus in the Gascoyne bioregion and in the Little Sandy Desert bioregion (eight records on FloraBase).

Most of the DRF, P1 and P2 species are found on clay soils, which do not occur in the Blacksmith tenement, or from high in the landscape or gorges and gullies, which are not included in the resource area.

Whilst it is unlikely that DRF, P1 or P2 species occur in the resource areas, there is potential that they occur in areas where infrastructure may be located. Targeted searches for these species should be conducted when potential infrastructure areas are identified.

## 4.2 Conservation Significant Vegetation Types

### 4.2.1 TECS AND PECS

No vegetation types listed as TECs by the Commonwealth or State governments, or PECs were identified from the study area.

Further clearing of the study area is unlikely to impact on any TECs or PECs, as the surface and sub-surface drainage from the Blacksmith tenement is to the north towards the Fortescue River. The known TEC '*Themeda* grasslands on cracking clays (Hamersley Station, Pilbara)' is to the south, and the known PEC 'Plant Assemblages of the Wona Land System' is on the northern side of the Fortescue Valley and upstream of the Blacksmith tenement.

### 4.2.2 'ECOSYSTEMS AT RISK'

The DEC considers 'Hilltop floras, Hamersley Range' as a *vulnerable* 'Ecosystem at Risk' due to frequent fires preventing regeneration and deliberate burning. As the resource areas within the Blacksmith tenement are associated with valley floors, future development will have little direct impact on hilltops. However, indirect impacts may include habitat fragmentation, changes to fire regimes and dust.

'All major ephemeral water courses' is also identified as an 'Ecosystem at Risk' in Kendrick (2002). The only major ephemeral water course in the study area is in 'Ajax', which is already threatened by cattle grazing. However, there has been little in the way of iron ore resources identified from the 'Ajax' riparian area, thus little risk of large-scale disturbance from proposed mining activities. However there is a risk to this ecosystem from infrastructure development.

Other nearby 'Ecosystems at Risk' listed in Kendrick (2002) include 'Valley floor Mulga', and 'Lower slopes Mulga' that do not occur in the Flinders tenement. Impacts are likely to be restricted to the effects of changes to downstream surface and subsurface water flow as a result of activities in the study area.

However, 'Ecosystems at Risk' have no statutory protection.

#### **4.2.3 POORLY REPRESENTED VEGETATION TYPES**

Vegetation types that are poorly represented (<1% of total unburnt area) within the study area and immediate environs or poorly represented nearby may be considered to have local significance. These vegetation types are restricted to specific landforms or landscape positions and occupy only a small proportion of the study area, but do not have any statutory protection,. However further surveys after sufficient time has passed for the vegetation to have recovered from fire will be required to more accurately determine local representation of vegetation types.

Vegetation types within the study area that may have local significance are discussed below.

##### ***Acacia maitlandii* Shrubland**

*Acacia maitlandii* Shrubland was identified from the north-eastern portion of the tenement and occupied <1% of the unburnt extent. It has been observed to occupy a similar proportion on nearby tenements and similar vegetation has been identified as having a High Conservation Risk (Astron Environmental Services 2010). Therefore it is likely that this vegetation type has local conservation significance.

##### ***Acacia orthocarpa* (atypical form) Shrubland**

*Acacia orthocarpa* (atypical form) Shrubland was assessed as occupying 1.14% of the unburnt extent of the tenement. It was confined to the 'Ajax' area on rocky hills and rises, and the vegetation type is not floristically similar to other vegetation types described in other Pilbara surveys. Therefore it is possible that this vegetation type is unique to the area, and therefore has local conservation significance.

##### ***Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland**

*Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland was recorded from 0.26% of the unburnt extent of the Blacksmith tenement, where it was restricted to gorges and gullies. Other

Pilbara flora surveys have identified similar vegetation as having local conservation significance due to its restricted extent.

#### ***Eucalyptus victrix* Open Woodland**

*Eucalyptus victrix* Open Woodland occupied 0.35% of the unburnt extent of the study area and was associated with the major drainage channel through the 'Ajax' resource area and a small area in 'Eagle'. However it is likely to have occupied a greater extent if the tenement had not been largely burnt. It has been identified as having conservation significance in other areas of the Pilbara (eg Astron Environmental Services 2010; ENV Australia 2010; Trudgen & Casson 1998) due to its restricted extent, and is considered likewise in the Flinders tenement.

#### **4.2.4 POORLY REPRESENTED FLORISTIC UNITS**

Similarly, vegetation types that are considered to be poorly represented on a regional scale, including those identified by the regional floristic analysis conducted by Griffin and Trudgen (**Appendix Nine**), also do not have legislative protection.

Almost all of the floristic groups inferred from the regional floristic analysis as occurring on the Blacksmith tenement have distributions restricted to the central Hamersley Range, however most floristic units are locally common or locally moderately common.

#### **4.2.5 VEGETATION TYPE CONCLUSIONS**

The vegetation types listed above *Acacia maitlandii* Shrubland, *Acacia orthocarpa* (atypical form) Shrubland, *Corymbia ferritcola/Eucalyptus leucophloia* Low Open Woodland, *Corymbia hamersleyana/Eucalyptus gamophylla* Low Open Woodland, and *Eucalyptus victrix* Open Woodland are considered to have local conservation significance due to either their small local extent or localised occurrence, being restricted to specific landforms that occupy only a small proportion of the area, no similar vegetation being recorded in other Pilbara surveys, or their extent occurring in areas under threat of mining. Although *Acacia orthocarpa* (atypical form) Shrubland is considered to have the highest conservation significance due to a combination of these factors, it is unlikely to be impacted by mining.

Floristic analysis conducted using the quadrat data identified that the valley floor vegetation type *Eucalyptus gamophylla/Corymbia hamersleyana* Low Woodland is likely to consist of several different floristic units/vegetation types that would have been definable if less area had been burnt and more quadrats assessed, although it is unlikely that any of these would have any particular conservation significance.

Regional floristic analysis has determined that most floristic units are restricted to the central Hamersley Range, however most are locally common or moderately common.

### 4.3 Vegetation Condition

Human impacts affecting vegetation condition include tracks and drill pads and cattle grazing.

Tracks and drill pads were often close together. The impacts of tracks and drill pads are intensive, completely removing native vegetation, but are local in nature, however it was not possible to accurately map the extent of this clearing. There was no indication of weed invasion resulting from this form of soil disturbance.

It is not possible to accurately determine the full extent of clearing due to tracks and drill pads, however it is estimated that less than 0.5% has been cleared.

Grazing cattle, tracks, dung and grazed plants were observed in the riparian area within the 'Ajax' resource area. Cattle grazing was associated with trampling of vegetation and damage to individual plants (including some grazing of *Gossypium* spp. *Acacia pyrifolia*, *Triodia* aff. *epactia* and *Poaceae* spp.).

Cattle grazing was only observed in this small area, estimated as less than 1% of the study area, therefore the impact is considered to be low. Even if grazing was more widespread than observed, the impact would be lower than clearing as grazing does not completely remove vegetation.

Fire can also be considered a form of disturbance impacting on vegetation condition, however fire is a natural occurrence, usually as a result of lightning strikes. Approximately 80% of the study area was burnt in this manner in early 2010. Despite the large extent of burnt lands, the impact on vegetation and flora is, in the long term, unlikely to be significant. The impact is also not caused by human activities.

### 4.4 Introduced Species

Five introduced species, *Bidens pinnata*, *Cenchrus ciliata*, *Cucumis melo* subsp. *agrestis*, *Portulaca oleracea* and *Sigesbeckia orientalis*, were observed in the study area during the surveys.

Buffel Grass *Cenchrus ciliaris*, were also observed close to the study area in areas of heavy cattle grazing, however due to heavy grazing in 2010 its presence in the riparian areas may have been overlooked. It is considered likely that low levels of Buffel Grass probably occur in the riparian area of 'Ajax' and possibly also in 'Champion'. However, Buffel Grass is unlikely to have been introduced or spread to new areas as a result of Flinders Mines exploration activities.

However, there is potential to introduce weeds in soil used for road works and Flinders Mines should endeavour to avoid spread of soil from areas with Buffel Grass or other introduced species.

## 4.5 Potential Environmental Impacts to Vegetation and Flora

### 4.5.1 CLEARING OF VEGETATION

Clearing significant areas of vegetation and loss of associated flora is typically the most substantial impact of mining and associated infrastructure.

DRF species have statutory protection under the *Wildlife Conservation Act* (Government of Western Australia 1950), and must not be cleared. Priority-listed species do not have statutory protection, however it is usually expected that developments should demonstrate that impacts on Priority 1 and Priority 2-listed species have been minimised.

No DRF, Priority 1 or Priority 2 flora species were recorded from the Blacksmith tenement study area.

No TECs or PECs are expected to be impacted by development of the Blacksmith tenement.

Locally significant vegetation types are expected to be impacted, however none of the characteristic species of these vegetation types have conservation significance, although P4 species *Rhynchosia bungarensis* was a common component in *Eucalyptus victrix* Open Woodland.

The only major riparian areas supporting *Eucalyptus victrix* (and possibly *Eucalyptus camaldulensis*) were in the 'Ajax' resource area. Impacts on riparian areas include changes to flow volume and turbidity, which may be transported downstream or into riparian areas downstream but not in the mining area.

Riparian areas have particularly high environmental importance, with riparian vegetation known to support a high level of species diversity (eg Matiske 2005). They are also likely to provide a valuable habitat and food source for fauna species, and assist in stabilising soil during times of high rainfall and subsequent flooding. Thus riparian areas play an important role in ecosystem function.

Recommendations:

- where possible, minimise clearing in locally significant vegetation types
- where possible, avoid or minimise clearing in and near riparian areas.

### 4.5.2 DUST

Dust from excavation, construction and vehicle movement has the potential to block the stomata of adjacent plants leading to the inability to exchange gases and subsequent loss of vigour or death. The lack of rainfall and its sporadic nature typical of the Pilbara, also limits the opportunities for natural 'washing' of dust from the leaf surfaces.

As well as smothering plants, dust is nutrient-rich in comparison with natural soils and build-up can lead to situations where weed invasion is favoured over native species.



Recommendation:

- implement appropriate dust suppression techniques to minimise this impact.

#### **4.5.3 BUSHFIRES**

Bushfires caused by lightning strike are a common natural occurrence in the Pilbara, with 20-30 thunderstorms per annum common for the region (BoM2009).

Bushfires can also be caused by human activities including misuse of electricity, deliberate or accidental activities including welding, grinding, smoking or deliberate burning, spontaneous combustion and mechanical friction (Environ Australia Pty Ltd 2005).

Whilst fire is a natural occurrence, environmental damage can occur if fire is too frequent, too hot or associated with other forms of disturbance (eg grazing or partial clearing). Recently burnt areas carry less flammable vegetation and act as firebreaks between areas that have not been recently burnt. However it is also important to not burn the vegetation at too frequent intervals as many plant species may not have the opportunity to set seed if burnt too frequently. Therefore frequent fire may change the vegetation composition. The situation also applies, with infrequent fire favouring long-lived perennial species (eg *Triodia* spp.) to the detriment of short-lived species (although they are likely to be present in the seed bank). Infrequent fires also increase the fuel loads, leading to more intensive fires that may kill species adapted to less intensive fires (eg some *Triodia* tussocks, some individual eucalypts), as well as having detrimental impacts on fauna species.

Therefore it is important to prevent bushfires not caused by natural conditions. The risk of fire resulting from human activities can be minimised by implementing fire prevention protocols such as:

- appropriate isolation of flammable compounds and explosives
- implementation of a hot work permit
- localised clearing around working plant
- enforcement of responsible smoking practices such as appropriate discarding of cigarette butts.

#### **4.5.4 INTRODUCTION OF WEEDS**

Increased vehicular traffic, combined with increased ground disturbance and disposal of water from drilling and domestic operations provide the opportunity for the spread and establishment of environmental weed species. Soil stockpiles also provide an opportunity for weed invasion.

Appropriate weed hygiene and management measures should be implemented to prevent weed invasion and the displacement of native vegetation, including:

- reducing soil movement, especially in areas that are likely to have weeds including riparian areas and areas of heavy livestock grazing
- cleaning machinery before moving to new locations.

#### 4.5.5 ALTERATION OF WATER REGIME

Changes in water regimes resulting from water extraction and reinjection, reduced surface/sheet flows from infrastructure, and diversions of water flow from or into existing creek beds has the potential to impact on the viability and composition of native vegetation. Where water flows are likely to be modified, modelling should be undertaken to evaluate the placement of infrastructure in terms of minimising impact.

Vegetation monitoring sites should also be established in areas mostly likely to be impacted by alterations to groundwater levels and changes to surface water flows, including in areas where groundwater dependent vegetation occur.

*Eucalyptus victrix* is considered to be at least partly groundwater dependent (ie it is a facultative phreatophyte) (eg Astron Environmental Services 2008; Maunsell Australia Pty Ltd 2006). Therefore any changes to groundwater have potential to impact on this species and the vegetation type in which it occurs (*Eucalyptus victrix* Open Woodland).

There was a *Melaleuca* species recorded in the riparian area of 'Ajax', although it was not possible to identify the species due to lack of reproductive material as a result of being burnt. *Melaleuca* species have a complex pattern of water use, eg *Melaleuca argentea* is at least partly phreatophytic (eg Astron Environmental Services 2008) or almost entirely dependent on surface or near surface water (Grierson 2010). Whilst it is unlikely that the *Melaleuca* observed in 'Ajax' is this species, it may occur in the Flinders tenement as it has been recorded in similar areas nearby (eg Coffey Environments 2010b; ENV Australia 2010).

*Melaleuca argentea* is well-studied in relation to other *Melaleuca* species, however it is likely that other *Melaleuca* species have a similarly complex pattern of water use. Therefore, any changes to surface or groundwater also have potential to impact on this genus, which although not included as a characteristic species during this survey, is likely to be characteristic of at least some parts of the riparian area that could not be assessed due to fire. Thus, changes to surface water flows or groundwater have potential to impact on other, as yet unidentified, vegetation types.

Additionally, ephemeral water courses are identified as being an 'Ecosystem at Risk', and impacts on riparian areas should be reduced where possible.

There is also potential to impact on downstream vegetation types, including 'Ecosystems at Risk' Mulga vegetation types.

Wherever possible, changes to surface water flow should be minimised. Roads should not be located in valley floors where they may impede flow or add sediment to the stream and any drainage channel should not be obstructed or, if possible, not diverted.

Recommendations to reduce impacts on natural water regimes include:

- undertake modelling of impacts of infrastructure locations to understand impacts of changes to surface and groundwater flows, in order to select locations with the least impact
- avoid locating infrastructure including roads in riparian areas, including minor streams
- avoid impeding natural stream flow.

#### 4.5.6 SUMMARY OF ENVIROMENTAL IMPACTS AND RECOMMENDATIONS

The potential impacts on flora and vegetation and recommendations to reduce these are listed in **Table 11**.

**Table 11: Summary of environmental impacts and recommendations**

Process	Potential Environmental Impacts	Recommendations
Vegetation clearing	Clearing of locally significant vegetation types	Where possible minimise clearing in these areas
	Changes to flow volume and stream turbidity	Minimise clearing in and near riparian areas
Excavation, construction and vehicle movement	Dust	Implement appropriate dust suppression techniques
Accidental or deliberate burning	Bushfire	Isolate flammable compounds and explosives Localised clearing around working plant (firebreaks) Enforce responsible smoking practises
Soil movement	Introduction of weeds	Reduce soil movement Clean machinery before moving to new areas
Infrastructure locations	Alteration of water regime	Undertake modeling of impacts of infrastructure positioning on ground and surface water to assist with site selection Avoid locating infrastructure, including roads, in riparian areas, including minor streams Avoid impeding natural stream flow

#### 4.6 Recommendations for Future Surveys

Additional surveys, conducted in 2013 or later, are recommended for the riparian areas of 'Ajax' and in 'Eagle' as the vegetation is likely to be different to other areas within the Blacksmith tenement. Surveys may be a requirement if these areas are included in resource or infrastructure areas.

Targeted conservation significant flora surveys should be conducted in areas identified for infrastructure, particularly if they are high in the landscape (ie upper slopes or hilltops), in or close to riparian areas, or in areas burnt in 2010.

Additional vegetation mapping, conducted as a Level 1 flora and vegetation survey, should be conducted over the remainder of the tenement when it has recovered from fire. A Level 1 survey is considered as a reconnaissance survey and is generally conducted to target areas for Level 2 surveys or, as in this case, when additional information is required but the areas is generally considered to have been adequately surveyed for most purposes.

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appendix one: desktop assessment



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**FLINDERS MINES LIMITED**

# **Pilbara Iron Ore Project**

## **Preliminary Desktop Environmental Study at E47/882 (Blacksmith)**

201000-00501-0000-EN-REP-0001

18-Mar-10

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PILBARA IRON ORE PROJECT  
PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)**

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## SYNOPSIS

A preliminary study of the natural and social environment at mineral exploration tenement E47/882 (Blacksmith) located approximately 70 km north-north-west of Tom Price and 160 km east-southeast of the Pannawonica township in the Pilbara region of Western Australia.

### Disclaimer

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### PROJECT 201000-00501 - PILBARA IRON ORE PROJECT

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REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	<i>D Page</i> D Page B Morna	<i>pp PA</i> R Anderson M Anderson	N/A	26-Nov-09	N/A	
B	Issued for Client Review	<i>B Morna</i> B Morna	<i>pp PA</i> R Anderson	<i>M Anderson</i> M Anderson	1-Dec-09		N/A
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**LIST OF ACRONYMS AND ABBREVIATIONS**

BOM	Bureau of Meteorology (Commonwealth)
BID	Bedded Iron Deposit
CID	Channel Iron Deposit
DEC	Department of Environment and Conservation (WA)
DEWHA	Department of the Environment, Heritage, Water and the Arts (Commonwealth)
DMP	Department of Mines and Petroleum (WA)
DRF	Declared Rare Flora
FMS	Flinders Mines Limited
EPA	Environmental Protection Authority (WA)
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
IBRA	Interim Biogeographic Regionalisation for Australia
NTA	<i>Native Title Act 1993 (Commonwealth)</i>
PEC	Potential Ecological Community
SRE	Short Range Endemic species
TEC	Threatened Ecological Community
WA Act	<i>Wildlife Conservation Act 1950 (WA)</i>



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## 1. INTRODUCTION

Flinders Mines Limited (FMS) has commissioned WorleyParsons Services Pty Ltd to complete a preliminary study of the natural and social environment at mineral exploration tenement E47/882. The tenement, named Blacksmith (and herein as the 'site'), is approximately 70 km north-north-west of Tom Price in the Pilbara region of Western Australia.

Figure 1 shows the site location.

The study comprises a search and review of published, publicly available information on:

- environmental reporting for nearby relevant projects; and
- regional surveys, database and online mapping tools for environmental and social factors.

The principal information sources include:

- Commonwealth Department of the Environment, Water, Heritage and the Arts;
- Department of Environment and Conservation;
- Department of Mines and Petroleum;
- Department of Indigenous Affairs; and
- Environmental Assessment reports from stakeholders surrounding the project area.

### 1.1 Related Environmental Legislation

- *Agriculture and Related Resources Protection Act 1976* (WA);
- *Aboriginal Heritage Act 1972* and Regulations 1974 (WA);
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth);
- *Environmental Protection Act 1986* (WA);
- *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth);
- Environmental Protection Regulations 1987 (WA);
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA);
- *Heritage of Western Australia Act 1990* (WA);
- *Mining Act 1978* (WA);
- *Native Title Act 1993* (Commonwealth);



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- *Native Title (State Provision) Act 1999 (WA);*
- *Rights in Water and Irrigation Act 1914 (WA);*
- *Wildlife Conservation Act 1950 (WA);*
- *Wildlife Conservation Regulations 1970 (WA);*
- *Wildlife Conservation (Rare Flora) Notice 2008 (WA); and*
- *Wildlife Conservation (Specially Protected Fauna) Notice 2008 (WA).*

## **1.2 State Policies**

The Environmental Protection Authority (EPA) has released the following Guidance and Position Statements which offer advice and the overarching principals used to assess proposals:

- Guidance Statement 41: Assessment of Aboriginal heritage;
- Guidance Statement 51: Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia;
- Guidance Statement 54: Consideration of subterranean fauna in groundwater and caves during environmental impact assessment in Western Australia;
- Guidance Statement 55: Implementing best practice in proposals submitted to the environmental impact assessment process;
- Guidance Statement 56: Terrestrial fauna surveys for environmental impact assessment in Western Australia;
- Position Statement 2: Environmental protection of native vegetation in Western Australia;
- Position Statement 3: Terrestrial biological surveys as an element of biodiversity protection;
- Position Statement 8: Environmental protection in natural resource management; and
- Position Statement 9: Environmental offsets.

The Department of Environment and Conservation (DEC) has released the following Policy Statements which indicate the overarching principals that are used in order to assess proposals. The following Policy Statements have relevance for the Flinders Mines project:

- Policy Statement 9: Conservation of threatened flora in the wild;
- Policy Statement 33: Conservation of threatened fauna in the wild; and
- Policy Statement 50: Setting priorities for the conservation of Western Australia's threatened flora and fauna.





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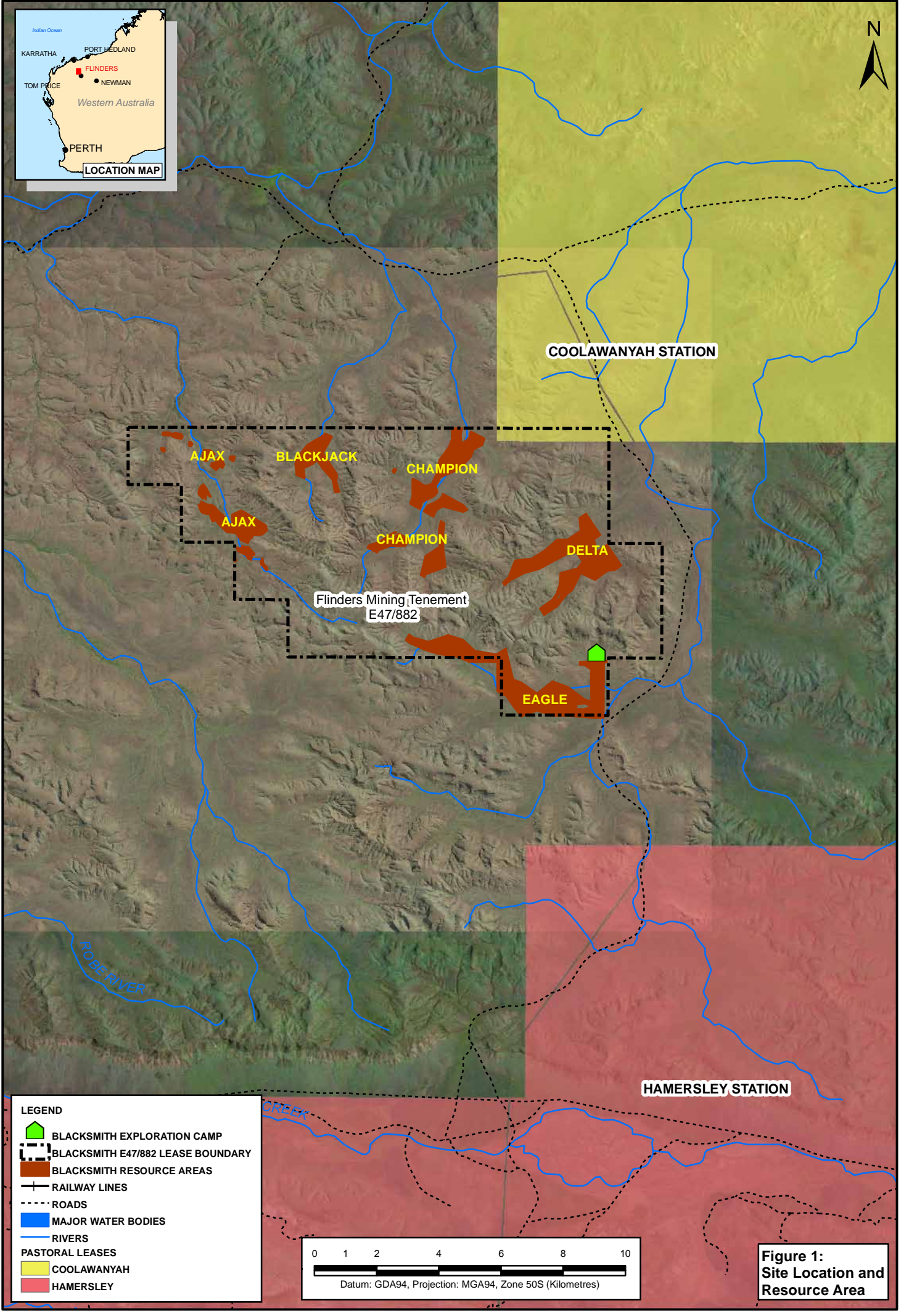
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## **2. PROJECT OVERVIEW**

Mining exploration tenement E47/882 is held by Flinders Mines Limited (FMS). It is within the Mt Sheila locality in the Shire of Ashburton, approximately 70 km north-north-west of Tom Price and 160 km east-southeast of the Pannawonica township in the Pilbara region of Western Australia is shown in Figure 1. Exploration activities have identified five areas of inferred iron ore resources, named Ajax, Blackjack, Champion, Delta and Eagle, with the Delta area likely to be the first to be developed. The total inferred resource is 511 million tones (Mt) (at 54% iron content).

The project progressed to pre-feasibility studies in August 2009 to identify the broader 'mine to ship' prospects, including studies on mine and infrastructure development, environmental considerations (including this report), safety considerations, permitting and approvals, marketing, financial modeling, and the establishment of a management team.

FMS also holds nearby tenement E47/1560 (named Anvil) for iron ore exploration approximately 4km southwest of the site and exploration is continuing there to identify the inferred resource in this area.



COOLAWANYAH STATION

AJAX

BLACKJACK

CHAMPION

AJAX

CHAMPION

DELTA

Flinders Mining Tenement  
E47/882

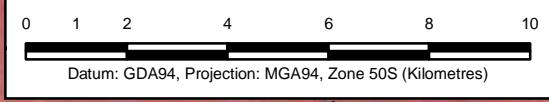
EAGLE

ROBER RIVER

HAMERSLEY STATION

**LEGEND**

-  BLACKSMITH EXPLORATION CAMP
-  BLACKSMITH E47/882 LEASE BOUNDARY
-  BLACKSMITH RESOURCE AREAS
-  RAILWAY LINES
-  ROADS
-  MAJOR WATER BODIES
-  RIVERS
- PASTORAL LEASES**
-  COOLAWANYAH
-  HAMERSLEY



**Figure 1:**  
Site Location and  
Resource Area



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PILBARA IRON ORE PROJECT  
PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)**

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### **3. RELATED ENVIRONMENTAL STUDIES**

The site has been covered in regional surveys such as:

- Van Vreeswyk et. al. (2004) An inventory and condition survey of the Pilbara region, Western Australia; and
- DEC 2009a, Pilbara Region Biological Survey 2002-2009. DEC has surveyed plant and animal communities in the Pilbara region, mapped the inter-relationships and patterns of these communities and documented the way communities are distributed in relation to soil, vegetation, climate, landforms and geology. However at this time only preliminary summary results, and not full reports or guidelines, are available.

The nearest developed resource with publicly available environmental information is Rio Tinto's Brockman /Nammuldi operation approximately 28km south of the site. The following reports have been reviewed and contribute to the information given in Sections 4 to 5:

- EPA 1990, Proposed Brockman No.2 detrital iron-ore mine, Hamersley Iron Pty Ltd, Report and Recommendations of the Environmental Protection Authority, Bulletin 467;
- Hamersley Iron 2005, Brockman Syncline 4 Iron Ore Project, Public Environmental Review;
- EPA 2006, Brockman 4 Syncline Project, Report and Recommendations of the Environmental Protection Authority, Bulletin 1214;
- Brockman Syncline 4 Iron Ore Project - Borefield Management Plan; and
- Brockman Syncline 4 Iron Ore Project - Snail Management Plan.

Further south is Rio Tinto Iron Ore's Western Turner Syncline 10 Iron Ore Project with the following available environmental information:

- Western Turner Syncline Section 10 – Environmental Protection Statement;
- Biota 2009a, West Turner Syncline Section 10 Development Two-Phase Fauna Survey;
- Biota 2007, Vegetation Survey Report;
- Biota 2008a, Subterranean fauna assessment;
- Biota 2009b, SRE Risk Assessment;
- Biota 2008c, Mygalomorph spiders and EIA;
- MWH 2009, Groundwater modeling;
- Pilbara Iron 2008, Botanical survey report;



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- Rio Tinto 2007, SCARD (Spontaneous Combustion and Acid Rock Drainage) Management Plan;
- Rio Tinto 2008, Closure Management Plan; and
- Rio Tinto Iron Ore 2008, Weed Management Plan.

A search of the DEC's Pilbara Biological Survey Database (listing approximately 800 records of biological surveys completed in the Pilbara region) indicates the surveys listed above are the closest to E47/882. This survey list and the DEC catalogue of research papers may be a source to identify and request access to other specialist studies as the on-ground local environment becomes better known during field studies.

There is no published environmental information on the mining exploration areas adjacent to the site, namely Fortescue Metal Group's Solomon exploration area, including the Serenity and Solomon East inferred deposits, or Rio Tinto's Caliwingina North inferred resource.



## **4. BIOPHYSICAL ENVIRONMENT**

### **4.1 Climate**

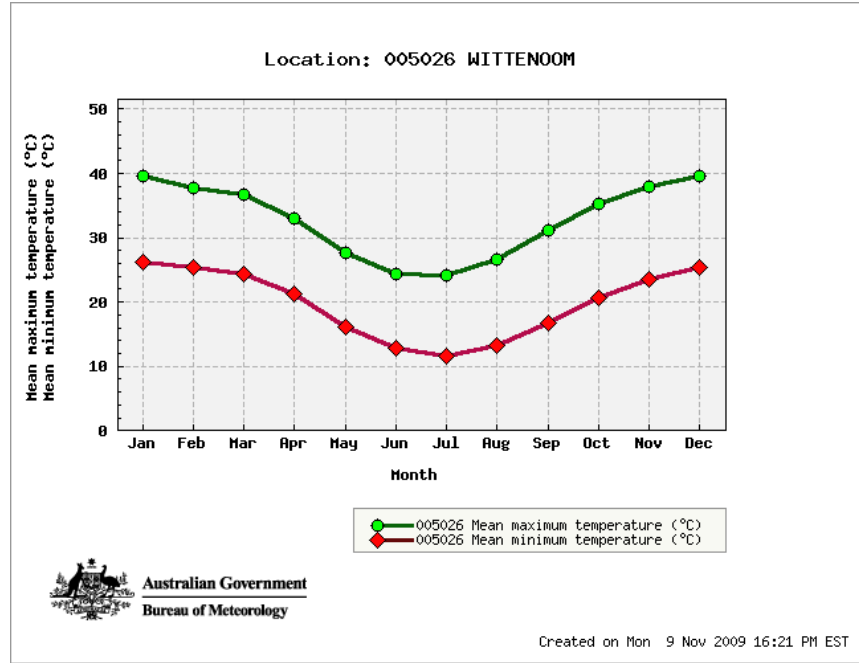
The Pilbara is a tropical arid region, with hot summers and mild winters. Rainfall is variable and largely falls in the summer months (BOM 2009a). These features are illustrated in Figure 2 and Figure 3 showing rainfall, temperature and evaporation at the nearest comprehensive weather station at Wittenoom (Site 005023 at latitude 22.24°S, longitude 118.34°E). The mean maximum temperature there in January is 39.6°C and the mean minimum temperature is 11.5°C in July. The average annual rainfall is 457 mm while the annual evaporation exceeds 3000 mm.

There is a cyclone season affecting the Pilbara from mid December to April. While the risk of damaging winds decreases with distance from the coast, widespread heavy rainfall and associated flooding can impact inland areas. The flood potential is associated with the track, speed and spatial extent of the tropical low. Rainfall of more than 100 mm is common with systems that move slowly over land over many days. For example in January and February 1961 rainfall totals exceeded 200 mm during two tropical cyclones, and Wittenoom town was isolated with water levels rising to 23 m in sections of the adjacent Gorge. (BOM 2009b).

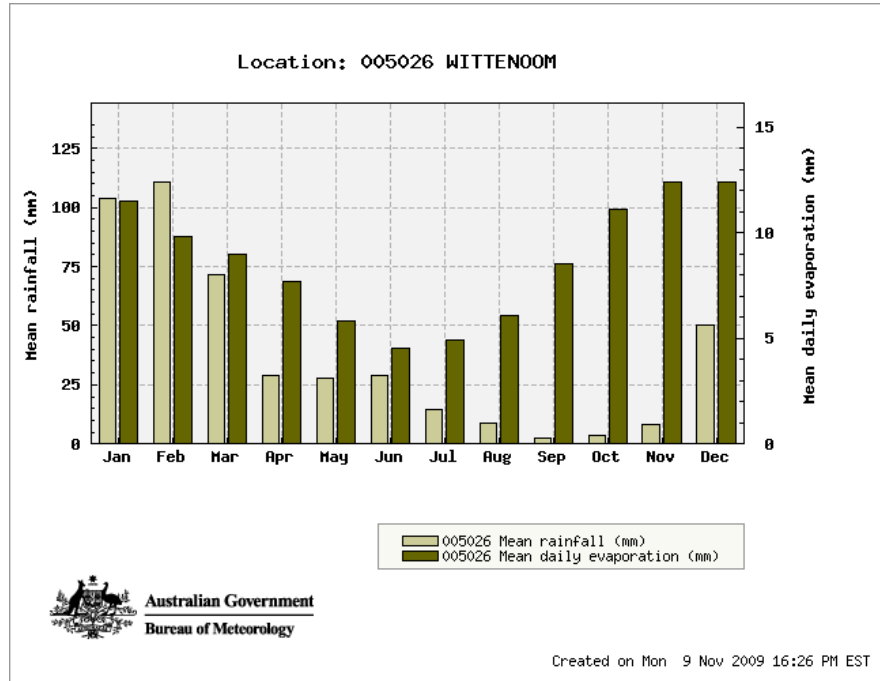
The climate and possibility of extreme weather conditions is an accepted factor for Pilbara mining projects. For example, flora and vegetation surveys are best carried out following seasonal summer rains when conditions are ideal for annual plants to grow, while some construction activities may be delayed or impossible during the wet season.



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**Figure 2: Mean minimum and maximum temperature at Wittenoom between 1951 and 2009**



**Figure 3: Mean rainfall and evaporation at Wittenoom between 1951 and 2009**



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## **4.2 Bioregion**

The site is within the Pilbara bioregion and Hamersley sub-region (PIL3) as described in the Interim Biogeographic Regionalisation for Australia (IBRA) (DEWHA 2009). The region is characterised by mountainous ranges and plateaus, alluvial plains, granite and basalt plains. It is dominated by hummock grasslands and acacia forests and woodlands. *Acacia* shrublands, tussock grasslands, chenopod (saltbush) and samphire shrublands, salt marshes, mangroves and eucalypt woodland occur along water courses (EPA 2004). The planning area falls within the Fortescue, Chichester and Roebourne subregions of the Pilbara Craton Bioregion.

The Hamersley sub-region is a mountainous area on the south side of the Fortescue Valley consisting of Proterozoic (up to 2500 million years old) sedimentary ranges and plateaux, with Mulga (*Acacia aneura*) low woodland on fine textured soil in valleys and Snappy Gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils in the ranges (Van Vreeswyk *et. al.* 2004 and Kendrick 2001).

## **4.3 Geology and Topography**

As described in Section 4.2 the site is within rangelands. The Hamersley Range is said to be the highest range in the Western Australia with 20 of the state's highest peaks including Mt Meharry in Karijini National Park which is 1249 mAHD (Landgate 2009).

The tenement is centrally located within the Hamersley Basin that unconformably overlies the southern margin of the Archaean Pilbara Craton. Geology comprises Brockman Iron Formation and McRae Shale that have been intruded by mafic sills and dykes. The targeted geology in the area is Channel Iron Deposit (CID) and Bedded Iron Deposit (BID). CID is a fluvial sedimentary deposit which has accumulated in ancient river channels (palaeochannels) (Ramanaidou *et. al.*, 2003). The CID overlies parent BID, which is iron-rich due to leaching of non-iron minerals from the original banded iron and silicon-rich sedimentary formations (GSWA 1995). Thus the focus of the mining operations is the lower-lying valley areas of the tenement where these geologies occur (see Figure 1).

Previous diamond exploration surveys of the area have noted Brockman Iron and McRae shale formations of the Hamersley Group along with dolerite of uncertain age, with cover including colluvium and alluvium (GSWA 1997). Any disturbed areas containing pyritic black shale hold the potential to react with air and water to produce acidic drainage water (acid rock drainage). However, as this is not the target ore it is unlikely to be exposed during the mining operation.

## **4.4 Hydrology**

There are no permanent waterways or major rivers in the project area. Drainage from seasonal rainfall forms ephemeral creeks along the flanks of topographic highs that drain into the Weelumurra and Caliwingina Creeks which are tributaries of the Fortescue River. Known interactions between



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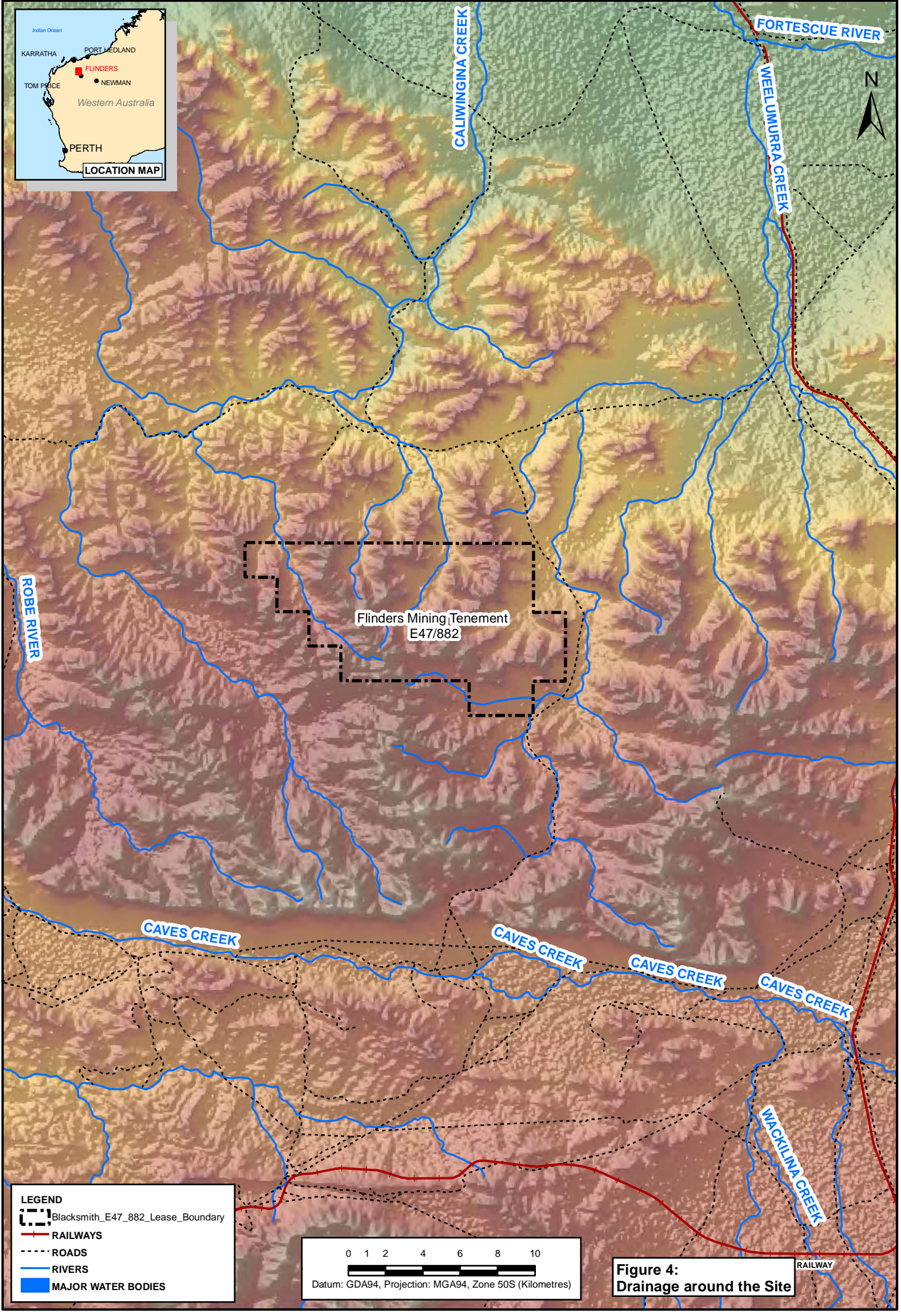
surface water and groundwater are limited to downward infiltration during periods of high rainfall, particularly around the creeks.

A water hole was observed in the Ajax deposit area during a November 2009 site visit (Golder Associates 2009; pers.comm. G Sutherland, 11 Dec 2009), see Appendix 3. The hydrology of the water hole is unknown although was considered likely to be permanent on initial assessment. Ajax is within a separate surface water catchment to the other deposits.

The site is within the Millstream Priority 2 drinking water catchment (Millstream-West Pilbara Water Supply Scheme)

Golders Associates and WorleyParsons are currently further investigating the surface water hydrology.





Flinders Mining Tenement  
E47/882

**LEGEND**

- Blacksmith\_E47\_882\_Lease\_Boundary
- RAILWAYS
- ROADS
- RIVERS
- MAJOR WATER BODIES

0 1 2 4 6 8 10

Datum: GDA94, Projection: MGA94, Zone 50S (Kilometres)

**Figure 4:**  
Drainage around the Site

RAILWAY



## **Groundwater**

Initial studies estimate that a large portion of the targeted desposit is above groundwater (Golder Associates 2009). FMS exploration drill holes encountered groundwater at between 30m to 50m below the surface (Golder Associates 2009).

A water hole was observed in the Ajax deposit area during a November 2009 site visit (Golder Associates 2009; pers.comm. G Sutherland, 11 Dec 2009), The hydrology and link to groundwater is unclear at this stage.

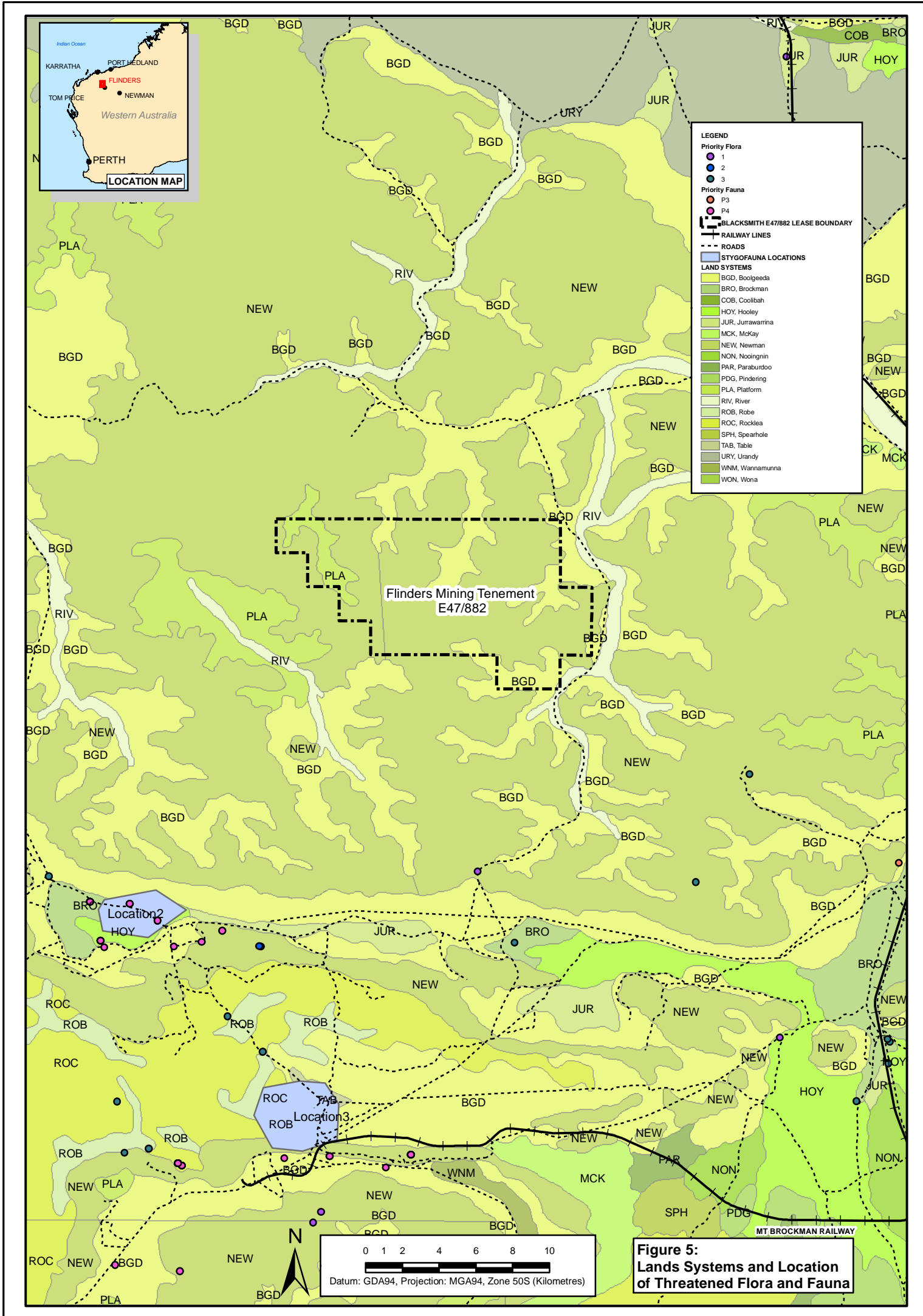
The nature of groundwater at E47/882 will be further studied and reported in the Water Resource Preliminary Studies. It is likely that groundwater abstraction bores will be used to provide project construction and operational water supplies.

Golders Associates and WorleyParsons are currently further studying the site hydrogeology and project water use options.

### **4.5 Land Systems**

Land System (rangelands) mapping covering the project area has been prepared by Agriculture Western Australia (Van Vreeswyk *et. al.* 2004). This mapping integrates vegetation, geological and physiographic information. The project area was overlain on this mapping and it intersects Boolgeeda, Newman and Platform land systems.

The area has stony plains with spinifex grasslands and mulga shrublands or hills and ranges with acacia shrublands and lies south of the Millstream-Chichester National Park.





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## **4.6 Flora and Vegetation**

The proposal area is located within the Fortescue Botanical District of the Eremaean Botanical Province described by Beard (1980). Beard mapped the vegetation of the Pilbara at a scale of 1:1,000,000. Vegetation in the area typically consists of open Acacia or Eucalypt woodland and Triodia hummock grassland (Australian Natural Resource Atlas 2001, Van Vreeswyk et. al. 2004, Kendrick 2001).

The localised vegetation types will be identified in on-ground flora surveys. As an example 31 vegetation types were defined within the Brockman area surveyed by Biota (2007).

Previous studies show the Hamersley Range (PIL3) IBRA subregion has high species diversity for the genera *Acacia*, *Triodia*, *Ptilotus*, *Corymbia* and *Sida* (Pilbara Iron 2008).

### **4.6.1 DEC Listed Threatened Flora**

All native flora species are protected under the Western Australian *Wildlife Conservation Act 1950* (WC Act). Threatened flora species as defined by DEC, are protected species considered to be either Declared Rare Flora (DRF) which are presumed extinct or extant taxa, or Priority Flora, which are poorly known and potentially under threat. These DRF and Priority species have been gazetted by the Minister for Environment and require special management attention. The current list of specially protected flora was published in the *Government Gazette* on 5 August 2008 under the *Wildlife Conservation (Rare Flora) Notice 2008*. Priority Flora do not have the same legal status as DRFs but are still considered during the approvals process.

DEC Policy Statements Nos 9: *Conservation of threatened flora in the wild*, 33: *Conservation of threatened fauna in the wild* and 50: *Setting Priorities for the conservation of Western Australia's threatened flora and fauna* outline the details related to the protection of threatened flora and fauna in Western Australia.

A search of the DEC threatened flora database with current available information showed no DRF species have been recorded within the project area (see Figure 5). Project specific data have been requested from the DEC and further assessment will be conducted when this information is received.

Field flora surveys would be required to verify these results and to ensure that there are no additional impacts to threatened flora. All future flora surveys are required to consider the principles and guidelines outlined in Position Statement 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000), Position Statement 3 *Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA 2002) and Guidance Statement 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).



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**4.6.2 Matters of National Environmental Significance**

The Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Search Tool (Department of Environment and Conservation 2008) was used to identify flora of significance in the investigation area. Threatened species categories include endangered, critically endangered, conservation dependant, vulnerable, and species that are extinct in the wild. Nominations for species and ecological communities are assessed by the Threatened Species Scientific Committee (Department of Environment, Water, Heritage and the Arts 2008a).

One flora species protected by the *Environmental Protection and Biodiversity Conservation Act 1999* is recorded as potentially occurring at the site, *Lepidium catapycnon* (see Figure 6). The results are the same for a search buffer of 10 km from the tenement boundaries). This species is noted as occurring on skeletal soil and hillsides (Paczkowska 1996) and is only known in the Hamersley Ranges (Brown *et. al.*, 1998). Previous flora surveys in this area have recorded several populations of the species (Pilbara Iron 3, Pilbara Iron 2008, Biota 2007), although it was not found at the Brockman 4 mine site (Hamersley Iron 2005).

Field surveys would be required to verify the presence of this, or any other, protected species.

**Table 1: Results of EPBC Act protected flora search**

Species	Status	Type of Presence
<i>Lepidium catapycnon</i> Hamersley Lepidium, Hamersley Catapycnon	Vulnerable	Species or species habitat likely to occur



**Figure 6: Declared Rare Flora, Hamersley Lepidium (Florabase undated)**



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## 4.7 Fauna

### 4.7.1 DEC Listed Threatened Fauna

All native fauna species are protected under the Western Australian *Wildlife Conservation Act 1950* (WC Act). Fauna species that are considered rare, threatened with extinction or have a high conservation value are specially protected under the WC Act. The current list of specially protected fauna was published in the *Government Gazette* on 5 August 2008 under the *Wildlife Conservation (Specially Protected Fauna) Notice 2008(2)*.

DEC Policy Statements Nos 33: *Conservation of threatened fauna in the wild* and 50: *Setting Priorities for the conservation of Western Australia's threatened flora and fauna* outline the details related to the protection of threatened fauna in Western Australia.

A search of the DEC threatened fauna database with current available information showed several threatened fauna species are known from the area of interest (see Figure 5). Project specific data have been requested from the DEC and further assessment will be conducted when this information is received.

Three individuals of *Pseudomys chapmani* (Western Pebble-mound Mouse) were recorded by Biota (2009) at two locations inside and one location outside the nearby Rio Tinto Syncline 10 area. This species is listed as 'Priority 4' in the DEC Priority Fauna List. These species or their habitat may also be present in the FMS site.

Short Range Endemic (SRE) species may also be present on site. These are invertebrate species that occur in localised niche habitats such as rock outcrops. Five potential Short Range Endemic (SRE) species were recorded during the Biota (2009) survey of Rio Tinto's nearby resource areas. By the nature of their limited distribution, they are generally identified during more detailed site visits.

Field fauna surveys would verify the presence of protected species or their habitats and consider additional impacts to threatened fauna. Identifying and assessing localised fauna habitats, e.g. caves which may house bats, will be carried out at this stage. Fauna surveys are required to consider the principles and guidelines outlined in Position Statement 3 *Terrestrial Biological Surveys as an element of Biodiversity Protection* (EPA 2002) and Guidance Statement 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004).

### 4.7.2 Matters of National Environmental Significance

The Department of the Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Search Tool was used to identify fauna of national and international significance in the investigation area. Threatened species categories include endangered, critically endangered, conservation dependant, vulnerable and species that are extinct in the wild. Nominations for species and



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ecological communities are assessed by the Threatened Species Scientific Committee (DEWHA 2008a). There are nine fauna species protected under various categories under the EPBC Act that may be present on site or use the site (see Table 2). Field surveys would be required to verify these results.

Some of these species, for example the Pilbara Olive Python and Rainbow Bee-eater have been found in Rio Tinto’s Syncline Section 10 study area (Biota 2009). Six individuals of *Merops ornatus* (Rainbow Bee-eater) were recorded by Biota (2009) at one location inside and two locations outside that study area, and this species is listed as ‘Vulnerable’ under the EPBC Act and as ‘rare and likely to become extinct’ under Schedule 1 of the *Wildlife Conservation Act 1950* (WA).

**Table 2: Results of EPBC Act protected fauna search**

Species	Status	Type of Presence
<b>Threatened Species</b>		
<i>Dasyurus hallucatus</i> Northern Quoll	Endangered	Species or species habitat likely to occur within area
<i>Rhinonicteris aurantia</i> (Pilbara form) Pilbara Leaf-nosed Bat	Vulnerable	Species or species habitat likely to occur within area
<i>Liasis olivaceus barroni</i> Olive Python (Pilbara subspecies)	Vulnerable	Species or species habitat may occur within area
<b>Migratory Terrestrial Species</b>		
<i>Haliaeetus leucogaster</i> White-bellied Sea Eagle	Migratory	Species or species habitat likely to occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
<b>Migratory Wetland Species</b>		
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover, Oriental Dotteral	Migratory	Species or species habitat may occur within area
<b>Migratory Marine Birds</b>		
<i>Apud pacificus</i> Fork-tailed Swift	Migratory	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i>	Migratory	Species or species habitat may occur within area



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PILBARA IRON ORE PROJECT  
PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)**

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Species	Status	Type of Presence
Cattle Egret		
<b>Other Matters Protected by the EPBC Act</b>		
<i>Apus pacificus</i> Fork-tailed Swift	Listed – overfly marine area	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Charadrius veredus</i> Oriental Plover, Oriental Dotteral	Migratory	Species or species habitat may occur within area
<i>Haliaeetus leucogaster</i> White-bellied Sea Eagle	Migratory	Species or species habitat likely to occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory	Species or species habitat may occur within area

**4.7.3 Subterranean Fauna**

Subterranean fauna are mostly invertebrate species (e.g. small crustaceans) and are classified as either stygofauna, which inhabit groundwater aquifers, or troglifauna, which inhabit underground air cavities or caves. The Pilbara is known to be rich in stygofauna species, although each species may only occupy a small niche environment (DEC 2009b).

The presence of subterranean fauna or their habitat on site would be identified during specialist field studies.

**4.8 DEC Listed Threatened and Priority Ecological Communities**

Threatened ecological communities (TECs), as defined by DEC, are a natural biological assemblage of plants, animals, microbes and so forth within a particular habitat, that face destruction or modification by processes such as land clearing or pollution. The communities are presumed totally destroyed, critically endangered, endangered, or vulnerable.

There are no known TECs within or adjacent to the E47/882 project area.

Priority Ecological Communities (PEC) are a further category of ecosystems that may be recognised as TECs but require further study. Possible threatened ecological communities that do not meet survey criteria are listed as Conservation Priorities One, Two and Three. Conservation Priority Four communities are those that are adequately known, rare but not threatened, or meet criteria for near





## FLINDERS MINES LIMITED

### PILBARA IRON ORE PROJECT

#### PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)

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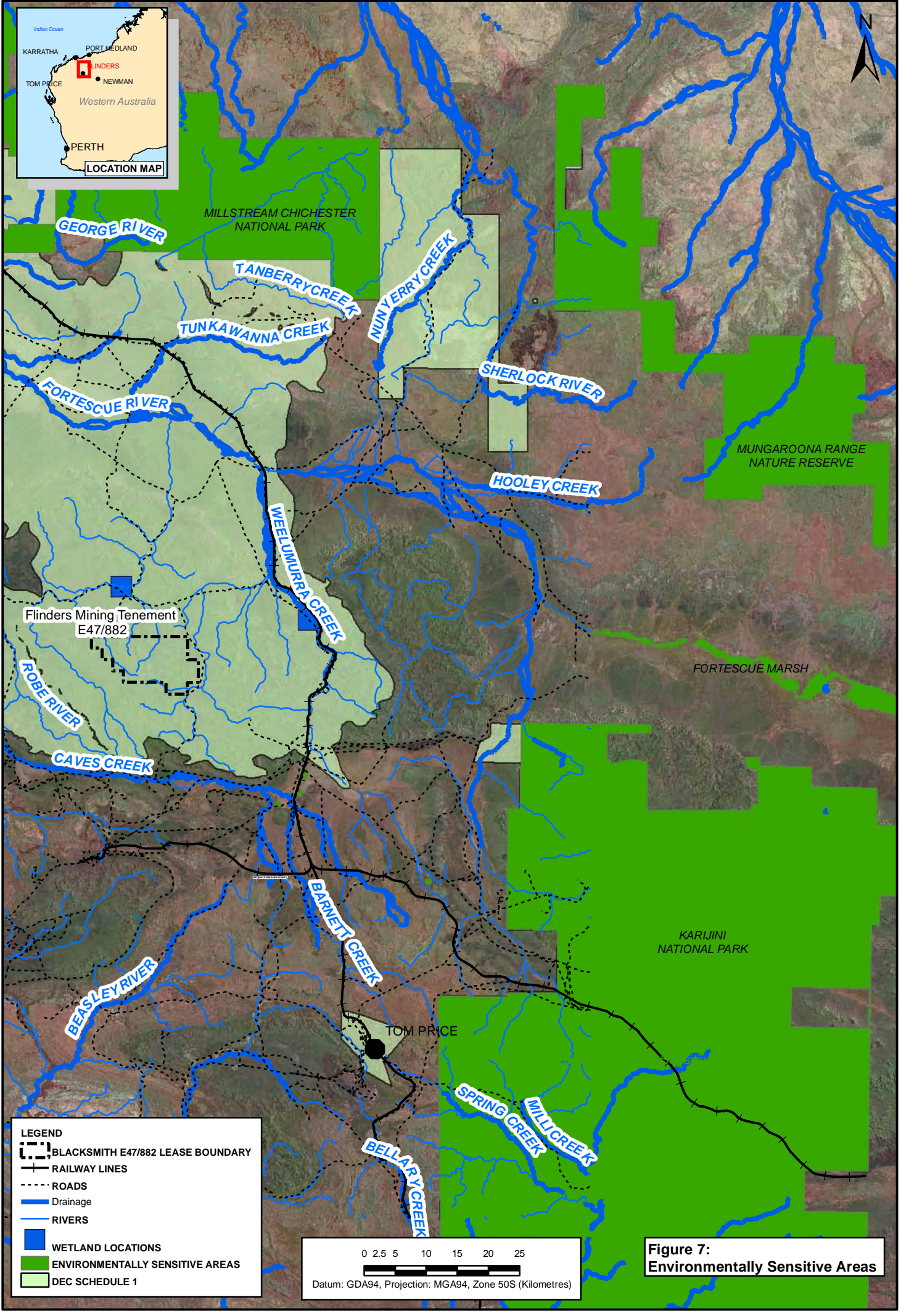
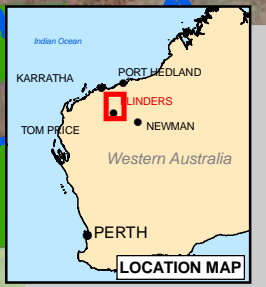
threatened, or that have been recently removed from the threatened list.

There are no known PECs within or adjacent to the E47/882 project area, with the nearest being the Cracking Clay communities of the Chichester and Mungaroona Range (Mulga Downs Site ID), and *Astrelba lappacea grasslands* on the boundary of Hamersley and Brockman Stations, both with a conservation status of Priority One. The project area is 56km and 85km from the communities respectively.

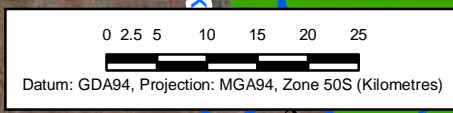
#### 4.9 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are declared in Regulation 6 in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Some examples are areas with 50m of Declared Rare Flora, certain wetlands and riparian areas within 50m of the wetland, and World Heritage sites. Threatened Ecological Communities are another type of ESA. There are no known Environmentally Sensitive Areas within or adjacent to E47/882.

The site is within a DEC 'Schedule 1' area based on its location within a water supply area. The *Environmental Protection Act 1986* restricts the clearing of native vegetation in Western Australia. Any vegetation clearing on site must therefore be approved e.g. under an overarching project environmental approval (Part IV of the *Environmental Protection Act 1986*) or with a native vegetation clearing permit (Environmental Protection (Clearing of Native Vegetation) Regulations 2004)) unless the project qualifies to clear under an exemption. Under the regulations, activities can qualify to be exempt from needing approval including 'low impact mining activities' which is described in Schedule 1 of the regulations. However these exemptions do not apply in some zones including water supply areas, town sites and ESAs. Given its location within the Millstream water supply area, vegetation clearing on site for 'low impact mining activities' must be approved e.g. with an overarching project environmental approval under Part IV of the EP Act, Programme of Work or native vegetation clearing permit.



- LEGEND**
- BLACKSMITH E47/882 LEASE BOUNDARY
  - RAILWAY LINES
  - ROADS
  - Drainage
  - RIVERS
  - WETLAND LOCATIONS
  - ENVIRONMENTALLY SENSITIVE AREAS
  - DEC SCHEDULE 1



**Figure 7:**  
Environmentally Sensitive Areas



## 5. SOCIAL ENVIRONMENT

### 5.1 Land Use and Tenure

The north eastern corner of the project area intersects with the pastoral lease of Coolawanyah Station and Hamersley station is approximately 4km to the south.

#### 5.1.1 Conservation Estate

The FMS site is located approximately 45 km from the nearest boundary of the Karijini National Park, 56 km from the nearest boundary of the Millstream-Chichester National Park and 85km from the Mungaroona Range Nature Reserve (see Figure 8). Both of these National Parks and the reserve are managed by the Department of Environment and Conservation (formerly CALM).

### 5.2 Heritage

#### 5.2.1 Indigenous heritage

A search of the Department of Indigenous Affairs Aboriginal Heritage Inquiry System showed no registered site within or adjacent to E47/882. Appendix 2 gives the search results. However all indigenous heritage sites are protected under the *Aboriginal Heritage Act 1972* whether or not they are identified on this register.

An ethnographic survey was carried out of the site in 2003 (reference 21741 HSR P 2000 OCO). Other survey work is presently being carried out to identify indigenous heritage values on site.

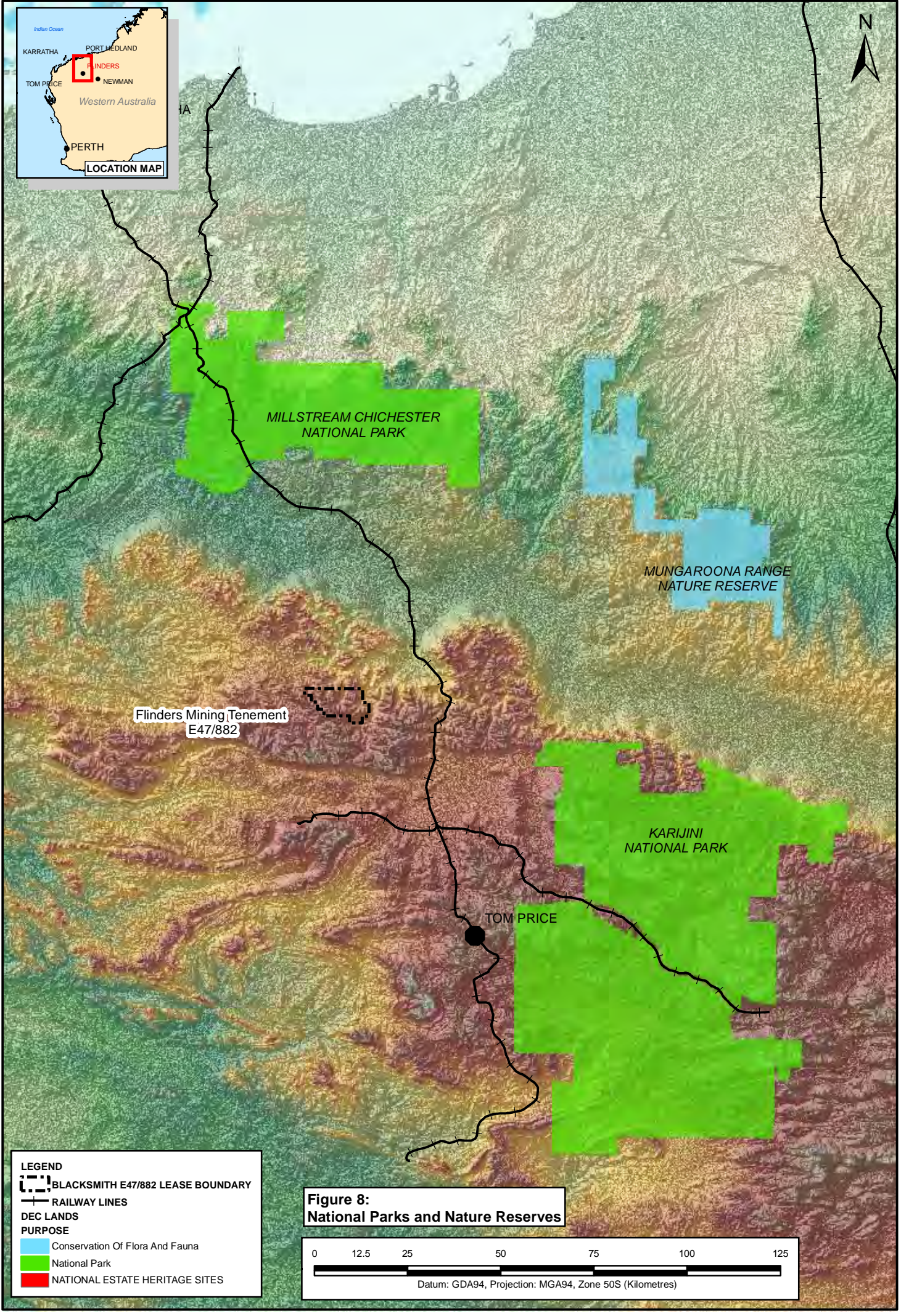
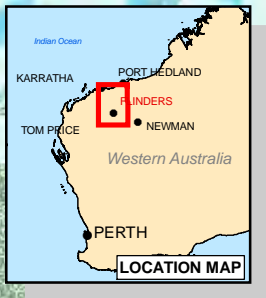
#### 5.2.2 Natural and other historic sites

There are no heritage sites protected under the *Environmental Protection and Biodiversity Conservation Act 1999* that are in or within 10 km of the site (see Appendix 1 for the search report).

The Heritage Council of Western Australia database does not indicate that there are any heritage areas on site, with the nearest sites being the permanent pools of the Ashburton River, Karijini National Park, and the Tom Price school, police station and community centre<sup>1</sup>.

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<sup>1</sup> Non-indigenous historic sites, including natural heritage sites, are sometimes referred to as 'European heritage'.



MILLSTREAM CHICHESTER NATIONAL PARK

MUNGAROOA RANGE NATURE RESERVE

Flinders Mining Tenement E47/882

KARIJINI NATIONAL PARK

TOM PRICE

**LEGEND**

BLACKSMITH E47/882 LEASE BOUNDARY

RAILWAY LINES

**DEC LANDS PURPOSE**

Conservation Of Flora And Fauna

National Park

NATIONAL ESTATE HERITAGE SITES

**Figure 8:**  
National Parks and Nature Reserves

0 12.5 25 50 75 100 125

Datum: GDA94, Projection: MGA94, Zone 50S (Kilometres)



## FLINDERS MINES LIMITED

### PILBARA IRON ORE PROJECT

#### PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)

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### 5.3 Native Title

The Commonwealth *Native Title Act 1993* (NTA) provides for Aboriginal people to claim native title and a process for negotiation and compensation where the land is leased out by the State. The NTA allows States and Territories to develop their own native title regimes that apply instead of the right to negotiate where the Australian Government Minister determines that the regime complies with criteria set out in the NTA. The *Native Title (State Provisions) Act 1999* represents Western Australia's native title regime. Native title claims ensure that the stated native title rights and interests of the Aboriginal traditional owners of the land are recognised by law. These rights and interests include the continued use and occupation of the land for traditional purposes such as ceremonies, hunting, fishing and procuring ochre and bush foods.

The site falls within the Eastern Guruma native title determination area ratified by the Federal Court in March 2007. The determination area covers approximately 6,024 km<sup>2</sup> of the Pilbara region. It recognises non-exclusive possession native title rights including the right "to enter and remain on the land, camp, erect temporary shelters, and travel over and visit any part of the land and waters; to hunt and fish, gather and use the resources of the land and waters such as food, water and medicinal plants; to engage in ritual and ceremony on and in relation to the land and waters; and to care for, maintain and protect from physical harm, particular objects, sites and areas of significance to the native title holders." (Federal Court 2007)

The determination also means that the Eastern Guruma people must be consulted about development on the land and they have a right to negotiate over mineral exploration and the development of new mines (National Native Title Tribunal 2007)

The second schedule of the determination recognises the interests of other parties including the mining interests related to tenement E47/882. The interrelationship between this interest and the native title interest is defined as follows:

- a) the extent that any of the other rights and interests is inconsistent with the continued existence, enjoyment or exercise of the native title rights and interests, the native title rights and interests continue to exist in their entirety, but the native title rights and interests have no effect in relation to the other rights and interests to the extent of the inconsistency during the currency of the other rights and interests; and otherwise,
- b) the existence and exercise of the native title rights and interests do not prevent the doing of any activity required or permitted to be done by or under the other rights and interests, and the other rights and interests, and the doing of any activity required or permitted to be done by or under the other rights and interests, prevail over the native title rights and interests and any exercise of the native title rights and interests, but do not extinguish them.



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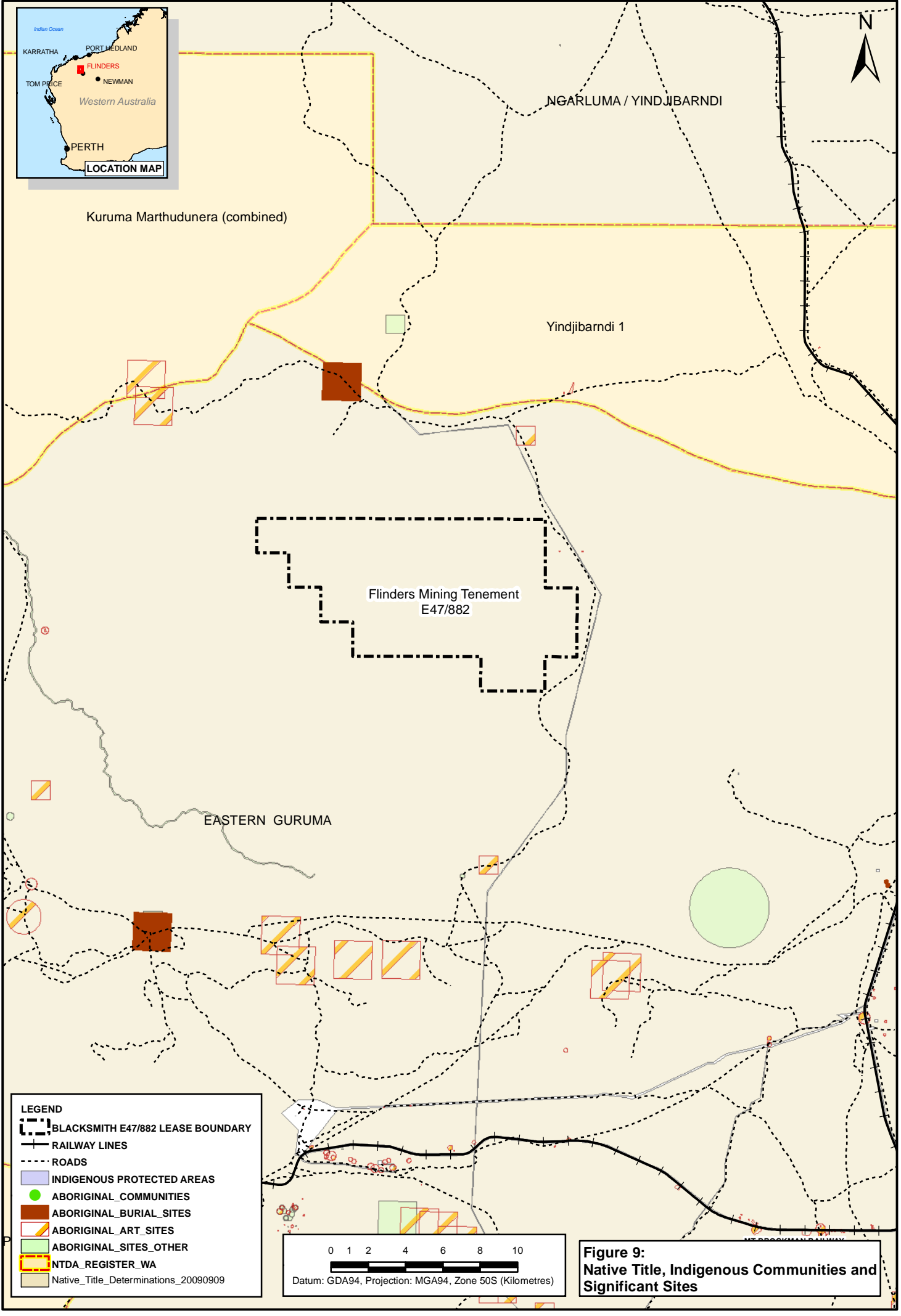
**FLINDERS MINES LIMITED**

**PILBARA IRON ORE PROJECT**

**PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)**

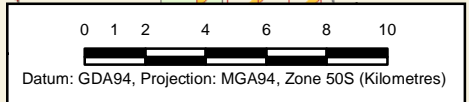
---

An Indigenous Land Use Agreement has been signed between the Eastern Guruma people, Hamersley Iron Pty Ltd, Rio Tinto Pty Ltd, and the State of Western Australia relating to exploration, mining and infrastructure development. The Eastern Guruma people also have an Indigenous Land Use Agreement with the Coolawanyah Pastoral Company Pty Ltd.



**LEGEND**

- BLACKSMITH E47/882 LEASE BOUNDARY
- RAILWAY LINES
- ROADS
- INDIGENOUS PROTECTED AREAS
- ABORIGINAL\_COMMUNITIES
- ABORIGINAL\_BURIAL\_SITES
- ABORIGINAL\_ART\_SITES
- ABORIGINAL\_SITES\_OTHER
- NTDA\_REGISTER\_WA
- Native\_Title\_Determinations\_20090909



**Figure 9:**  
Native Title, Indigenous Communities and Significant Sites



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PRELIMINARY DESKTOP ENVIRONMENTAL STUDY AT E47/882 (BLACKSMITH)**

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## **Appendix 1 – EPBC Act Protected Matters Report**



Australian Government

Department of the Environment, Water, Heritage and the Arts

## Protected Matters Search Tool

You are here: [Environment Home](#) > [EPBC Act](#) > [Search](#)

4 November 2009 14:25

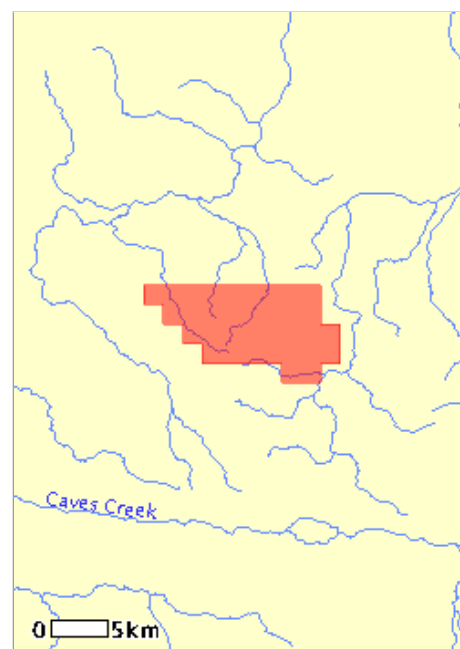
# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the [caveat](#) at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at <http://www.environment.gov.au/atlas> may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

**Search Type:** Area  
**Buffer:** 10 km  
**Coordinates:** -22.09867,117.3513, -22.09867,117.5013,  
-22.132,117.5013, -22.132,117.518, -22.16533,117.518,  
-22.16533,117.5013, -22.182,117.5013, -22.182,117.468,  
-22.16533,117.468, -22.16534,117.4013,  
-22.14867,117.4013, -22.14867,117.3846,  
-22.132,117.3846, -22.132,117.368, -22.11534,117.368,  
-22.11534,117.3513



**Report Contents:** [Summary](#)  
[Details](#)

- [Matters of NES](#)
- [Other matters protected by the EPBC Act](#)
- [Extra Information](#)

[Caveat](#)  
[Acknowledgments](#)

This map may contain data which are  
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## Summary

### Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

<b>World Heritage Properties:</b>	None
<b>National Heritage Places:</b>	None
<b>Wetlands of International Significance: (Ramsar Sites)</b>	None
<b>Commonwealth Marine Areas:</b>	None
<b>Threatened Ecological Communities:</b>	None
<b><u>Threatened Species:</u></b>	4
<b><u>Migratory Species:</u></b>	8

## Other Matters Protected by the EPBC Act

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

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

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

<b>Commonwealth Lands:</b>	None
<b>Commonwealth Heritage Places:</b>	None
<b>Places on the RNE:</b>	None
<b><u>Listed Marine Species:</u></b>	6
<b>Whales and Other Cetaceans:</b>	None
<b>Critical Habitats:</b>	None
<b>Commonwealth Reserves:</b>	None

## Extra Information

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

<b>State and Territory Reserves:</b>	None
<b>Other Commonwealth Reserves:</b>	None
<b>Regional Forest Agreements:</b>	None

## Details

### Matters of National Environmental Significance

Threatened Species [ [Dataset Information](#) ]**Mammals**[Dasyurus hallucatus](#)

Northern Quoll

Status      Type of Presence

Endangered      Species or species habitat likely to occur within area

[Rhinonicteris aurantia \(Pilbara form\)](#)

Pilbara Leaf-nosed Bat

Vulnerable      Species or species habitat likely to occur within area

**Reptiles**[Liasis olivaceus barroni](#)

Olive Python (Pilbara subspecies)

Vulnerable      Species or species habitat may occur within area

**Plants**[Lepidium catapycnon](#)

Hamersley Lepidium, Hamersley Catapycnon

Vulnerable      Species or species habitat likely to occur within area

Migratory Species [ [Dataset Information](#) ]

Status      Type of Presence

**Migratory Terrestrial Species****Birds**[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle

Migratory      Species or species habitat likely to occur within area

[Merops ornatus](#)

Rainbow Bee-eater

Migratory      Species or species habitat may occur within area

**Migratory Wetland Species****Birds**[Ardea alba](#)

Great Egret, White Egret

Migratory      Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret

Migratory      Species or species habitat may occur within area

[Charadrius veredus](#)

Oriental Plover, Oriental Dotterel

Migratory      Species or species habitat may occur within area

**Migratory Marine Birds**[Apus pacificus](#)

Fork-tailed Swift

Migratory      Species or species habitat may occur within area

[Ardea alba](#)

Great Egret, White Egret

Migratory      Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret

Migratory      Species or species habitat may occur within area

**Other Matters Protected by the EPBC Act**Listed Marine Species [ [Dataset Information](#) ]

Status      Type of Presence

**Birds**[Apus pacificus](#)

Fork-tailed Swift

Listed -  
overfly  
marine  
area      Species or species habitat may occur within area[Ardea alba](#)

Great Egret, White Egret

Listed -  
overfly  
marine  
area      Species or species habitat may occur within area[Ardea ibis](#)

Cattle Egret

Listed -  
overfly  
marine  
area      Species or species habitat may occur within area

[Charadrius veredus](#)

Oriental Plover, Oriental Dotterel

Listed -  
overfly  
marine  
areaSpecies or species habitat may occur within  
area[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle

Listed

Species or species habitat likely to occur  
within area[Merops ornatus](#)

Rainbow Bee-eater

Listed -  
overfly  
marine  
areaSpecies or species habitat may occur within  
area

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## Caveat

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

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

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

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

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

Only selected species covered by the [migratory](#) and [marine](#) provisions of the Act have been mapped.

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

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

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

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

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

## Acknowledgments

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

- [New South Wales National Parks and Wildlife Service](#)

- [Department of Sustainability and Environment, Victoria](#)
- [Department of Primary Industries, Water and Environment, Tasmania](#)
- [Department of Environment and Heritage, South Australia Planning SA](#)
- [Parks and Wildlife Commission of the Northern Territory](#)
- [Environmental Protection Agency, Queensland](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- Other groups and individuals

[ANUcliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University](#) was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

[Department of the Environment, Water, Heritage and the Arts](#)

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## **Appendix 2– Aboriginal Heritage Inquiry System Report**



## Search Criteria

0 sites in mining tenement 'E 4700882'.

## Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

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## Legend

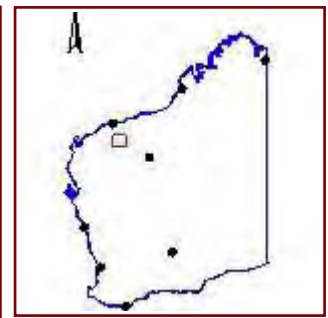
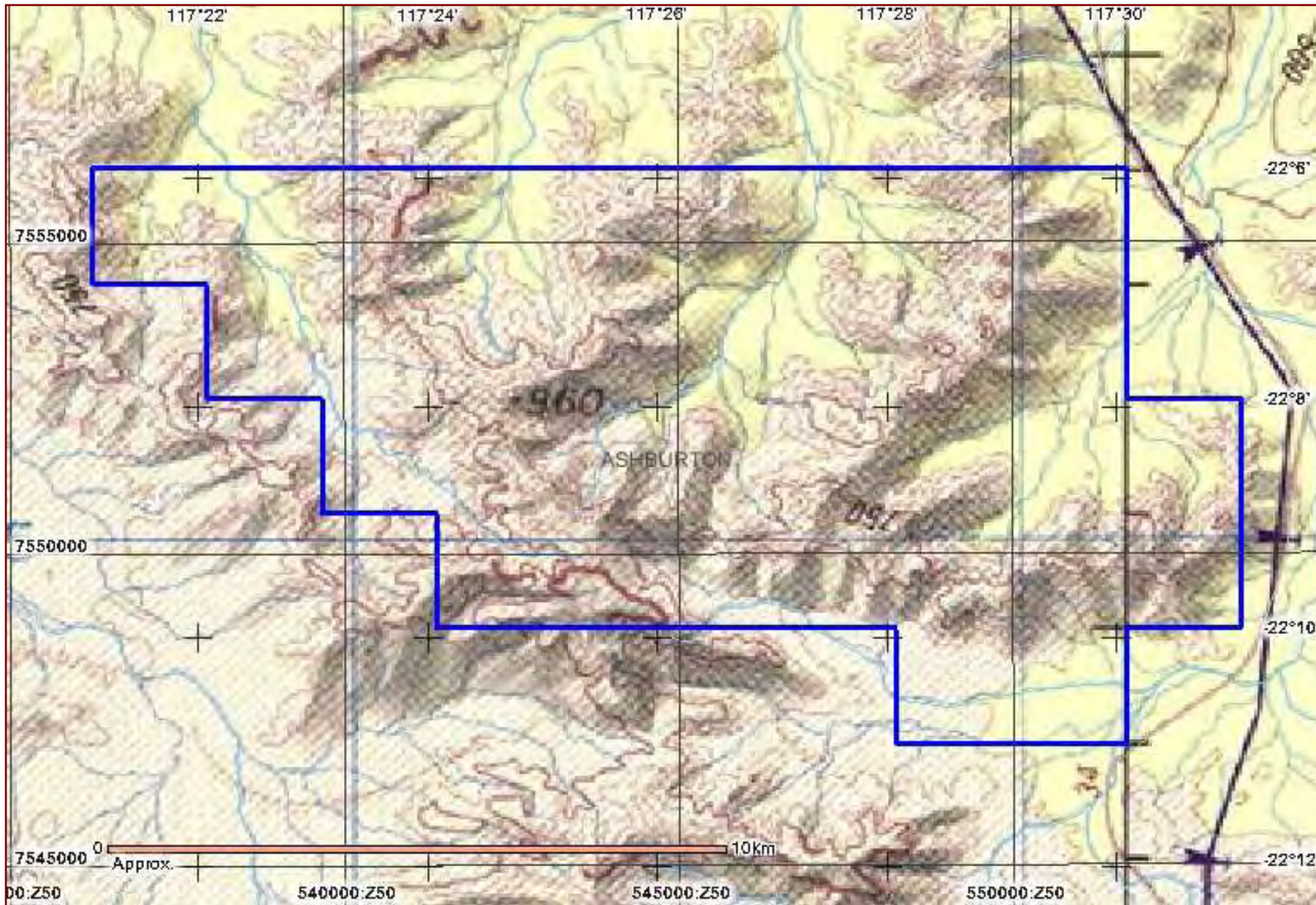
Restriction	Access	Coordinate Accuracy
N No restriction	C Closed	Accuracy is shown as a code in brackets following the site coordinates.
M Male access only	O Open	[Reliable] The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F Female access	V Vulnerable	[Unreliable] The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

## Status

L Lodged	IR	Insufficient Information (as assessed by Site Assessment Group)	Site Assessment Group (SAG)
I Insufficient Information	PR	Permanent register (as assessed by Site Assessment Group)	Sites lodged with the Department are assessed under the direction of the Registrar of Aboriginal Sites. These are not to be considered the final assessment.
P Permanent register	SR	Stored data (as assessed by Site Assessment Group)	
S Stored data			Final assessment will be determined by the Aboriginal Cultural Material Committee (ACMC).

## Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.



**Legend**

- Highlighted Area
- Town
- Map Area
- Search Area

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## Search Criteria

Survey 3591

## Disclaimer

Heritage Surveys have been mapped using information from the reports and / or other relevant data sources. Heritage Surveys consisting of small discrete areas may not be visible except at large scales. Reports shown may not be held at DIA. Please consult report holder for more information. Refer to [www.dia.wa.gov.au/heritage](http://www.dia.wa.gov.au/heritage) for information on requesting reports held by DIA.

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## Legend

### Access

Some reports are restricted. The type of restriction is shown as a code in brackets following the catalogue number. No code indicates an unrestricted report.

[CLOSED]	Closed
[OWE]	Open with exception
[TBD]	To be determined
[RESTRICTED PENDING]	Restricted pending

### Spatial Accuracy

The following legend strictly applies to the spatial accuracy of heritage survey boundaries as captured by DIA.

Very Good	Boundaries captured from surveyed titles, GPS (2001 onwards) submitted maps georeferenced to within 20m accuracy.
Good	Boundaries captured from GPS (pre 2001) submitted maps georeferenced to within 250m accuracy.
Moderate	
Unreliable	Boundaries captured from submitted maps georeferenced to an accuracy exceeding 250m.
Indeterminate	Surveys submitted with insufficient information to allow boundary capture.

## Survey 3591

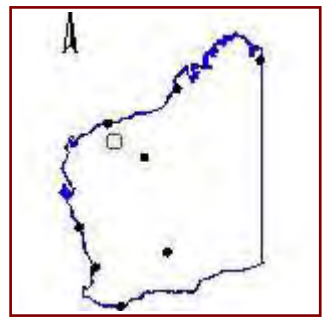
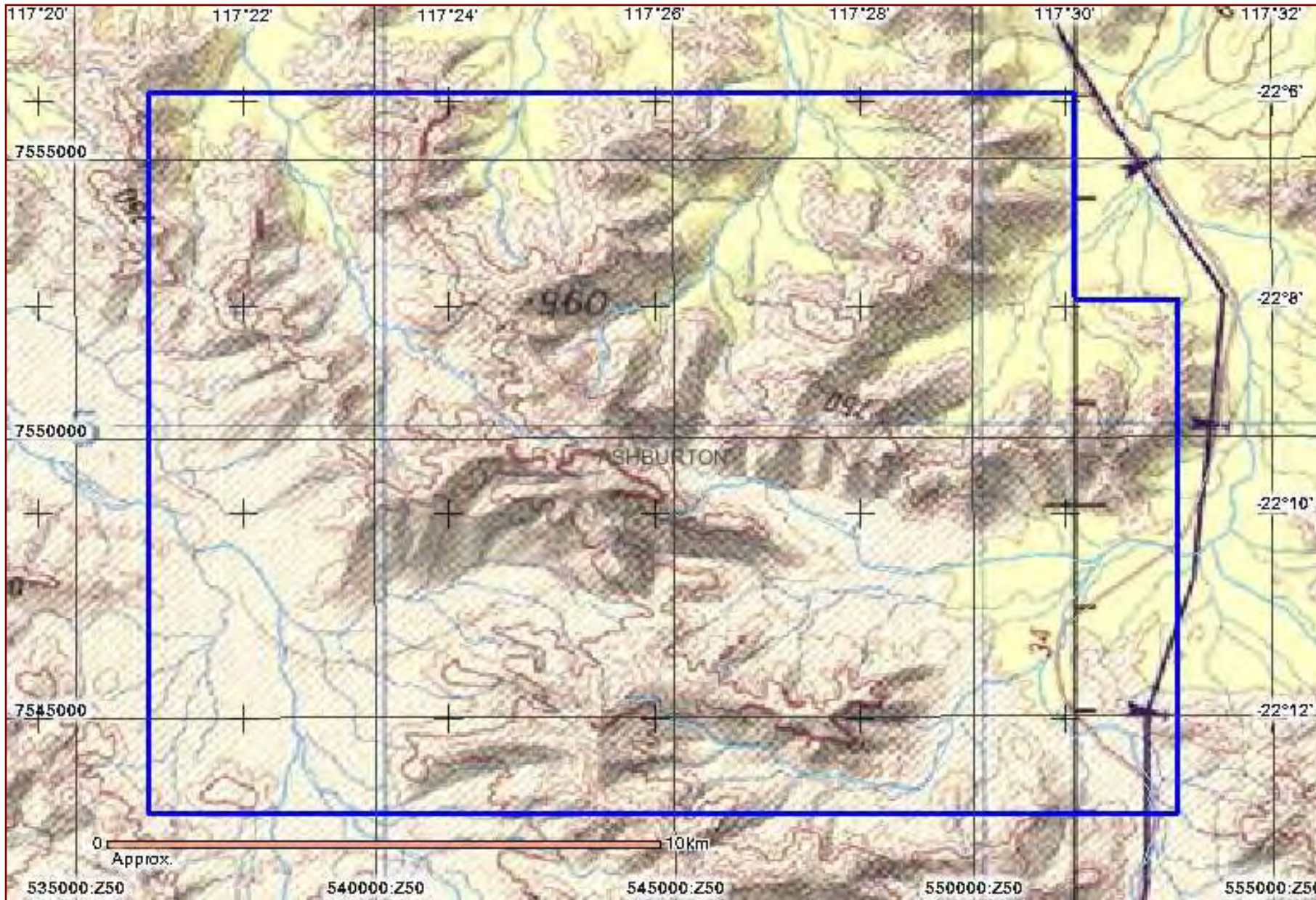
Project EL47/882, Hamersley Station  
 Start Date 19 May 2000  
 Proponents Independent Diamond Laboratories  
 L. A. Field and Associates  
 Consultants R. O'Connor  
 Survey Types Ethnographic  
 Aboriginal People Consulted? Yes

### Related Reports

Report ID	Catalogue Number	Title	Recorders	Held At
21741	HSR P 2000 OCO	Report on an ethnographic survey of EL47/882, Hamersley Station area	Rory O'Connor	

### Related Survey Areas

Area Number	Survey Type	Area Description	Survey Methodology	Spatial Accuracy	Field / Desktop
1	Ethnographic	EL47/882, Hamersley Station area as shown in Figure 1.	Site Identification	Good	Field and Desktop



**Legend**

- Highlighted Area
- Town
- Map Area
- Search Area

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## **Appendix 3– Plates**



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**Plate 1: Waterhole within the Ajax area.**

Source: unknown, November 2009.

## appendix two: definitions and criteria

**Table 12: DEC definitions and criteria for TECs and PECs (DEC 2010a)**

Criteria		Definition
<b>Threatened Ecological Communities</b>		
Presumed Destroyed (PD)	Totally	<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies ( A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed</p>
Critically (CR)	Endangered	<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>
Endangered (EN)		<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting</p>



Criteria	Definition
	<p>any one or more of the following criteria (A, B, or C):</p> <p>A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):</p> <ul style="list-style-type: none"> <li>i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);</li> <li>ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.</li> </ul> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <ul style="list-style-type: none"> <li>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);</li> <li>ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;</li> <li>iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.</li> </ul> <p>C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).</p>
Vulnerable (VU)	<p>An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.</p> <p>B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.</p> <p>C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.</p>
<b>Priority Ecological Communities</b>	
Priority One	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.
Priority Three	<ul style="list-style-type: none"> <li>i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or;</li> <li>ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may</li> </ul>

Criteria	Definition
	<p>occur, much of it not under imminent threat, or;</p> <p>iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.</p> <p>Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.</p>
Priority Four	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>A) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change These communities are usually represented on conservation lands.</p> <p>B) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>C) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority Five	<p><i>Conservation Dependent Ecological Communities</i></p> <p>Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

**Table 13: EPBC Act categories for TECs (Australian Government 1999)**

EPBC Act Category	Definition
Critically Endangered (CR)	An ecological community that is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	An ecological community that is not critically endangered, and is facing a very high risk of extinction in the wild in the new future.
Vulnerable (VU)	An ecological community that is not critically endangered or endangered, and is facing a high risk of extinction in the medium-term future.

**Table 14: DEC conservation codes and definitions for flora (Smith 2010)**

Conservation Code		Definition
X	Declared Rare Flora - Presumed Extinct	Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.
R	Declared Rare Flora - Extant	Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee. ( = Threatened Flora = Endangered + Vulnerable).
P1	Priority One - Poorly Known	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Priority Two - Poorly Known	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (ie not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3	Priority Three - Poorly Known	Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (ie not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.
P4	Priority Four - Rare	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

**Table 15: EPBC Act categories for flora (Australian Government 1999)**

EPBC Act Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	<p>A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time:</p> <ul style="list-style-type: none"> <li>(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or</li> <li>(b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</li> </ul>
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	<p>A native species is eligible to be included in the endangered category at a particular time if, at that time:</p> <ul style="list-style-type: none"> <li>(a) it is not critically endangered; and</li> <li>(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</li> </ul>
Vulnerable	<p>A native species is eligible to be included in the vulnerable category at a particular time if, at that time:</p> <ul style="list-style-type: none"> <li>(a) it is not critically endangered or endangered; and</li> <li>(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.</li> </ul>
Conservation Dependent	<p>A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:</p> <ul style="list-style-type: none"> <li>(a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or</li> <li>(b) the following subparagraphs are satisfied: <ul style="list-style-type: none"> <li>(i) the species is a species of fish;</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;</li> <li>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;</li> <li>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</li> </ul>

## appendix three: protected matters search results



# EPBC Act Protected Matters Report: Coordinates

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

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

You may wish to print this report for reference before moving to other pages or websites.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

**Report created: 13/12/10 19:11:59**

## [Summary](#)

## [Details](#)

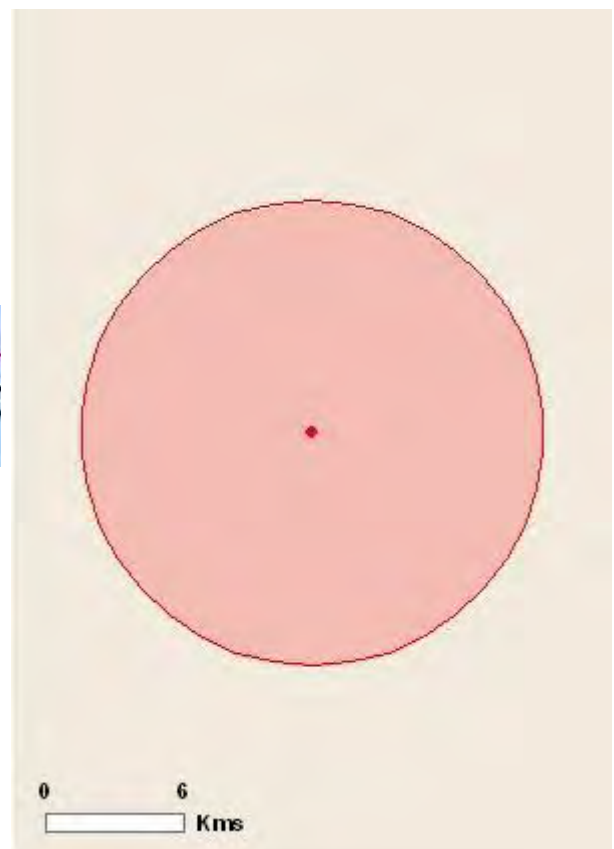
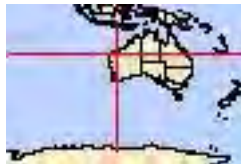
[Matters of NES](#)

[Other matters protected by the EPBC Act](#)

[Extra Information](#)

## [Caveat](#)

## [Acknowledgements](#)



This map may contain data which are  
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[Coordinates](#)

Buffer: 10Km

# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Significance (Ramsar Wetlands):</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Areas:</a>	None
<a href="#">Threatened Ecological Communities:</a>	None
<a href="#">Threatened Species:</a>	4
<a href="#">Migratory Species:</a>	8

## Other Matters Protected by the EPBC Act

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

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

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	6

<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves:</a>	None

## Report Summary for Extra Information

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

<a href="#">Place on the RNE:</a>	None
<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	5
<a href="#">Nationally Important Wetlands:</a>	None

## Details

### Matters of National Environmental Significance

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

Name	Status	Type of Presence
<b>MAMMALS</b>		
<a href="#">Dasyurus hallucatus</a>		
Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Rhinonicteris aurantia (Pilbara form)</a>		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area

#### PLANTS

<a href="#">Lepidium catapycnon</a>		
Hamersley Lepidium, Hamersley Catapycnon [9397]	Vulnerable	Species or species habitat likely to occur within area

#### REPTILES

<a href="#">Liasis olivaceus barroni</a>		
Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area

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

Name	Status	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a>		
Fork-tailed Swift [678]		Species or species habitat may occur within area
<a href="#">Ardea alba</a>		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
<a href="#">Ardea ibis</a>		
Cattle Egret [59542]		Species or species habitat may occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Haliaeetus leucogaster</a>		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area

[Merops ornatus](#)



Rainbow Bee-eater [670] Species or species habitat may occur within area

### **Migratory Wetlands Species**

[Ardea alba](#)

Great Egret, White Egret [59541] Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret [59542] Species or species habitat may occur within area

[Charadrius veredus](#)

Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area

### **Other Matters Protected by the EPBC Act**

#### **Listed Marine Species**

**[ Resource Information ]**

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

#### **Birds**

[Apus pacificus](#)

Fork-tailed Swift [678] Species or species habitat may occur within area

[Ardea alba](#)

Great Egret, White Egret [59541] Species or species habitat may occur within area

[Ardea ibis](#)

Cattle Egret [59542] Species or species habitat may occur within area

[Charadrius veredus](#)

Oriental Plover, Oriental Dotterel [882] Species or species habitat may occur within area

[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle [943] Species or species habitat likely to occur within area

[Merops ornatus](#)

Rainbow Bee-eater [670] Species or species habitat may occur within area

### **Extra Information**

#### **Invasive Species**

**[ Resource Information ]**

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

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

#### **Mammals**

[Felis catus](#)

Cat, House Cat, Domestic Cat [19] Species or species habitat likely to occur within area

[Oryctolagus cuniculus](#)

Rabbit, European Rabbit [128] Species or species habitat likely to occur within area

[Vulpes vulpes](#)

Red Fox, Fox [18] Species or species habitat may occur within area

#### **Plants**

[Cenchrus ciliaris](#)

Buffel-grass, Black Buffel-grass [20213] Species or species habitat likely to occur within area

## Caveat

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

## Coordinates

117.46017 -22.11885

## Acknowledgements

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

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Other groups and individuals](#)

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

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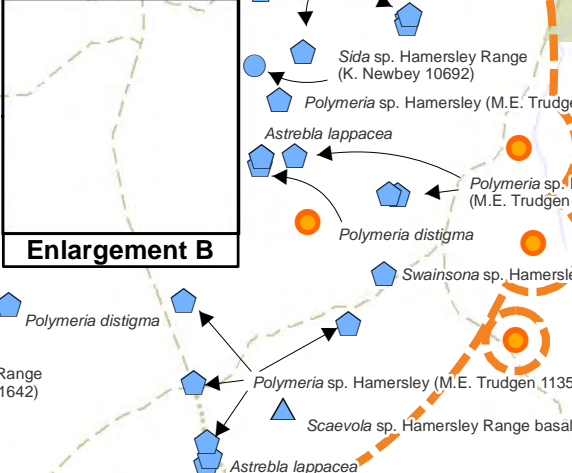
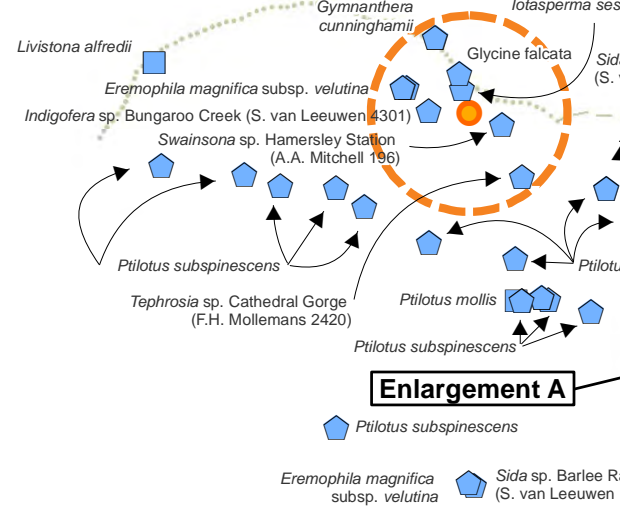
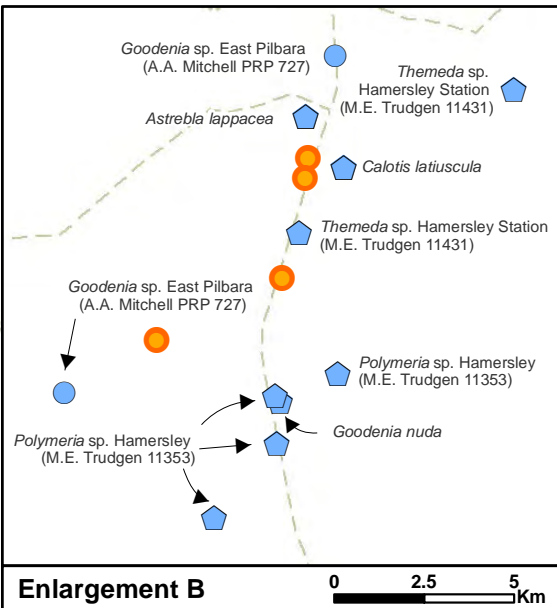
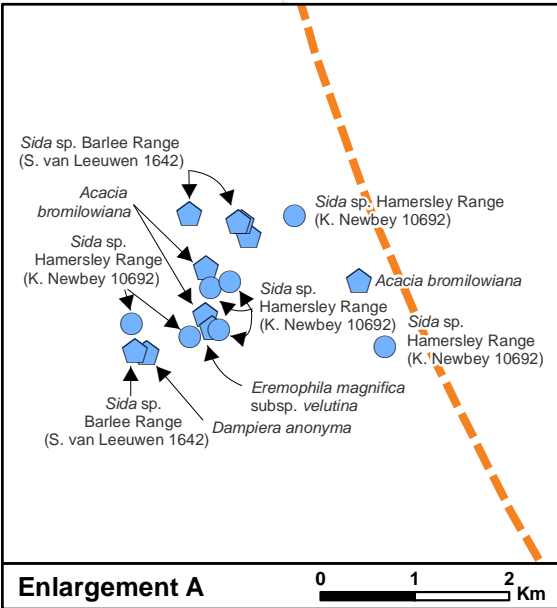
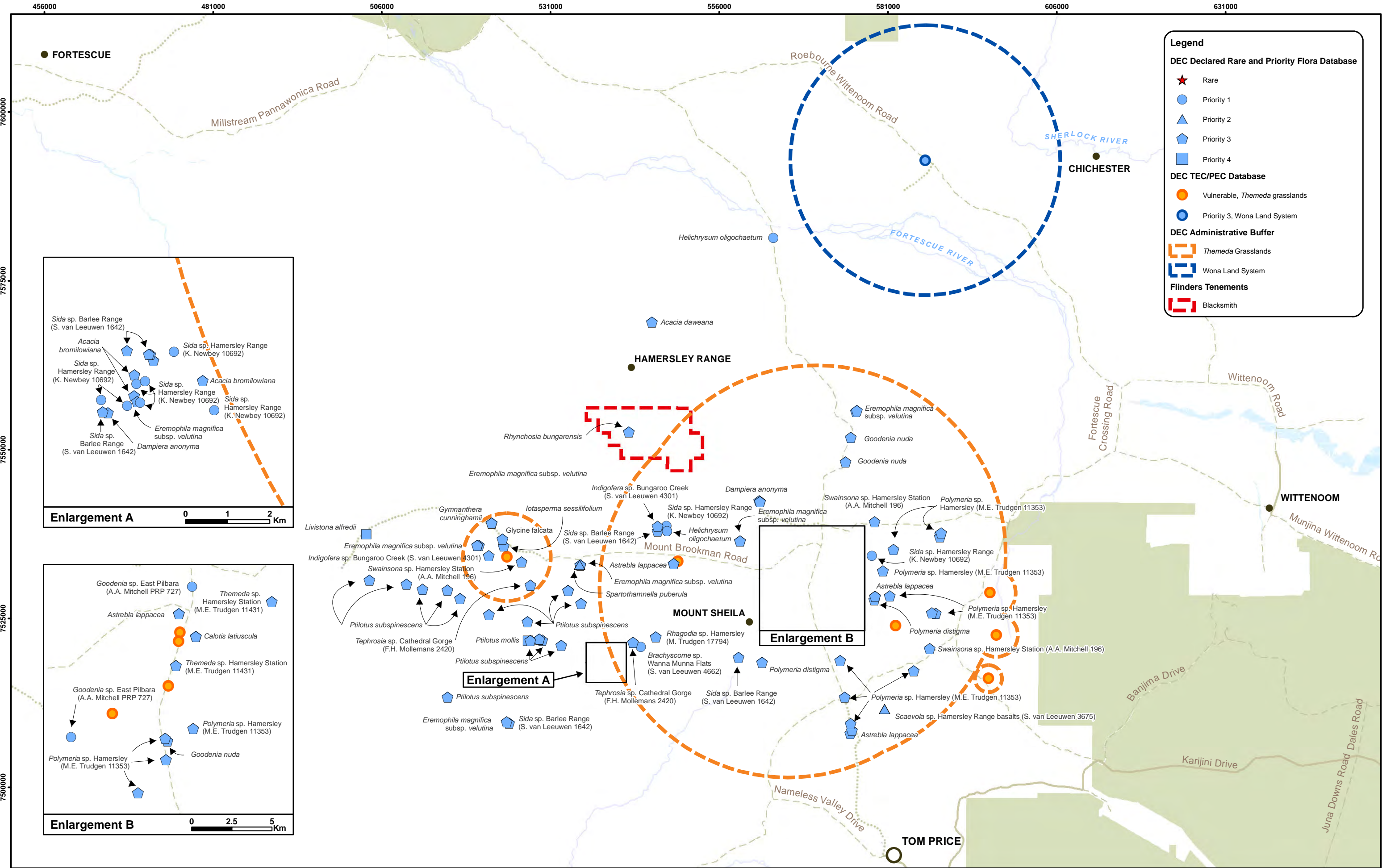
## appendix four: conservation significant flora list

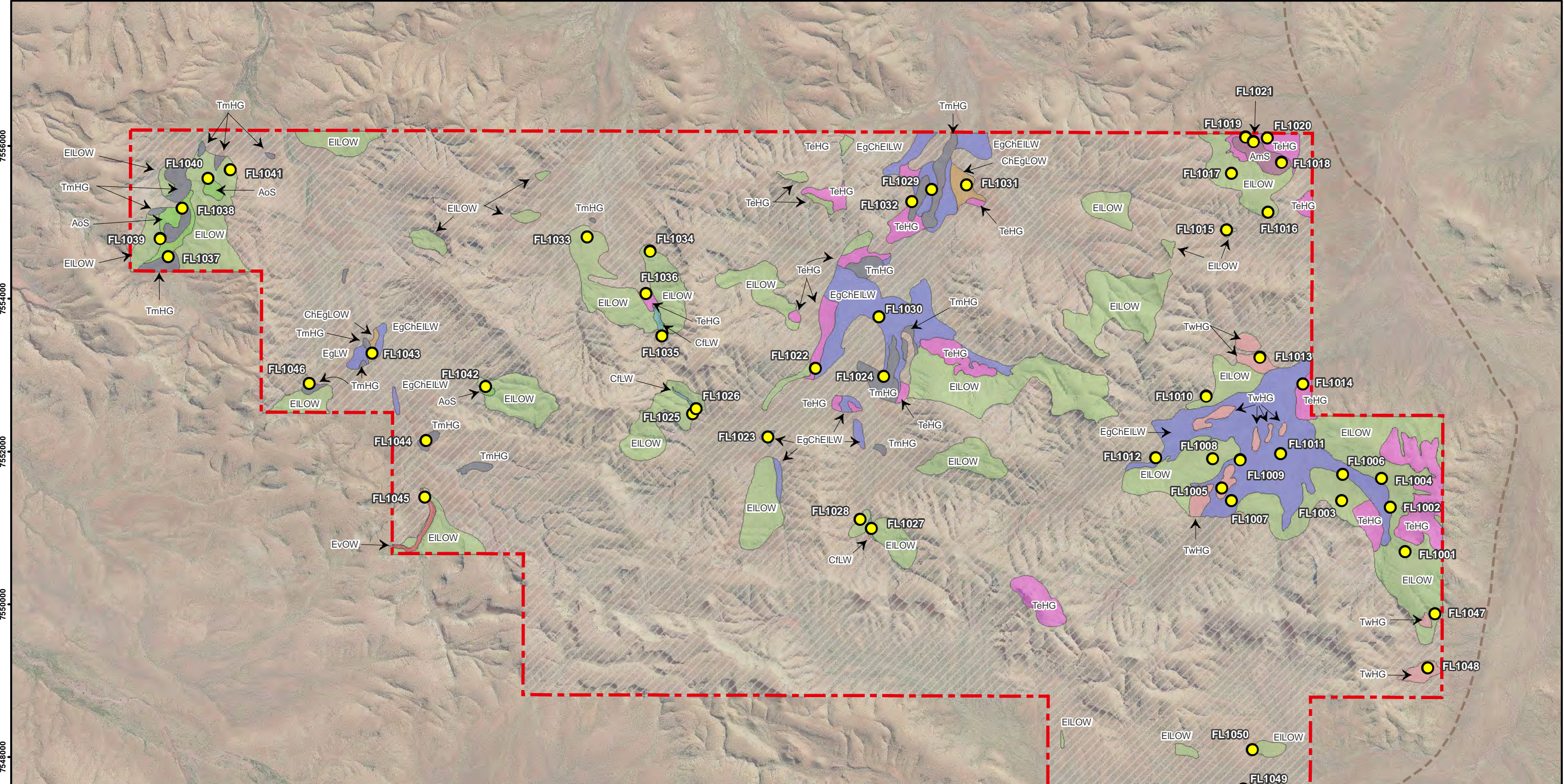
**Table 16: DEC flora database results**

Species	Conservation Code	Habit	Flowering Period	Habitat - Landform
<i>Acacia bromilowiana</i>	P4	Tree or shrub, to 12 m high	Jul-Aug	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds
<i>Acacia dawsoniana</i>	P3	Spreading shrub, 0.3–1.5(–2) m high	Jul-Sep	Stony red loamy soils. Low rocky rises, along drainage lines.
<i>Astrebla lappacea</i>	P3	Tufted perennial, grass-like or herb, 0.3–0.8 m high	Jun–Jul	Clay, loam
<i>Brachyscome</i> sp. Wanna Munna Flats (S. van Leeuwen 4662)	P1	-	-	-
<i>Calotis latiuscula</i>	P3	Erect herb, to 0.5 m high	Jun–Oct	Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds
<i>Dampiera anonyma</i>	P3	Multistemmed perennial, herb, to 0.5(-1) m high.	Jun-Sep	Skeletal red-brown to brown gravelly soil over banded ironstone, basalt, shale and jaspilite. Hill summits, upper slopes
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	P3	Shrub, 0.5–1.5 m high.	Aug–Sep	Skeletal soils over ironstone. Summits.
<i>Glycine falcata</i>	P3	Mat-forming perennial, herb, to 0.2 m high.	May–Jul	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains
<i>Goodenia nuda</i>	P4	Erect to ascending herb to 0.5 m high	Apr-Aug	Plain. Brown-red sand - loam, river beds
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727)	P1	Open, erect annual or biennial, herb, to 0.2 m high.	Aug	Red brown clay, calcrete pebbles, plains, swamps
<i>Gymnanthera cunninghamii</i>	P3	Erect shrub, 1–2 m high.	Jan–Dec	Sandy soil, limestone, creeklines
<i>Helichrysum oligochaetum</i>	P1	Erect annual, herb, to ca 0.25 m high	Aug–Nov	Red clay. Alluvial plains
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	P3	-	-	-
<i>Iotasperma sessilifolium</i>	P3	Erect herb.		Cracking clay, black loam. Edges of waterholes, plains.
<i>Lepidium catapycnon</i>	T	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag	Oct	Skeletal soils. Hillsides
<i>Livistona alfredii</i>	P4	Tree-like monocot (palm), to 10 m high	Jul–Sep	Edges of permanent pools
<i>Polymeria distigma</i>	P3	Prostrate trailing herb.	Apr–Jul.	Sandy soils.
<i>Polymeria</i> sp. Hamersley (M.E. Trudgen 11353)	P3	-	-	-
<i>Ptilotus mollis</i>	P4	Compact, perennial shrub, to 0.5 m high, soft grey foliage	May/Sep	Stony hills and screes

Species	Conservation Code	Habit	Flowering Period	Habitat - Landform
<i>Ptilotus subspinescens</i>	P3	Compact shrub, to 0.8 m high.	sep–Oct	Gentle rocky slopes, screes and the bases of screes.
<i>Rhagodia</i> sp. Hamersley (M. Trudgen 17794)	P3	Erect Shrub		Floodplain / lower slopes
<i>Rhynchosia bungarensis</i>	P4	Compact, prostrate shrub, to 0.5 m high.	-	Pebbly, coarse sand, banks of flow line
<i>Scaevola</i> sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	Shrub, to 1 m high	Jul–Aug.	Skeletal, brown gritty soil over basalt. Summits of hills, steep hills.
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	Spreading shrub, to 0.5 m high	Aug	Skeletal red soils pockets. Steep slope
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692)	P1	-	-	-
<i>Spartothamnella puberula</i>	P2	Shrub, 0.35–1.5 m high.	Sep–Nov	Rocky loam, sandy or skeletal soils, clay. Sandplains, hills.
<i>Swainsona</i> sp. Hamersley Station (A.A. Mitchell 196)	P3	Prostrate annual, herb, to 0.1 m high	Mar.	Flat crab-holed plain
<i>Tephrosia</i> sp. Cathedral Gorge (FH Mollemans 2420)	P3	Erect shrub, to 0.25 m high	Feb	Clay-sand & pebbles
<i>Themeda</i> sp. Hamersley Station (ME Trudgen 11431)	P3	Tussocky perennial, grass-like or herb, 0.9–1.8 m high.	Aug	Red clay. Clay pan, grass plain.
<i>Thryptomene wittweri</i>	T	Spreading or rounded shrub, 0.5–1.5(–2.1) m high.	Apr/Jul/ Aug	Skeletal red stony soils. Breakaways, stony creek beds.

## appendix five: maps





**Legend**

Quadrats	<b>Vegetation Type</b>	ELOW - <i>Eucalyptus leucophloia</i> Low Open Woodland
Local Roads	AmS - <i>Acacia maitlandii</i> Shrubland	EvOW - <i>Eucalyptus victrix</i> Open Woodland
2010 Burnt Areas	AoS - <i>Acacia orthocarpa</i> Shrubland	TeHG - <i>Triodia epactia</i> Hummock Grassland
<b>Flinders Tenements</b>	CFLW - <i>Corymbia ferritcola</i> / <i>Eucalyptus leucophloia</i> Low Open Woodland	TmHG - <i>Triodia aff. melvillei</i> Hummock Grassland
Blacksmith	ChEgLOW - <i>Corymbia hamersleyana</i> / <i>Eucalyptus gamophylla</i> Low Open Woodland	TwHG - <i>Triodia wiseana</i> Hummock Grassland
	EgChEILW - <i>Eucalyptus gamophylla</i> / <i>Corymbia hamersleyana</i> / <i>E. leucophloia</i> Low Woodland	

**Map 2**

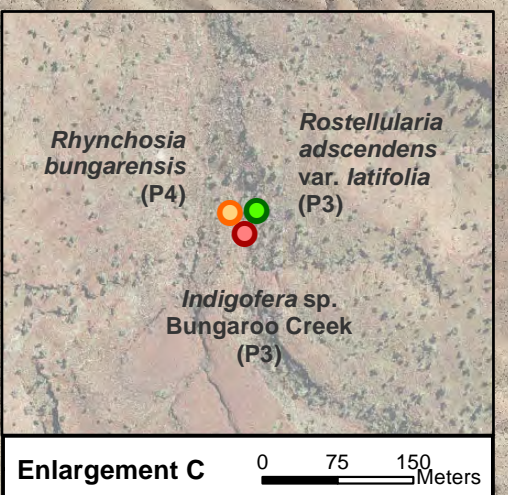
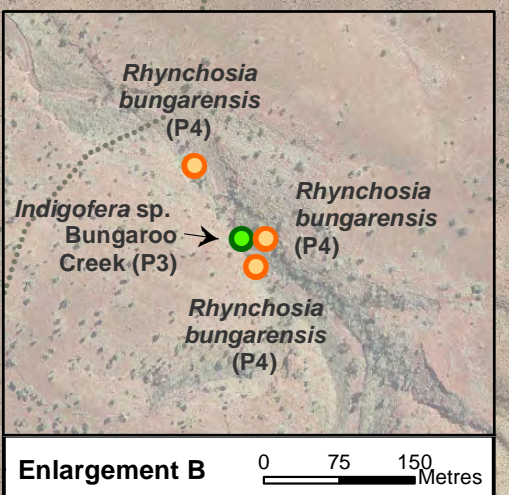
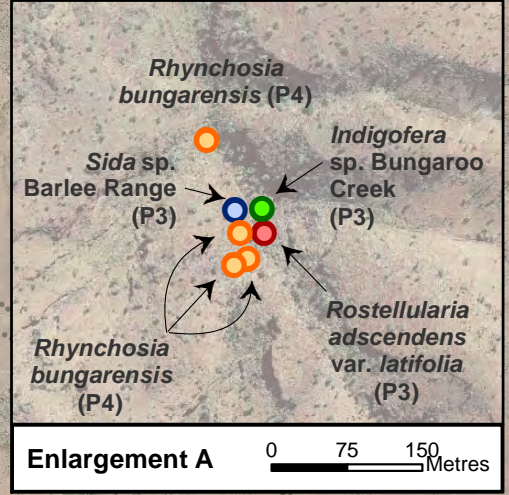
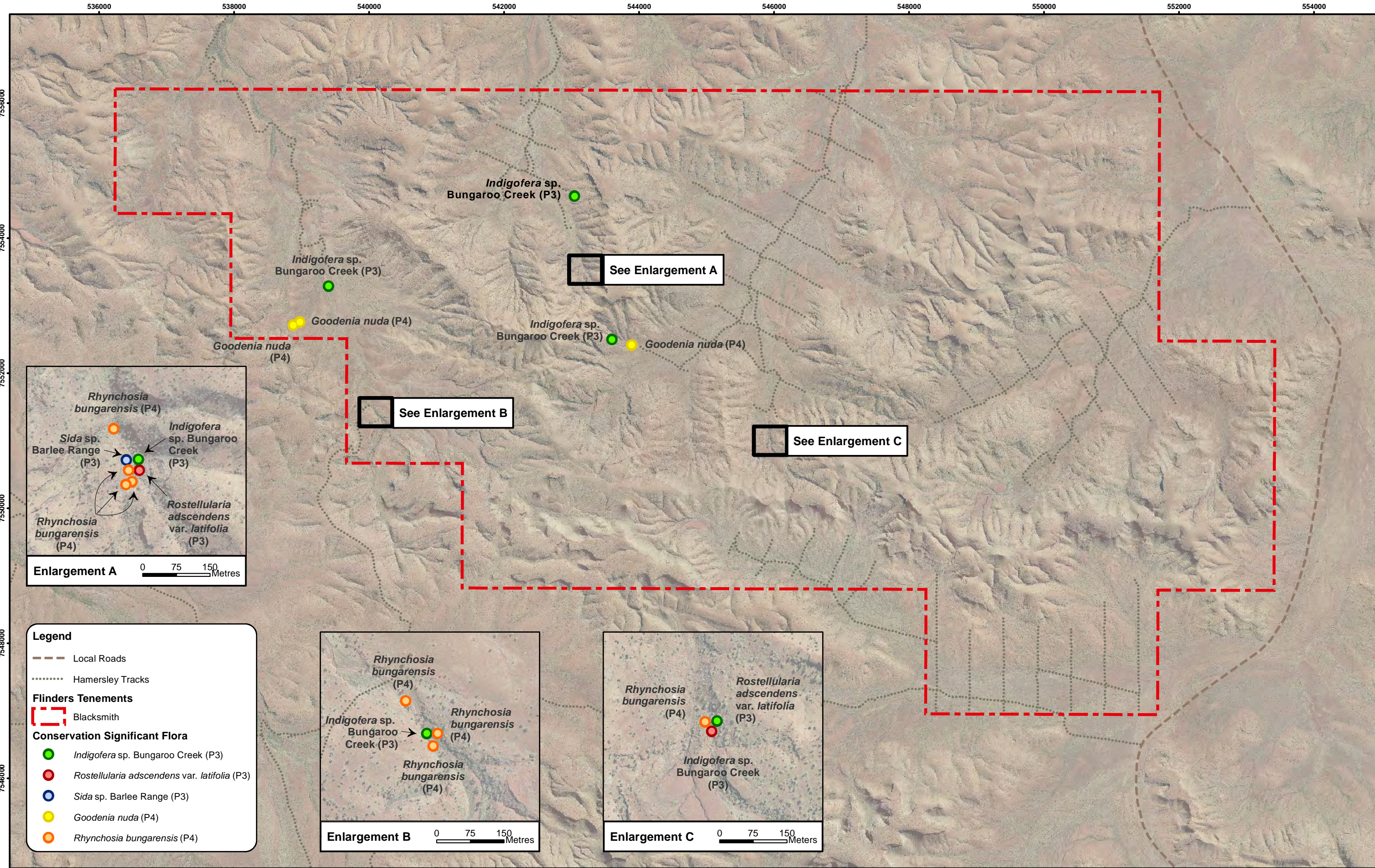
**Pilbara Iron Ore Project - Blacksmith Flora and Vegetation Survey**  
**Vegetation Types**

Nov 2010

prepared for Flinders Mines Ltd  
0 0.5 1 1.5 2 Km  
1:50,000 @ A3  
Project No. 2463-10







**Legend**

- Local Roads (dashed brown line)
- Hamersley Tracks (dotted grey line)

**Flinders Tenements**

- Blacksmith (red dashed outline)

**Conservation Significant Flora**

- Indigofera sp. Bungaroo Creek (P3) (green dot)
- Rostellularia adscendens var. latifolia (P3) (red dot)
- Sida sp. Barlee Range (P3) (blue dot)
- Goodenia nuda (P4) (yellow dot)
- Rhynchosia bungarensis (P4) (orange dot)

**Map 4**

**Pilbara Iron Ore Project - Blacksmith Flora and Vegetation Survey  
Conservation Significant Flora Locations**

Nov 2010

prepared for Flinders Mines Ltd  
 0 0.5 1 1.5 2 Km  
 1:50,000 @ A3  
 Project No. 2463-10



## appendix six: floristic quadrat summaries

Site		FL1001	
Described by Re-score	HEH	01/11/10	Quadrat 50 m x 50 m
	JKN	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	552928 mE 7550690 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate to steep north-west facing mid slope of high hill arm dissected by minor gullies		
Soil	No exposed soil		
Rock Type	Ironstone. Blackish red rocks of angular to sub-angular shape		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Triodia wiseana</i> mid-dense hummock grassland over <i>Cymbopogon ambiguus</i> open tussock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r;G+ ^ <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> ^hummock grass, tussock grass\1\i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	2% leaf litter, litter <1 cm deep, 45% bare ground, no weed cover No evidence of human disturbance Shrub layer depleted by drought		



Images: May 2010 (left), March 2011 (right)

#### Species

*Acacia hamersleyensis*  
*Acacia pyrifolia* var. *pyrifolia*  
*Acacia tenuissima*  
*Amaranthus undulatus*  
*Aristida holathera* var. *holathera*  
*Cleome viscosa*  
*Corchorus lasiocarpus*  
*Cucumis melo* subsp. *agrestis*  
*Cymbopogon ambiguus*  
*Dampiera candidans*  
*Dysphania rhadinostachya* subsp. *rhadinostachya*  
*Eriachne aristidea*  
*Eriachne ciliata*  
*Eriachne mucronata* (typical form)  
*Eucalyptus leucophloia* subsp. *leucophloia*  
*Fimbristylis simulans*  
*Gomphrena cunninghamii*

#### Cover of dominant species (%)

15

2

**Species****Cover of dominant species (%)**

*Goodenia stobbsiana*

*Gossypium australe* (Whim Creek form)

*Grevillea wickhamii*

*Keraudrenia nephrosperma*

*Oldenlandia crouchiana*

*Paspalidium clementii*

*Polycarpaea corymbosa* var. *corymbosa*

*Polycarpaea longiflora*

*Polygala* aff. *isingii*

*Ptilotus calostachyus*

*Ptilotus fusiformis*

*Ptilotus polystachyus*

*Senna glutinosa*

*Solanum ?lasiophyllum*

*Striga curviflora*

*Trachymene oleracea* subsp. *oleracea*

*Trichodesma zeylanicum* var. *zeylanicum*

*Trichosanthes cucumerina* var. *cucumerina*

*Triodia wiseana*

35

*Triumfetta maconochieana*

Site		FL1002	
Described by Re-score	LJA	26/05/10	Quadrat 50 m x 50 m
	JKN	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	552736 mE 7551275 mN	
Season	Poor (2010), Good (2011)		
Habitat	Very gently sloping north facing minor drainage channel on valley floor		
Soil	Sandy loam soil with rock fragments		
Rock Type	No exposed rock		
Vegetation Description	<i>Triodia wiseana</i> closed hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\2\d		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 20% bare ground, no weed cover No evidence of human disturbance Areas of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> saplings. Some dead shrubs		



#### Species

#### Cover of dominant species (%)

*?Clerodendrum*  
*Acacia dictyophleba*  
*Acacia pruinocarpa*  
*Acacia pyrifolia* var. *pyrifolia*  
*Amaranthus undulatus*  
*Aristida holathera* var. *holathera*  
*Cleome viscosa*  
*Clerodendrum floribundum* var. *angustifolium*  
*Corymbia hamersleyana*  
*Cucumis melo* subsp. *agrestis*  
*Cymbopogon ambiguus*  
*Dysphania rhadinostachya* subsp. *rhadinostachya*  
*Enneapogon lindleyanus*

Species	Cover of dominant species (%)
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia biconvexa</i>	
<i>Fimbristylis simulans</i>	
<i>Gossypium australe</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	1
<i>Grevillea wickhamii</i>	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Oldenlandia crouchiana</i>	
<i>Phyllanthus maderaspatensis</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus polystachyus</i>	
<i>Rhynchosia minima</i>	
<i>Santalum lanceolatum</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Themeda triandra</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	
<i>Triodia wiseana</i>	80

Site		FL1003	
Described by Re-score	HEH	26/05/10	Quadrat 50 m x 50 m
	JKN	30/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	552099 mE 7551360 mN	
Season	Poor (2010), Good (2011)		
Habitat	Steep north facing lower scree slope of low hill		
Soil	No soil exposed		
Rock Type	Ironstone. Red rocks of subrounded to angular shape		
Vegetation Description	<i>Triodia wiseana</i> mid-dense hummock grassland over <i>Cymbopogon ambiguus</i> open tussock grassland with <i>Hakea chordophylla</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> scattered shrubs		
NVIS V	U ^ <i>Hakea chordophylla</i> ^tree\6\r;M ^ <i>Senna glutinosa</i> subsp. <i>glutinosa</i> \^shrub\3\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>2 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 46% bare ground, no weed cover No evidence of human disturbance		



**Species**

**Cover of dominant species (%)**

*Acacia dictyophleba*

*Acacia tenuissima*

*Aristida holathera* var. *holathera*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Bulbostylis barbata*

*Cleome viscosa*

*Cucumis maderaspatanus*

*Cymbopogon ambiguus*

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*Dysphania rhadinostachya* subsp. *rhadinostachya*

*Enneapogon lindleyanus*

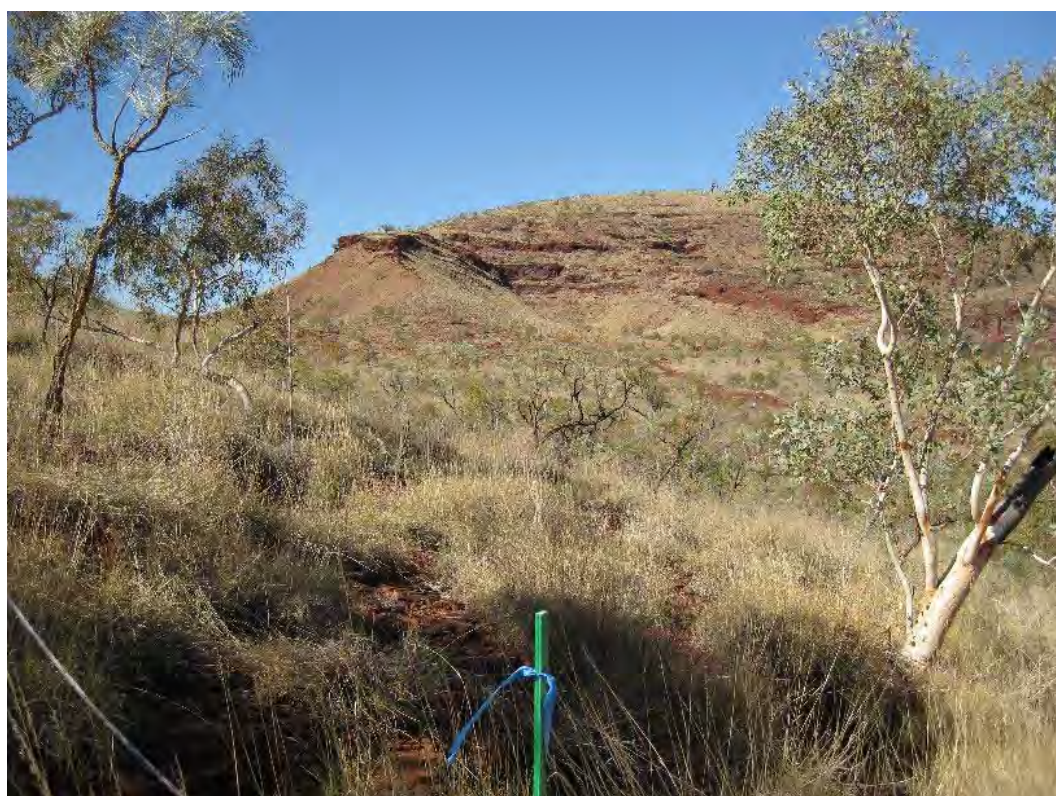
*Enneapogon polyphyllus*

*Eriachne aristidea*

<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia australis</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Hakea chordophylla</i>	1-2
<i>Indigofera monophylla</i> (MJOPP-2)	
<i>Mnesithea formosa</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus auriculifolius</i>	8
<i>Ptilotus calostachyus</i>	
<i>Ptilotus clementii</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Ptilotus incanus</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Striga curviflora</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Tribulus hirsutus</i>	
<i>Tribulus platypterus</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia wiseana</i>	40
<i>Yakirra australiensis</i> var. <i>australiensis</i>	



Site		FL1004	
Described by	LJA	26/05/10	Quadrat 50 m x 50 m
Re-score	JKN	30/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	552619 mE	7551648 mN
Season	Poor (2010), Good (2011)		
Habitat	Moderate south facing lower slope with minor gully		
Soil	Red skeletal loam		
Rock Type	Banded ironstone		
Vegetation Description	<i>Triodia epactia</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> scattered tall shrubs		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\;M ^ <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> ^shrub\3\;G+ ^ <i>Triodia epactia</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	5% leaf litter, litter 1-2 cm deep, 80% bare ground, no weed cover No evidence of human disturbance		



#### Species

*Acacia dictyophleba*

*Acacia monticola*

*Acacia orthocarpa*

*Acacia pyrifolia* var. *pyrifolia*

*Aristida holathera* var. *holathera*

*Bidens bipinnata*

*Bulbostylis barbata*

*Cleome viscosa*

*Clerodendrum floribundum* var. *angustifolium*

*Corchorus lasiocarpus*

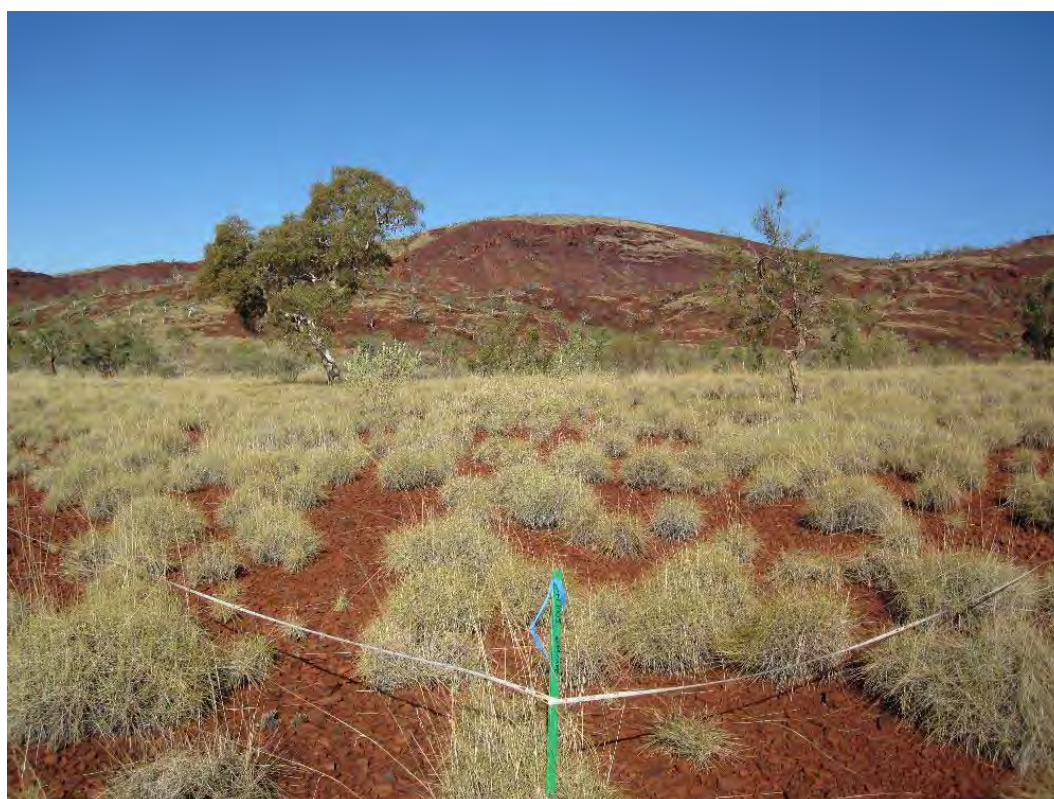
*Corymbia hamersleyana*

*Cucumis maderaspatanus*

#### Cover of dominant species (%)

Species	Cover of dominant species (%)
<i>Cymbopogon ambiguus</i>	
<i>Dodonaea coriacea</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Ehretia saligna</i> var. <i>saligna</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Euphorbia alsiniflora</i>	
<i>Gompholobium</i> sp. Pilbara (N.F. Norris 908)	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia muelleriana</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	1
<i>Hybanthus aurantiacus</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia</i> sp. (FL1004)	
<i>Mirbelia viminalis</i>	
<i>Mnesithea formosa</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus auriculifolius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna notabilis</i>	
<i>Sida</i> sp. articulation below (A.A. Mitchell PRP 1605)	
<i>Solanum ?asiophyllum</i>	
<i>Tephrosia spechtii</i>	
<i>Themeda triandra</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	15
<i>Triodia wiseana</i>	
<i>Triumfetta maconochieana</i>	
<i>Waltheria virgata</i>	
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

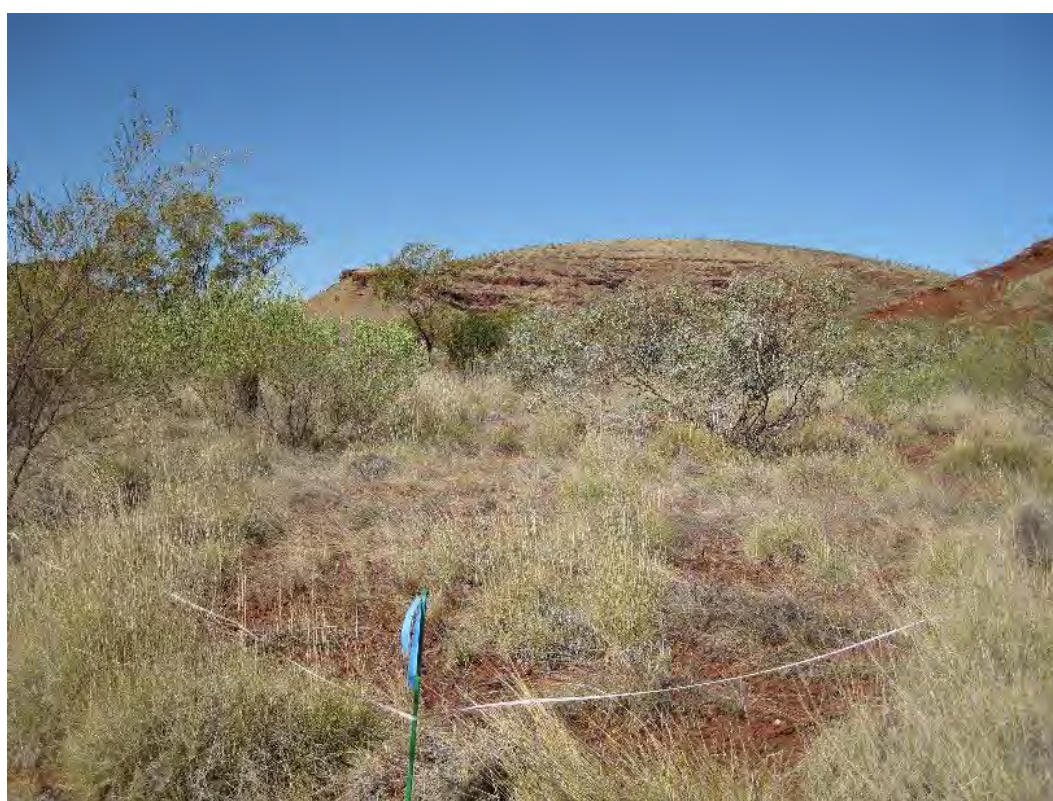
Site		FL1005	
Described by	HEH	26/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	5502528 mE 7551527 mN	
Season	Poor (2010), Good (2011)		
Habitat	Very gentle, south east facing, upper slope and crest of very low hill		
Soil	No soil exposed		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>C. hamersleyana</i> low open woodland over <i>Triodia wiseana</i> mid-dense hummock grassland		
NVIS V	U ^ <i>Corymbia deserticola</i> subsp. <i>deserticola</i> , ^ <i>C. hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	5% leaf litter, litter 1-2 cm deep, 80% bare ground, no weed cover No evidence of human disturbance		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	1
<i>Acacia maitlandii</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia retivenea</i>	
<i>Amaranthus undulatus</i>	
<i>Aristida holathera</i> var. <i>latifolia</i>	
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	<2
<i>Corymbia hamersleyana</i>	<2
<i>Cucumis maderaspatanus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	

Species	Cover of dominant species (%)
<i>Eriachne aristidea</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Fimbristylis simulans</i>	
<i>Gompholobium</i> sp. Pilbara (N.F. Norris 908)	
<i>Goodenia stobbsiana</i>	
<i>Hakea chordophylla</i>	
<i>Hibiscus leptocladus</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Rhynchosia minima</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Solanum phlomoides</i>	
<i>Themeda triandra</i>	
<i>Triodia wiseana</i>	48

Site		FL1006	
Described by	LJA	26/05/10	Quadrat 50 m x 50 m
	JKN	30/08/10	
Re-score	JKN	26/03/11	
MGA Zone	GDA94 50	552113 mE 7551703 mN	
Season	Poor (2010), Good (2011)		
Habitat	Flat valley floor with some incised minor drainages		
Soil	Red clay loam with loose rock		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus gamophylla</i> low open woodland over <i>Acacia dictyophleba</i> , <i>A. monticola</i> , <i>A. pyrifolia</i> and <i>A. atkinsiana</i> tall open shrubland over <i>Triodia epactia</i> and <i>T. wiseana</i> hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> and <i>Themeda triandra</i> very open tussock grassland with <i>Corymbia hamersleyana</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> \^tree\6r;M ^ <i>Acacia dictyophleba</i> , ^ <i>A. monticola</i> , <i>A. pyrifolia</i> \^shrub\4c;G+ ^ <i>Triodia epactia</i> , <i>T. wiseana</i> , <i>Aristida holathera</i> var. <i>holathera</i> \^hummock grass, tussock grass\2i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	2% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover No evidence of human disturbance		

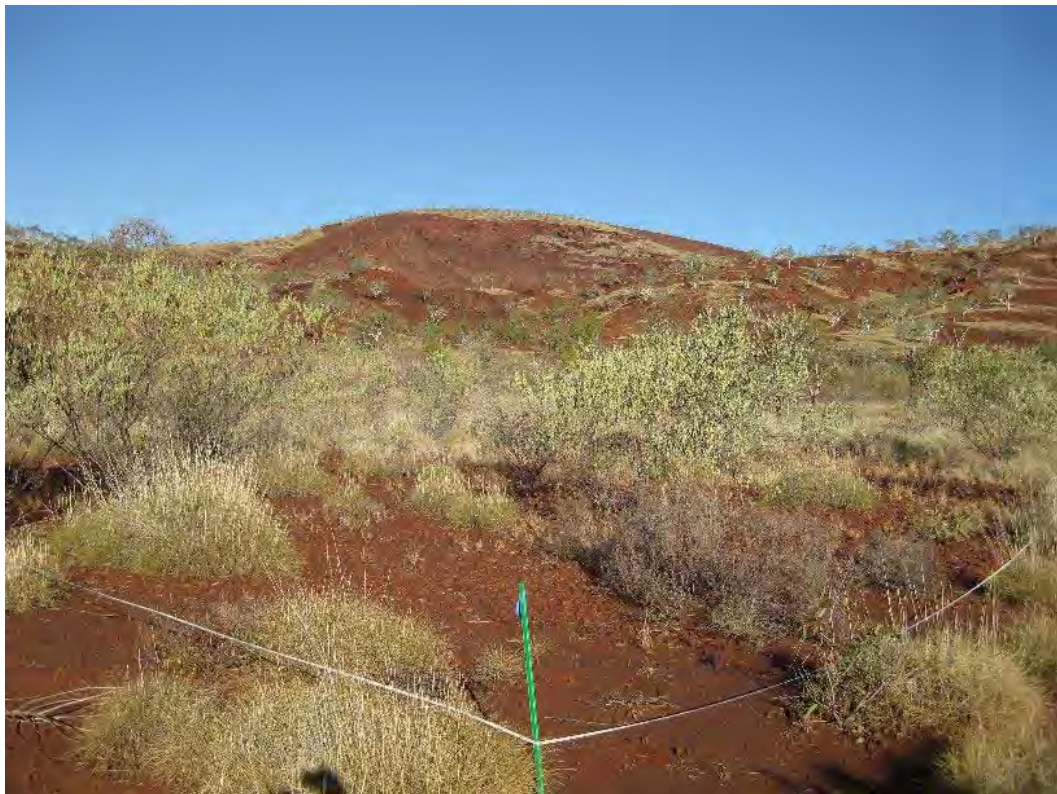


Species	Cover of dominant species (%)
<i>Abutilon dioicum</i>	
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia atkinsiana</i>	
<i>Acacia dictyophleba</i>	1
<i>Acacia monticola</i>	1
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia tenuissima</i>	
<i>Amaranthus undulatus</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	2
<i>Bidens bipinnata</i>	
<i>Bulbostylis barbata</i>	

Species	Cover of dominant species (%)
<i>Cassytha capillaris</i>	
<i>Cenchrus ciliaris</i>	
<i>Cleome viscosa</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	1
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	
<i>Digitaria brownii</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Enneapogon lindleyanus</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus gamophylla</i>	2
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia microptera</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Grevillea wickhamii</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Mirbelia viminalis</i>	
<i>Mnesithea formosa</i>	
<i>Mollugo molluginea</i>	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus auriculifolius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Rhynchosia minima</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	

Species	Cover of dominant species (%)
<i>Solanum diversiflorum</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Themeda triandra</i>	2
<i>Tribulus hirsutus</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	15
<i>Triodia wiseana</i>	2
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL1007	
Described by	LJA	26/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	550653 mE 7551357 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor with minor drainage channels		
Soil	Red clay loam		
Rock Type	Ironstone. 50-90% rock cover of sub-angular tabular to sub-rounded tabular shape		
Vegetation Description	<i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>A. retivenea</i> tall open shrubland over <i>Triodia epactia</i> mid-dense hummock grassland		
NVIS V	M ^ <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>A. retivenea</i> ^\^shrub\4\;G+ ^ <i>Triodia epactia</i> ^\^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	5% leaf litter, litter <1 cm deep, 60% bare ground, no weed cover No evidence of human disturbance		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	2
<i>Acacia elachantha</i>	
<i>Acacia elachantha</i> (golden hairy variant)	
<i>Acacia maitlandii</i>	
<i>Acacia monticola</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia retivenea</i>	2
<i>Acacia tenuissima</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	2
<i>Amaranthus undulatus</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	
<i>Aristida holathera</i> var. <i>latifolia</i>	



Species	Cover of dominant species (%)
<i>Boerhavia coccinea</i>	
<i>Bonamia rosea</i>	
<i>Cleome viscosa</i>	
<i>Corchorus</i> aff. <i>parviflorus</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	
<i>Crotalaria novae-hollandiae</i> subsp. <i>novae-hollandiae</i>	
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eragrostis cumingii</i>	
<i>Eriachne aristidea</i>	
<i>Eucalyptus gamophylla</i>	
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Fimbristylis simulans</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia triodiophila</i>	
<i>Gossypium australe</i>	
<i>Grevillea wickhamii</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Hibiscus leptocladus</i>	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Paspalidium clementii</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla x glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Swainsona formosa</i>	
<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)	1
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	3.5
<i>Triodia wiseana</i>	1

Site		FL1008	
Described by	LJA	26/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	550406 mE 7551904 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle mostly north facing upper slope to crest of low rise in valley		
Soil	Red skeletal loamy clay with rock fragments		
Rock Type	Ironstone. 70-100% surface rock of rounded to sub-angular shape and 2-10% outcropping		
Vegetation Description	<i>Triodia wiseana</i> hummock grassland with <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> scattered tall shrubs over <i>Acacia maitlandii</i> scattered shrubs		
NVIS V	U ^ <i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6;c;M ^ <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> , ^ <i>Acacia maitlandii</i> ^shrub\4;r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\2 i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover Several seedling <i>Acacia maitlandii</i> and many dead <i>Gompholobium</i> sp. Pilbara		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia dictyophleba*

*Acacia maitlandii*

*Acacia monticola*

*Acacia pyrifolia* var. *pyrifolia*

*Acacia retivenea*

*Acacia tenuissima*

*Aristida holathera* var. *holathera*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Cassytha capillaris*

*Corymbia hamersleyana*

1

1

Species	Cover of dominant species (%)
<i>Cucumis melo</i> subsp. <i>agrestis</i>	
<i>Cymbopogon ambiguus</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Fimbristylis simulans</i>	
<i>Gompholobium</i> sp. Pilbara (N.F. Norris 908)	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia stobbsiana</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	1
<i>Hakea chordophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus calostachyus</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	
<i>Triodia wiseana</i>	20
<i>Triumfetta maconochieana</i>	

Site		FL1009	
Described by	HEH	26/05/10	Quadrat 40 m x 63 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	550768 mE 7551888 mN	
Season	Poor (2010), Good (2011)		
Habitat	Slightly undulating valley floor		
Soil	Stony silty loam		
Rock Type	Red to dark reddish brown pisolite and lag gravel		
Vegetation Description	<i>Eucalyptus gamophylla</i> and <i>E. leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>A. elachantha</i> tall open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Aristida</i> (FL1009) very open tussock grassland with <i>Acacia dictyophleba</i> and <i>Acacia retivenea</i> scattered shrubs		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\7\r;M ^ <i>Acacia tumida</i> var. <i>pilbarensis</i> , ^ <i>A. elachantha</i> , <i>A. dictyophleba</i> \^shrub\4\r;G+ ^ <i>Triodia epactia</i> , <i>Aristida</i> sp. (FL1009)\^hummock grass, tussock grass\2\i		
Vegetation Condition	Very Good		
Fire Age	>5 years	No evidence of recent fire	
Notes	2% leaf litter, litter 0-2 cm deep, 70% bare ground, no weed cover Disturbance type: Minor clearing (ripped track through quadrat)		



Species	Cover of dominant species (%)
<i>Acacia dictyophleba</i>	1
<i>Acacia elachantha</i> (golden hairy variant)	1
<i>Acacia elachantha</i> (silvery hairy variant)	
<i>Acacia maitlandii</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia retivenea</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	1
<i>Aristida holathera</i> var. <i>latifolia</i>	
<i>Aristida</i> sp. (FL1009)	8
<i>Bonamia rosea</i>	
<i>Cleome viscosa</i>	

Species	Cover of dominant species (%)
<i>Corchorus</i> aff. <i>parviflorus</i>	
<i>Cucumis maderaspatanus</i>	
<i>Eragrostis</i> aff. <i>eriopoda</i>	
<i>Eriachne aristidea</i>	
<i>Eucalyptus gamophylla</i>	7
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Heliotropium ovalifolium</i>	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paspalidium clementii</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna</i> sp.	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Tribulopsis angustifolia</i>	
<i>Tribulus hirsutus</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	20
<i>Triumfetta maconochieana</i>	

Site		FL10010	
Described by	LJA	27/05/10	Quadrat 50 m x 50 m
Re-score	JKN	31/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	550324 mE 7552725 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle south facing footslope of steep hill		
Soil	Red skeletal clay loam		
Rock Type	Ironstone. Continuous lag gravel		
Vegetation Description	<i>Triodia wiseana</i> mid-dense hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\2\c		
Vegetation Condition	Very Good		
Fire Age	>5 years	Adjacent to recently burnt area (Feb/Mar)	
Notes	<1% leaf litter, litter <1 cm deep, 50% bare ground, no weed cover No evidence of human disturbance		



#### Species

#### Cover of dominant species (%)

*Acacia hamersleyensis*  
*Acacia pyrifolia* var. *pyrifolia*  
*Acacia tenuissima*  
*Amyema* sp.  
*Aristida holathera* var. *holathera*  
*Cassytha capillaris*  
*Cleome viscosa*  
*Corymbia hamersleyana*  
*Crotalaria novae-hollandiae* subsp. *novae-hollandiae*  
*Cymbopogon obtectus*  
*Dampiera candicans*  
*Diplatia grandibractea*  
*Dodonaea coriacea*

Species	Cover of dominant species (%)
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.5
<i>Fimbristylis simulans</i>	
<i>Hakea chordophylla</i>	
<i>Indigofera monophylla</i>	
<i>Isotropis atropurpurea</i>	
<i>Paspalidium clementii</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Setaria surgens</i>	
<i>Themeda triandra</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	
<i>Triodia wiseana</i>	50

Site		FL1011	
Described by	HEH	27/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	551298 mE 7551968 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	No soil exposed		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus gamophylla</i> and <i>E. leucophloia</i> subsp. <i>leucophloia</i> low woodland over <i>Acacia elachantha</i> tall open shrubland over <i>Mirbelia viminialis</i> open shrubland over <i>Triodia epactia</i> mid-dense hummock grassland with <i>Aristida holathera</i> var. <i>holathera</i> scattered tussock grasses		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> , <i>E. leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r;M ^ <i>Mirbelia viminialis</i> , <i>Acacia elachantha</i> ^shrub\4\r;G+ ^ <i>Triodia epactia</i> , <i>Aristida holathera</i> var. <i>holathera</i> ^hummock grass, tussock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>2 years	Charred stumps and logs	
Notes	16% leaf litter, litter 1 cm deep, 60% bare ground, no weed cover No evidence of human disturbance Very minor <i>Mirbelia viminialis</i> drainage line		

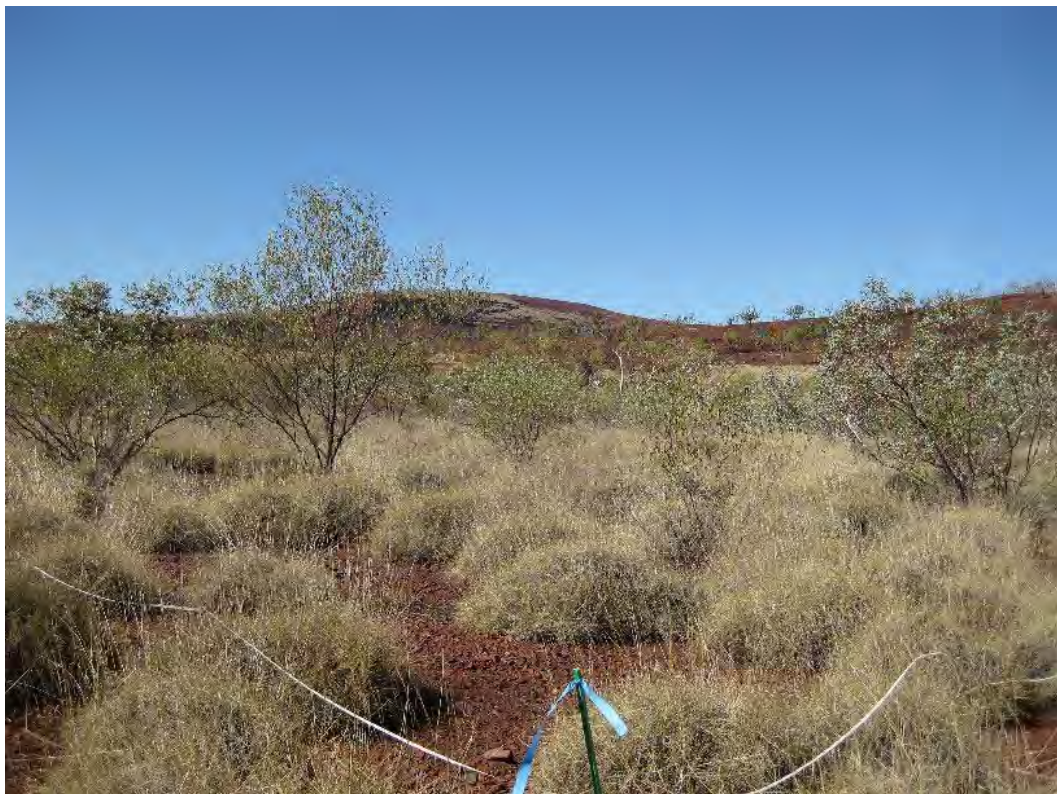


Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia ancistrocarpa</i>	
<i>Acacia arida</i>	
<i>Acacia dictyophleba</i>	
<i>Acacia elachantha</i>	2
<i>Acacia hamersleyensis</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia tenuissima</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	1
<i>Cleome viscosa</i>	



Species	Cover of dominant species (%)
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	
<i>Corymbia hamersleyana</i>	2
<i>Cucumis melo</i> subsp. <i>agrestis</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus gamophylla</i>	8
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	4
<i>Fimbristylis simulans</i>	
<i>Goodenia nuda</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i> (Whim Creek form)	
Indeterminant spp.	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Mirbelia viminalis</i>	2.5
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus fusiformis</i>	
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Themeda triandra</i>	
<i>Tribulus hirsutus</i>	
<i>Triodia epactia</i>	32

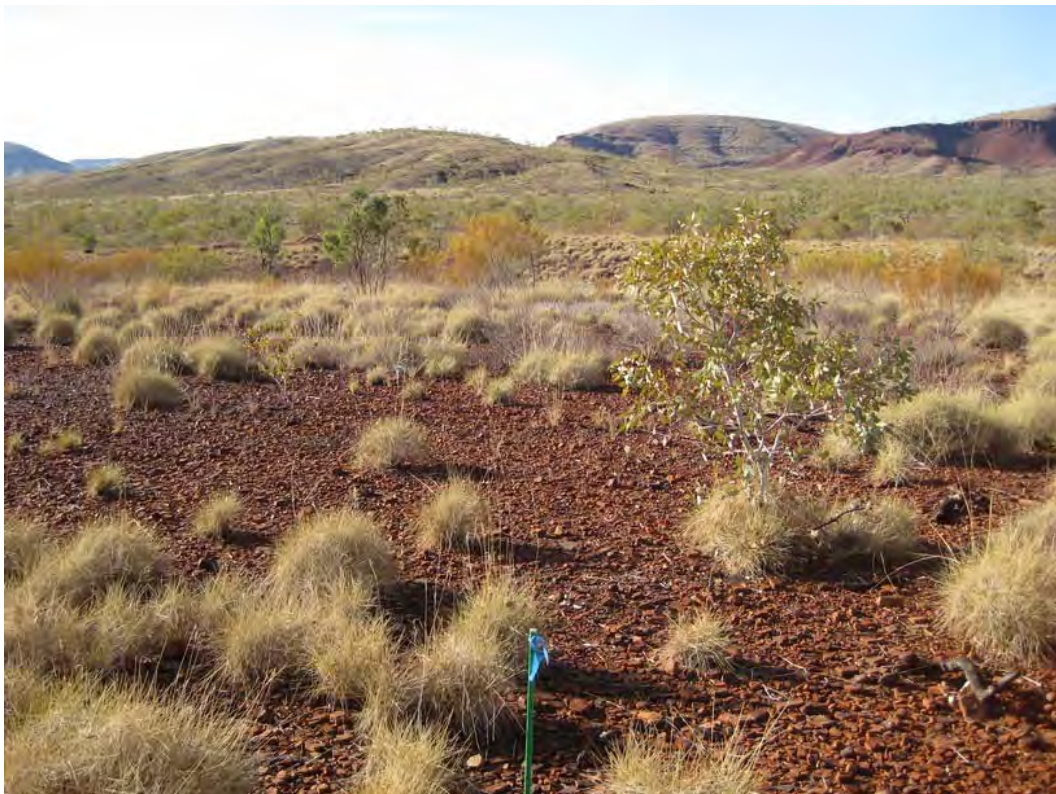
Site		FL10012	
Described by	LJA	27/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	HEH	26/03/11	
MGA Zone	GDA94 50	549664 mE 7551917 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Dark brownish clay loam		
Rock Type	Alluvial. 50-90% pebbles to cobbles, of sub-angular to sub-rounded shape		
Vegetation Description	<i>Eucalyptus gamophylla</i> low open woodland over <i>Acacia dictyophleba</i> and <i>A. retivenea</i> tall open shrubland over <i>Triodia epactia</i> hummock grassland		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> ^tree\6\r;M ^ <i>Acacia dictyophleba</i> , <i>A. retivenea</i> ^shrub\4\r;G+ ^ <i>Triodia epactia</i> ^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5years	No evidence of recent fire	
Notes	5% leaf litter, litter 1-2 cm deep, 75% bare ground, no weed cover No evidence of human disturbance		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	5
<i>Acacia elachantha</i>	
<i>Acacia monticola</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia retivenea</i>	5
<i>Acacia tumida</i> var. <i>pilbarensis</i>	
<i>Amyema</i> sp.	
<i>Aristida holathera</i> var. <i>holathera</i>	
<i>Boerhavia coccinea</i>	
<i>Bonamia rosea</i>	
<i>Cleome viscosa</i>	

Species	Cover of dominant species (%)
<i>Corymbia hamersleyana</i>	
<i>Cucumis melo</i> subsp. <i>agrestis</i>	
<i>Cymbopogon ambiguus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eucalyptus gamophylla</i>	6
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Goodenia microptera</i>	
<i>Hakea chordophylla</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Paraneurachne muelleri</i>	
<i>Paspalidium clementii</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus polystachyus</i>	
<i>Rhynchosia minima</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna venusta</i>	
<i>Sida</i> aff. <i>pilbarensis</i> (EOB46-01B)	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia</i> aff. <i>melvillei</i>	
<i>Triodia epactia</i>	25

Site		FL10013	
Described by	HEH	27/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	551028 mE 7553232 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle south east facing upper slope to crest of low undulating hill		
Soil	No soil exposed		
Rock Type	Ironstone. Abundant red small to large pebbles of sub-angular tabular to sub-rounded tabular shape		
Vegetation Description	<i>Triodia wiseana</i> mid-dense hummock grassland with <i>Corymbia deserticola</i> subsp. <i>deserticola</i> , <i>C. hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Hakea chordophylla</i> low scattered trees with <i>Acacia tenuissima</i> scattered shrubs		
NVIS V	U ^ <i>Hakea chordophylla</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> , <i>C. hamersleyana</i> ^tree\6\r;M ^ <i>Acacia tenuissima</i> ^shrub\3\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>2 years	Surrounded by recent (Feb/Mar 2010) fire	
Notes	<2% leaf litter, litter <1 cm deep, 55% bare ground, no weed cover No evidence of human disturbance within quadrat, though close to drill lines Old pebble mouse mound. <i>Gompholobium</i> sp. Pilbara would make a shrub layer if alive but the majority was dead at this time.		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	
<i>Acacia elachantha</i>	
<i>Acacia retivenea</i>	
<i>Acacia tenuissima</i>	<2
<i>Aristida holathera</i> var. <i>holathera</i>	
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	1
<i>Corymbia hamersleyana</i>	
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	

<i>Dodonaea coriacea</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Eulalia aurea</i>	
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
<i>Fimbristylis simulans</i>	
<i>Gompholobium</i> sp. Pilbara (N.F. Norris 908)	
<i>Goodenia stobbsiana</i>	
<i>Hakea chordophylla</i>	3
<i>Hybanthus aurantiacus</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	1
<i>Mollugo molluginea</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Sida arenicola</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	
<i>Triodia wiseana</i>	40
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL10014	
Described by	LJA	27/05/10	Quadrat 50 m x 50 m
Re-score	JKN	30/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	551590 mE 7552884 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor (no association with drainage)		
Soil	Red clay loam		
Rock Type	Ironstone. Pebbles to cobbles		
Vegetation Description	<i>Triodia epactia</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Eucalyptus gamophylla</i> scattered low mallee over <i>Acacia ancistrocarpa</i> , <i>A. tumida</i> , var. <i>pilbarensis</i> , <i>A. tenuissima</i> and <i>A. pyrifolia</i> scattered shrubs		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Eucalyptus gamophylla</i> ^tree, tree mallee\6\;M ^^ <i>Acacia ancistrocarpa</i> , <i>A. tumida</i> var. <i>pilbarensis</i> , <i>A. tenuissima</i> \shrub\3\;G+ ^ <i>Triodia epactia</i> ^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5 years	Old fire scars on trees	
Notes	2% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover No evidence of human disturbance Several dead <i>Acacia tumida</i> (drought?)		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia ancistrocarpa*

<1

*Acacia dictyophleba*

*Acacia pyrifolia* var. *pyrifolia*

<1

*Acacia tenuissima*

*Acacia tumida* var. *pilbarensis*

<1

*Aristida holathera* var. *holathera*

*Aristida holathera* var. *latifolia*

*Cleome viscosa*

*Corchorus lasiocarpus*

*Eriachne ciliata*

Species	Cover of dominant species (%)
<i>Eucalyptus gamophylla</i>	1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Goodenia stobbsiana</i>	
<i>Hakea chordophylla</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Paspalidium clementii</i>	
<i>Polycarpaea holtzei</i>	
<i>Polygala</i> aff. <i>isingii</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Rhyncharrhena linearis</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Sida</i> aff. <i>echinocarpa</i> (MET 15,350)	
<i>Solanum ?lasiophyllum</i>	
<i>Solanum diversiflorum</i>	
<i>Themeda triandra</i>	
<i>Triodia epactia</i>	20
<i>Triodia wiseana</i>	

Site		FL10015	
Described by	HEH	27/05/10	Quadrat 50 m x 50 m
Re-score	HEH	28/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	550589 mE 7554900 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle to moderate east facing mid slope of tall hill		
Soil	No soil exposed		
Rock Type	Ironstone. Blackish red small pebbles to stones of subrounded shape		
Vegetation Description	<i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Triodia epactia</i> hummock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , ^ <i>Corymbia hamersleyana</i> \^tree\6\r; G+ ^ <i>Triodia epactia</i> \^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5 yrs, 5% <1 yr	Feb/Mar 2010 in NW corner (5% of quadrat) . Fire scars through area	
Notes	5% leaf litter, litter 1-2 cm deep (around trees), 83% bare ground, no weed cover No evidence of human disturbance		



**Species**

**Cover of dominant species (%)**

- Aristida holathera* var. *latifolia*
- Bonamia* sp. Dampier (A.A. Mitchell PRP 217)
- Cleome viscosa*
- Corchorus incanus* subsp. *incanus*
- Corchorus lasiocarpus* subsp. *parvus*
- Corymbia hamersleyana*
- Cucumis maderaspatanus*
- Cymbopogon ambiguus*
- Dampiera candidans*
- Dysphania rhadinostachya* subsp. *rhadinostachya*
- Eriachne aristidea*

2



Species	Cover of dominant species (%)
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2
<i>Fimbristylis simulans</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
Indeterminant spp.	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus calostachyus</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Tephrosia</i> aff. <i>supina</i> (HD133-20)	
<i>Triodia epactia</i>	15
<i>Waltheria virgata</i>	

Site		FL10016	
Described by	HEH	27/05/10	Quadrat 50 m x 50 m
Re-score	HEH	28/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	551133 mE 7555133 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate east facing upper slope of east west spur		
Soil	No soil exposed		
Rock Type	Banded Ironstone. 50-90% rock of angular tabular to sub-rounded tabular shape with 10-30% outcropping,		
Vegetation Description	<i>Triodia wiseana</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Eriachne mucronata</i> scattered tussock grasses		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\;G+ ^ <i>Triodia wiseana</i> , <i>Eriachne mucronata</i> ^hummock grass, tussock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	Mostly >5 year	5% of quadrat (SW corner) <1 year (Feb/Mar 2010)	
Notes	<1% leaf litter, litter <1 cm deep, 70% bare ground, no weed cover No evidence of human disturbance A few dead low shrubs		



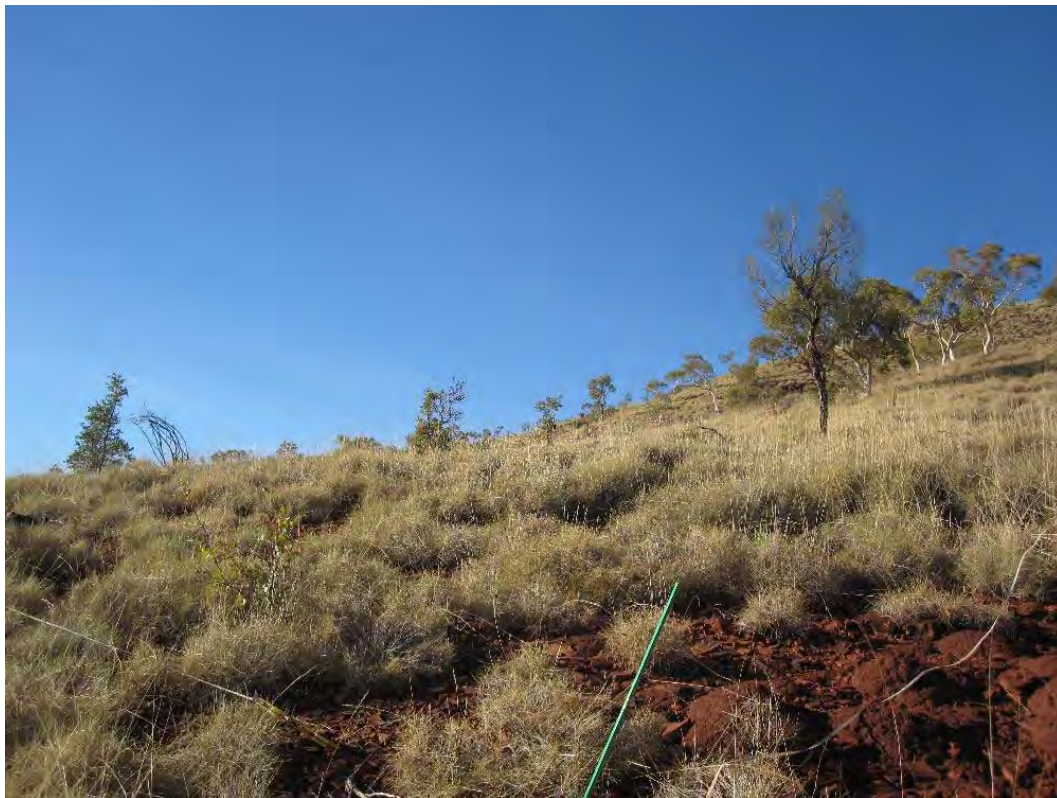
**Species**

**Cover of dominant species (%)**

- Acacia atkinsiana*
- Acacia dictyophleba*
- Acacia maitlandii*
- Acacia monticola*
- Acacia pyrifolia* var. *pyrifolia*
- Acacia tenuissima*
- Acacia tumida* var. *pilbarensis*
- Aristida holathera* var. *latifolia*
- Bonamia* sp. Dampier (A.A. Mitchell PRP 217)
- Bulbostylis barbata*
- Cleome viscosa*

<i>Corchorus incanus</i> subsp. <i>incanus</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	
<i>Cymbopogon ambiguus</i>	
<i>Dampiera candicans</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Euphorbia alsiniflora</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia stobbsiana</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Hakea chordophylla</i>	
<i>Hybanthus aurantiacus</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polygala</i> aff. <i>isingii</i>	
<i>Ptilotus astrolasius</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Tephrosia</i> aff. <i>supina</i> (HD133-20)	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia wiseana</i>	30
<i>Triumfetta maconochieana</i>	
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL10017	
Described by Re-score	HEH	28/05/10	Quadrat 50 m x 50 m
	JKN	28/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	550652 mE 7555642 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate to steep north facing midslope of tall hill		
Soil	No soil exposed		
Rock Type	Banded Ironstone. Red and black small to large pebbles and outcropping		
Vegetation Description	<i>Triodia wiseana</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\r; G+ ^ <i>Triodia wiseana</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>2 years	A few charred stags	
Notes	1% leaf litter, litter <1 cm deep, 30% bare ground, no weed cover No evidence of human disturbance <i>Cymbopogon ambiguus</i> on steeper south east facing slope of quadrat in the north east corner.		



#### Species

#### Cover of dominant species (%)

*Acacia dictyophleba*

*Acacia elachantha*

*Acacia inaequilatera*

*Acacia maitlandii*

*Acacia retivenea*

*Acacia tenuissima*

*Acacia trudgeniana*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Cleome viscosa*

*Cucumis maderaspatanus*

*Cymbopogon ambiguus*

3

*Dysphania rhadinostachya* subsp. *rhadinostachya*

*Eriachne aristidea*

Species	Cover of dominant species (%)
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	3
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Fimbristylis simulans</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Hakea chordophylla</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna ferraria</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna notabilis</i>	
<i>Tephrosia stipuligera</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia</i> aff. <i>melvillei</i>	
<i>Triodia wiseana</i>	65
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL10018	
Described by	LJA	28/05/10	Quadrat 50 m x 50 m
Re-score	HEH	28/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	551317 mE 7555785 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle north facing lower slope		
Soil	Red skeletal loam		
Rock Type	Banded Ironstone. <90% Red and black small to large pebbles of angular tabular to sub-rounded tabular shape with 2% outcropping		
Vegetation Description	<i>Acacia maitlandii</i> shrubland over <i>Triodia wiseana</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\6\;M+ ^ <i>Acacia maitlandii</i> ^shrub\3\;G ^ <i>Triodia wiseana</i> ^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5 years	A few charred stags	
Notes	<1% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover No evidence of human disturbance		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	1
<i>Acacia maitlandii</i>	15
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia trachycarpa</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	
<i>Corymbia hamersleyana</i>	
<i>Dodonaea coriacea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	1
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1

**Species****Cover of dominant species (%)***Fimbristylis simulans**Goodenia stobbsiana**Indigofera monophylla**Isotropis atropurpurea**Jasminum didymum* subsp. *lineare**Oldenlandia crouchiana**Paraneurachne muelleri**Polycarpaea corymbosa* var. *corymbosa**Polycarpaea holtzei**Polycarpaea longiflora**Ptilotus astrolasius**Ptilotus calostachyus**Ptilotus fusiformis**Senna glutinosa* subsp. *glutinosa**Senna notabilis**Tephrosia spechtii**Triodia wiseana*

18

*Triumfetta maconochieana**Yakirra australiensis* var. *australiensis*

Site		FL1019	
Described by Re-score	HEH	28/05/10	Quadrat 50 m x 50 m
	JKN	28/08/10	
	JKN	26/03/11	
MGA Zone	GDA94 50	550840 mE 7556114 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	No soil exposed		
Rock Type	Ironstone. Blackish red medium pebbles to cobbles		
Vegetation Description	<i>Corymbia hamersleyana</i> low open woodland over <i>Triodia wiseana</i> and <i>T. epactia</i> closed hummock grassland with <i>Acacia inaequilatera</i> tall scattered shrubs over <i>Acacia maitlandii</i> scattered shrubs		
NVIS V	U ^ <i>Corymbia hamersleyana</i> ^tree\6\;M ^ <i>Acacia inaequilatera</i> , ^ <i>A. maitlandii</i> \^shrub\4\;G+ ^ <i>Triodia wiseana</i> , <i>T. epactia</i> \^hummock grass\2\c		
Vegetation Condition	Very Good		
Fire Age	>2 years	Charred stags	
Notes	4% leaf litter, litter 1-10 cm deep, 15% bare ground, no weed cover Disturbance type: Minor clearing (old tracks) <i>Triodia</i> very high. Gully in north west corner (though outside quadrat). Very minor drainages (sinks) throughout quadrat where water would pool.		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia elachantha*

*Acacia inaequilatera*

1

*Acacia maitlandii*

1

*Acacia pyrifolia* var. *pyrifolia*

1

*Acacia retivenea*

*Acacia tenuissima*

*Amaranthus undulatus*

*Aristida holathera* var. *latifolia*

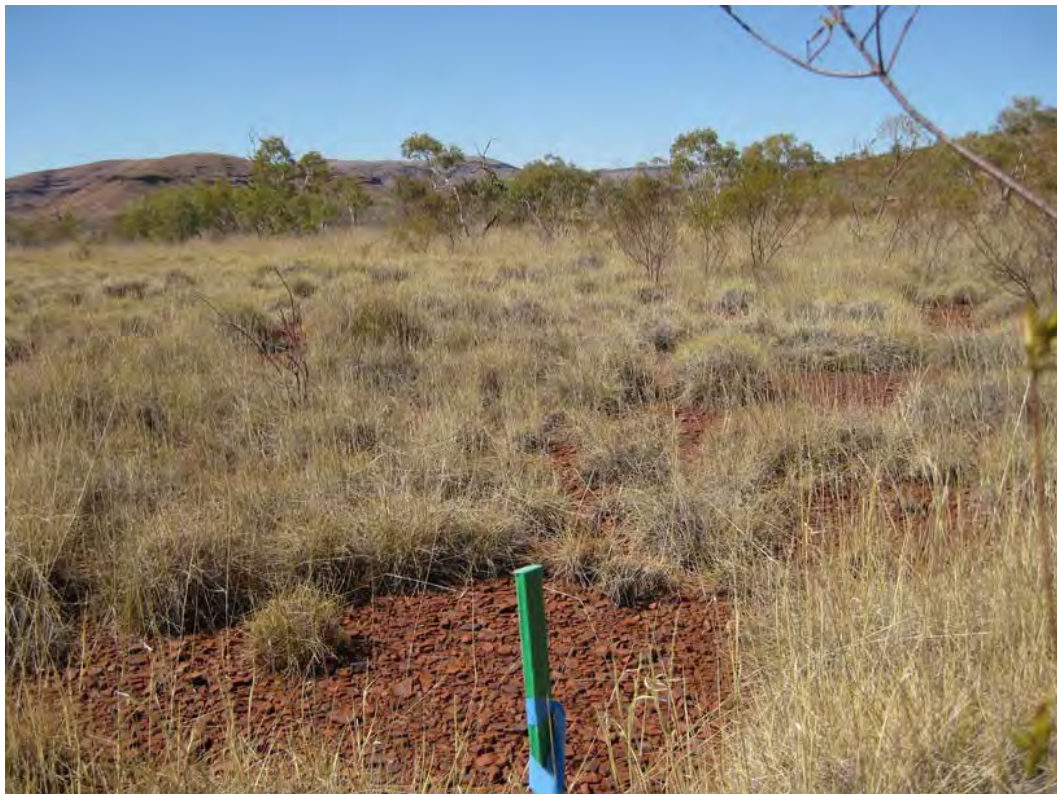
*Boerhavia coccinea*

*Cleome viscosa*



Species	Cover of dominant species (%)
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corymbia hamersleyana</i>	5
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
<i>Cucumis maderaspatanus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus gamophylla</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia alsiniflora</i>	
<i>Fimbristylis simulans</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia nuda</i>	
<i>Gossypium australe</i>	
<i>Gossypium robinsonii</i>	
<i>Indigofera colutea</i>	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Mollugo molluginea</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Polymeria</i> aff. <i>ambigua</i> (PAN 26B-20)	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus clementii</i>	
<i>Ptilotus fusiformis</i>	
<i>Rhynchosia minima</i>	
<i>Santalum lanceolatum</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Tephrosia stipuligera</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	5.5
<i>Triodia wiseana</i>	25

Site		FL1020	
Described by	LJA	28/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	551126 mE 7556101 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Red clay loam with discontinuous lag gravel		
Rock Type	Ironstone.		
Vegetation Description	<i>Triodia wiseana</i> and <i>T. epactia</i> mid-dense hummock grassland with <i>Acacia maitlandii</i> scattered shrubs		
NVIS V	M ^ <i>Acacia maitlandii</i> \^shrub\3\;G+ ^ <i>Triodia wiseana</i> , <i>T. epactia</i> \^hummock grass\2\i		
Vegetation Condition	Very Good		
Fire Age	>5 years	No evidence of recent fire	
Notes	1% leaf litter, litter <1 cm deep, 45% bare ground, no weed cover Disturbance type: Vehicle tyre tracks Most trees and shrubs are in minor drainage channel with <i>Triodia epactia</i>		



Species	Cover of dominant species (%)
<i>Acacia ancistrocarpa</i>	
<i>Acacia atkinsiana</i>	
<i>Acacia maitlandii</i>	1
<i>Acacia tenuissima</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	
<i>Corymbia hamersleyana</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eriachne</i> sp. (FL1020)	
<i>Eucalyptus gamophylla</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia australis</i>	

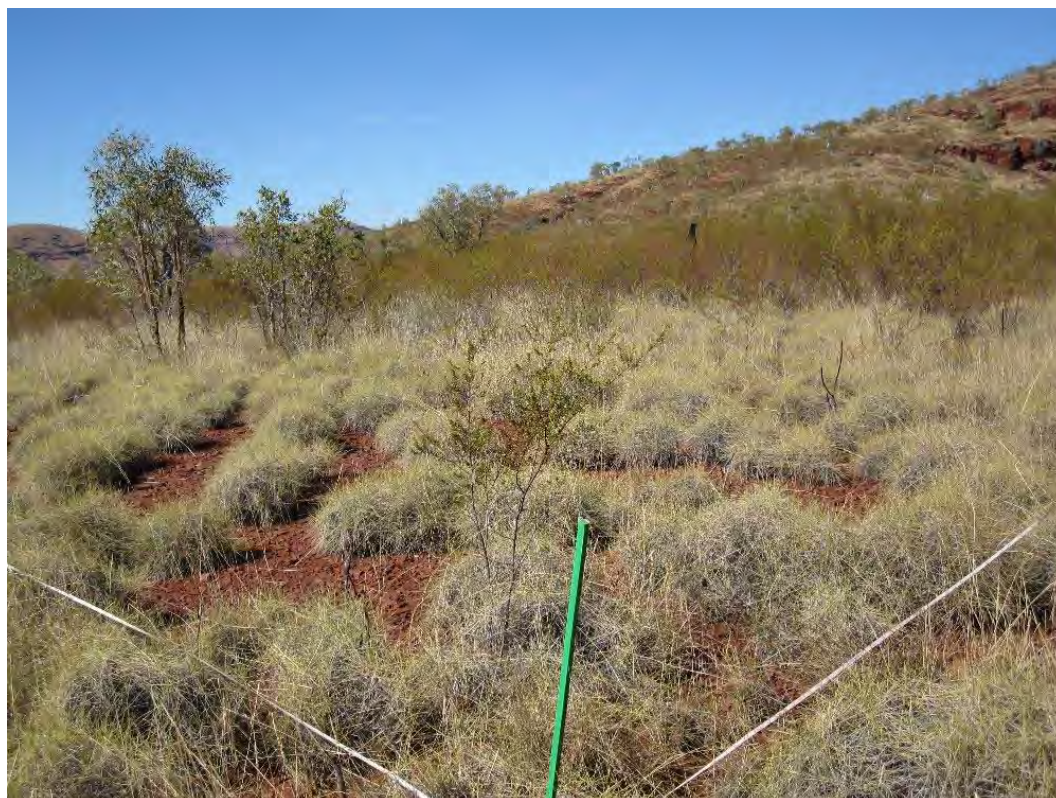
**Species****Cover of dominant species (%)**

*Euphorbia tannensis* subsp. *eremophila*  
*Evolvulus alsinoides* var. *villosicalyx*  
*Fimbristylis simulans*  
*Gompholobium* sp. Pilbara (N.F. Norris 908)  
*Grevillea wickhamii* subsp. *hispidula*  
*Keraudrenia nephrosperma*  
*Keraudrenia velutina* subsp. *elliptica*  
*Mollugo molluginea*  
*Polycarpaea holtzei*  
*Polygala* aff. *isingii*  
*Ptilotus astrolasius*  
*Ptilotus fusiformis*  
*Schizachyrium fragile*  
*Senna artemisioides* subsp. *oligophylla*  
*Senna glutinosa* subsp. *glutinosa*  
*Senna glutinosa* subsp. *pruinosa*  
*Trachymene oleracea* subsp. *oleracea*  
*Trichodesma zeylanicum* var. *zeylanicum*  
*Triodia epactia*  
*Triodia wiseana*  
*Yakirra australiensis* var. *australiensis*

5

15

Site		FL1021	
Described by Re-score	HEH	28/05/10	Quadrat 50 m x 50 m
	HEH	30/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	550942 mE 7556058 mN	
Season	Poor (2010), Good (2011)		
Habitat	Undulating valley floor		
Soil	No soil exposed		
Rock Type	Blackish red Ironstone		
Vegetation Description	<i>Acacia maitlandii</i> shrubland over <i>Triodia wiseana</i> and <i>T. epactia</i> hummock grassland with <i>Corymbia hamersleyana</i> scattered low trees		
NVIS V	U ^ <i>Corymbia hamersleyana</i> ^tree\6\r;M ^ <i>A. maitlandii</i> ^shrub\3\r;G+ ^ <i>Triodia wiseana</i> , <i>T. epactia</i> ^hummock grass\2\i		
Vegetation Condition	Very Good		
Fire Age	>2 years	Charred logs on ground	
Notes	<1% leaf litter, litter <1 cm deep, 75% bare ground, no weed cover No evidence of human disturbance besides the quadrat being situated very closely to a drill line		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia ancistrocarpa*

*Acacia atkinsiana*

*Acacia dictyophleba*

*Acacia maitlandii*

30

*Acacia pyrifolia* var. *pyrifolia*

*Acacia retivenea*

*Acacia tenuissima*

*Aristida holathera* var. *holathera*

*Bulbostylis barbata*

*Corymbia deserticola* subsp. *deserticola*

*Corymbia hamersleyana*

1

Species	Cover of dominant species (%)
<i>Cucumis maderaspatanus</i>	
<i>Dodonaea coriacea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
<i>Fimbristylis simulans</i>	
<i>Gompholobium</i> sp. Pilbara (N.F. Norris 908)	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Tinospora smilacina</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia epactia</i>	8
<i>Triodia wiseana</i>	12
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL1022	
Described by	LJA	28/05/10	Quadrat 50 m x 50 m
Re-score	HEH	27/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	545209 mE 7553086 mN	
Season	Poor (2010), Good (2011)		
Habitat	undulating valley floor adjacent to drainage channel		
Soil	Red clay loam with discontinuous lag gravel		
Rock Type	Pebbles to rocks		
Vegetation Description	<i>Acacia elachantha</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> tall open shrubland over <i>Triodia epactia</i> open hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> tussock grass, <i>Paraneurachne muelleri</i> and <i>Themeda triandra</i> very open tussock grassland over Malvaceae sp. (FL1022) very open herbland with <i>Corymbia hamersleyana</i> and <i>C. deserticola</i> subsp. <i>deserticola</i> scattered low trees		
NVIS V	U ^ <i>Corymbia hamersleyana</i> ^tree\6r;M ^ <i>Acacia elachantha</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> ^shrub\4r;G+ ^ <i>Triodia epactia</i> , <i>Aristida holathera</i> var. <i>holathera</i> , Malvaceae sp. (FL1022) ^hummock grass, tussock grass, forb\2i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	5% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover No evidence of human disturbance		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	
<i>Acacia elachantha</i>	4
<i>Acacia retivenea</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	3
<i>Aristida holathera</i> var. <i>holathera</i>	5
<i>Boerhavia coccinea</i>	
<i>Bonamia rosea</i>	
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Cleome viscosa</i>	

Species	Cover of dominant species (%)
<i>Corchorus</i> aff. <i>parviflorus</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia deserticola</i> subsp. <i>deserticola</i>	
<i>Corymbia hamersleyana</i>	1
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	
<i>Cymbopogon</i> sp. (FL1022)	2
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eragrostis</i> aff. <i>eriopoda</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus gamophylla</i>	
<i>Eulalia aurea</i>	
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Fimbristylis simulans</i>	
<i>Goodenia forrestii</i>	
<i>Goodenia microptera</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	2
<i>Heliotropium tenuifolium</i>	
<i>Hibiscus sturtii</i> var. <i>platyklamys</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Malvaceae</i> sp. (FL1022)	4
<i>Melhania</i> sp. (CH15-39)	
<i>Mollugo molluginea</i>	
<i>Paraneurachne muelleri</i>	2
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Polymeria</i> aff. <i>ambigua</i> (PAN 26B-20)	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Rhynchosia minima</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna notabilis</i>	
<i>Solanum phlomoides</i>	

**Species****Cover of dominant species (%)***Themeda triandra*

2

*Trachymene oleracea* subsp. *oleracea**Trichodesma zeylanicum* var. *zeylanicum**Triodia* aff. *melvillei**Triodia epactia*

8

*Triodia wiseana**Yakirra australiensis* var. *australiensis*



Site		FL1023	
Described by Re-score	HEH	28/05/10	Quadrat 50 m x 50 m
	HEH	27/08/10	
	HEH	25/3/11	
MGA Zone	GDA94 50	544588 mE 7552188 mN	
Season	Poor (2010), Good (2011)		
Habitat	Slightly undulating valley floor		
Soil	Stony silty clay loam		
Rock Type	Ironstone. Blackish red small pebbles to cobbles with pisolite layer		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> (trees), <i>E. gamophylla</i> (mallees) and <i>Corymbia hamersleyana</i> (mallees) low open woodland over <i>Triodia epactia</i> hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> very open tussock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>E. gamophylla</i> , <i>Corymbia hamersleyana</i> \^tree, tree mallee\6\r;G+ ^ <i>Triodia epactia</i> , <i>Aristida holathera</i> var. <i>holathera</i> \^hummock grass, tussock grass\2 i		
Vegetation Condition	Excellent		
Fire Age	>2 years	Though the NE corner burnt recently (Feb/Mar)	
Notes	% leaf litter, litter <1 cm deep, 75% bare ground, no weed cover No evidence of human disturbance Minor drainage through quadrat		



**Species**

**Cover of dominant species (%)**

- Acacia adoxa* var. *adoxo*
- Acacia dictyophleba*
- Acacia elachantha*
- Acacia monticola*
- Acacia pyrifolia* var. *pyrifolia*
- Acacia retivenea*
- Acacia tumida* var. *pilbarensis*
- Aristida holathera* var. *holathera*
- Cleome viscosa*
- Corchorus* aff. *parviflorus*
- Corchorus* sp.

Species	Cover of dominant species (%)
<i>Corymbia hamersleyana</i>	1
<i>Cymbopogon ambiguus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus gamophylla</i>	2
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	3
<i>Eulalia aurea</i>	
<i>Euphorbia</i> aff. <i>australis</i>	
<i>Fimbristylis simulans</i>	
<i>Goodenia microptera</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Hakea chordophylla</i>	
<i>Heliotropium tenuifolium</i>	
<i>Indigofera monophylla</i>	
<i>Isotropis atropurpurea</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	1
<i>Polycarpaea holtzei</i>	
<i>Polymeria</i> aff. <i>ambigua</i> (PAN 26B-20)	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Santalum lanceolatum</i>	
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>glutinosa</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Senna glaucifolia</i> x	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna notabilis</i>	
<i>Solanum diversiflorum</i>	
<i>Tribulus hirsutus</i>	
<i>Triodia</i> aff. <i>melvillei</i>	1
<i>Triodia epactia</i>	25
<i>Triodia wiseana</i>	

Site		FL1024	
Described by Re-score	HEH	28/05/10	Quadrat 50 m x 50 m
	JKN	27/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	546151 mE 7552937 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle south facing mid to upper slope of low hill		
Soil	No soil exposed		
Rock Type	Ironstone. Continuous brownish red lag gravel		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> mid-dense hummock grassland		
NVIS V	G+ ^ <i>Triodia</i> aff. <i>melvillei</i> ^hummock grass\2\c		
Vegetation Condition	Very Good		
Fire Age	>2 years	Charred logs on ground	
Notes	<1% leaf litter, litter <1 cm, 55% bare ground, no weed cover No evidence of human disturbance though site is surrounded by ripped drill lines, recent drill lines and drill pads.		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia dictyophleba*

*Acacia monticola*

*Acacia retivenea*

*Acacia tenuissima*

*Corymbia deserticola* subsp. *deserticola*

*Cucumis maderaspatanus*

*Cymbopogon ambiguus*

*Evolvulus alsinoides* var. *villosicalyx*

*Fimbristylis simulans*

*Gomphrena cunninghamii*

*Goodenia stobbsiana*

*Grevillea wickhamii* subsp. *hispidula*

**Species****Cover of dominant species (%)***Hakea chordophylla**Heliotropium tenuifolium**Jasminum didymum* subsp. *lineare**Mirbelia viminalis**Polycarpaea holtzei**Polygala* aff. *isingii**Ptilotus fusiformis**Schizachyrium fragile**Senna notabilis**Sida* sp. Pilbara (A.A. Mitchell PRP 1543)*Trachymene oleracea* subsp. *oleracea**Trichodesma zeylanicum* var. *zeylanicum**Triodia* aff. *melvillei*

45

*Triodia wiseana**Yakirra australiensis* var. *australiensis*

Site		FL1025	
Described by	HEH	29/05/10	Quadrat 50 m x 50 m
Re-score	HEH	27/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	543600 mE 7552496 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate to steep mid slope of large hill arm		
Soil	No soil exposed		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Triodia epactia</i> mid-dense hummock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> ^tree\6\;G+ ^ <i>Triodia epactia</i> ^hummock grass\2\c		
Vegetation Condition	Very Good		
Fire Age	Mostly >2 years	3.5% burnt in Feb/Mar 2010	
Notes	1% leaf litter, litter <1 cm deep, 55% bare ground, no weed cover No evidence of human disturbance Various aspects of slopes		



**Species**

**Cover of dominant species (%)**

*Acacia adoxa* var. *adoxo*

*Acacia maitlandii*

*Acacia monticola*

*Acacia pyrifolia* var. *pyrifolia*

*Alternanthera nana*

*Aristida holathera* var. *latifolia*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Bulbostylis barbata*

*Clerodendrum floribundum* var. *angustifolium*

*Corchorus lasiocarpus* subsp. *parvus*

*Corchorus lasiocarpus* var. *lasiocarpus*

Species	Cover of dominant species (%)
<i>Corymbia hamersleyana</i>	<2
<i>Cymbopogon ambiguus</i>	
<i>Dampiera candidans</i>	
<i>Dodonaea coriacea</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	4
<i>Euphorbia alsiniflora</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Goodenia cusackiana</i>	
<i>Goodenia microptera</i>	
<i>Goodenia muelleriana</i>	
<i>Gossypium robinsonii</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Hakea chordophylla</i>	
<i>Hibiscus</i> aff. <i>coatesii</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Mirbelia viminalis</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna notabilis</i>	
<i>Sida</i> sp. articulation below (A.A. Mitchell PRP 1605)	
<i>Solanum horridum</i>	
<i>Tephrosia</i> aff. <i>supina</i> (HD133-20)	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia</i> aff. <i>melvillei</i>	
<i>Triodia epactia</i>	45
<i>Triodia wiseana</i>	
<i>Triumfetta maconochieana</i>	
<i>Waltheria virgata</i>	
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL1026	
Described by	LJA	29/05/10	Quadrat 100 m x 25 m
Re-score	HEH	27/08/10	
	HEH	25/3/11	
MGA Zone	GDA94 50	543616 mE 7552563 mN	
Season	Poor (2010), Good (2011)		
Habitat	Steep to vertical east and west facing gully		
Soil	No soil exposed		
Rock Type	Ironstone		
Vegetation Description	<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Acacia monticola</i> , <i>A. pruinocarpa</i> and <i>Gossypium robinsonii</i> tall open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471) and <i>Cymbopogon ambiguus</i> open tussock grassland		
NVIS V	U ^ <i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\7r;M ^ <i>Acacia monticola</i> , ^ <i>A. pruinocarpa</i> and ^ <i>Gossypium robinsonii</i> \^shrub\2c;G+ ^ <i>Triodia epactia</i> , <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471), <i>Cymbopogon ambiguus</i> \^hummock grass, tussock grass\3c		
Vegetation Condition	Very Good		
Fire Age	>2 years	Charred logs on ground	
Notes	<1% leaf litter, litter <1 cm deep, 75% bare ground, no weed cover No evidence of human disturbance.		



Species	Cover of dominant species (%)
<i>Abutilon dioicum</i>	
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia maitlandii</i>	
<i>Acacia monticola</i>	2
<i>Acacia pruinocarpa</i>	2
<i>Acacia pyrifolia</i> var. <i>morrisonii</i>	
<i>Alectryon oleifolius</i> subsp. <i>oleifolius</i>	
<i>Aristida nitidula</i>	
<i>Astrotricha hamptonii</i>	
<i>Bidens bipinnata</i>	

Species	Cover of dominant species (%)
<i>Boerhavia coccinea</i>	
<i>Capparis spinosa</i> var. <i>nummularia</i>	
<i>Cheilanthes lasiophylla</i>	
<i>Cleome viscosa</i>	
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corchorus crozophorifolius</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i>	1
<i>Corymbia hamersleyana</i>	
<i>Cucumis melo</i> subsp. <i>agrestis</i>	
<i>Cymbopogon ambiguus</i>	2
<i>Cyperus vaginatus</i>	
<i>Duperreya commixta</i>	
<i>Enneapogon intermedius</i>	
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia alsiniflora</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Ficus brachypoda</i>	
<i>Fimbristylis simulans</i>	
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	
<i>Gomphrena cunninghamii</i>	
<i>Gossypium australe</i> (Whim Creek form)	
<i>Gossypium robinsonii</i>	2
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	
<i>Hakea chordophylla</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera fractiflexa</i>	
<i>Indigofera monophylla</i>	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Isotropis atropurpurea</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Paraneurachne muelleri</i>	
<i>Paspalidium clementii</i>	
<i>Paspalidium tabulatum</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Pterocaulon serrulatum</i>	
<i>Ptilotus fusiformis</i>	
<i>Ptilotus obovatus</i>	
<i>Rhagodia eremaea</i>	
<i>Santalum lanceolatum</i>	



Species	Cover of dominant species (%)
<i>Senna ferraria</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	
<i>Senna venusta</i>	
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)	5
<i>Tinospora smilacina</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia epactia</i>	10-30
<i>Triodia wiseana</i>	

Site		FL1027	
Described by Re-score	HEH	29/05/10	Quadrat 100 m x 30 m
	JKN	27/08/10	
	HEH	25/3/11	
MGA Zone	GDA94 50	545948 mE 7550902 mN	
Season	Poor (2010), Good (2011)		
Habitat	Slight to steep rocky gorge		
Soil	No soil exposed		
Rock Type	Ironstone. Dark brown, blackish red medium pebbles to boulders of variable shapes		
Vegetation Description	<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Eucalyptus</i> sp. and <i>Brachychiton acuminatus</i> low woodland over <i>Triodia epactia</i> hummock grassland over <i>Eulalia aurea</i> , <i>Cymbopogon ambiguus</i> , <i>Themeda triandra</i> and <i>Eragrostis</i> aff. <i>eripoda</i> open tussock grassland with <i>Acacia monticola</i> scattered tall shrubs		
NVIS V	U ^ <i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Brachychiton acuminatus</i> \^tree\6\r;M ^ <i>Acacia monticola</i> \^shrub\3\r;G+ ^ <i>Triodia epactia</i> , <i>Eulalia aurea</i> , <i>Cymbopogon ambiguus</i> \^hummock grass, tussock grass\3\c		
Vegetation Condition	Excellent		
Fire Age	Mostly >2 years	One third recently burnt in Feb 2010	
Notes	>70% bare ground		



#### Species

#### Cover of dominant species (%)

*Abutilon dioicum*  
*Abutilon* sp. (FL1027)  
*Acacia inaequilatera*  
*Acacia monticola*  
*Acacia pruinocarpa*  
*Acacia pyrifolia* var. *pyrifolia*  
*Achyranthes aspera*  
*Alternanthera nana*  
*Amaranthus undulatus*  
*Amyema benthamii*  
*Aristida nitidula*

1.5

Species	Cover of dominant species (%)
<i>Astrotricha hamptonii</i>	
<i>Bidens bipinnata</i>	
<i>Brachychiton acuminatus</i>	1
<i>Capparis spinosa</i> var. <i>nummularia</i>	
<i>Cleome viscosa</i>	
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corchorus crozophorifolius</i>	
<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i>	4
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	10-30
<i>Cyperus hesperius</i>	
<i>Digitaria brownii</i>	10-30
<i>Dodonaea pachyneura</i>	
<i>Duperreya commixta</i>	
<i>Ehretia saligna</i> var. <i>saligna</i>	
<i>Enneapogon lindleyanus</i>	
<i>Eragrostis</i> aff. <i>eriopoda</i>	10-30
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2
<i>Eucalyptus</i> sp.	2
<i>Eulalia aurea</i>	15
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Ficus brachypoda</i>	1
<i>Fimbristylis simulans</i>	
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	
<i>Gossypium australe</i>	
<i>Gossypium robinsonii</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Josephinia</i> sp.	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	10-30
<i>Paspalidium tabulatum</i>	
<i>Phyllanthus maderaspatensis</i>	
<i>Phyllanthus reticulatus</i> var. <i>glaber</i>	
<i>Pluchea dentex</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea involucrata</i>	

**Species****Cover of dominant species (%)**

<i>Polycarpaea longiflora</i>	
<i>Pomax rupestris</i>	
<i>Pterocaulon ?serrulatum</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus fusiformis</i>	
<i>Ptilotus obovatus</i>	
<i>Rhagodia eremaea</i>	
<i>Rhynchosia bungarensis</i>	
<i>Rhynchosia minima</i>	
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna notabilis</i>	
<i>Senna venusta</i>	
<i>Setaria surgens</i>	
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	
<i>Solanum phlomoides</i>	
<i>Streptoglossa decurrens</i>	
<i>Themeda triandra</i>	10-30
<i>Tinospora smilacina</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Trichosanthes cucumerina</i> var. <i>cucumerina</i>	
<i>Triodia</i> aff. <i>melvillei</i>	10-30
<i>Triodia epactia</i>	15
<i>Waltheria virgata</i>	

Site		FL1028	
Described by Re-score	LJA	29/05/10	Quadrat 50 m x 50 m
	JKN	27/08/10	
	HEH	25/3/11	
MGA Zone	GDA94 50	545795 mE 7551114 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle south facing upper slope of medium rise		
Soil	Red skeletal clay loam with surface rocks		
Rock Type	Ironstone		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Triodia epactia</i> mid-dense hummock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> ^tree\6\r;G+ ^ <i>Triodia epactia</i> \hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	1% leaf litter, litter <1 cm deep, 60% bare ground, no weed cover No evidence of human disturbance		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia dictyophleba*

*Acacia maitlandii*

*Acacia monticola*

*Acacia retivenea*

*Acacia tenuissima*

*Aristida holathera* var. *latifolia*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Clerodendrum floribundum* var. *angustifolium*

*Corchorus lasiocarpus* subsp. *parvus*

1

*Corymbia hamersleyana*

1

*Cymbopogon ambiguus*

Species	Cover of dominant species (%)
<i>Dampiera candidans</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1.5
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Fimbristylis simulans</i>	
<i>Gossypium australe</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	1
<i>Hakea chordophylla</i>	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Melhania</i> sp. (CH15-39)	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus fusiformis</i>	
<i>Ptilotus incanus</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Tephrosia spechtii</i>	
<i>Themeda triandra</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	35
<i>Triodia wiseana</i>	1
<i>Triumfetta maconochieana</i>	
<i>Waltheria virgata</i>	

Site		FL1029	
Described by	HEH	30/05/10	Quadrat 85 m x 30 m
Re-score	HEH	28/08/10	
	HEH	25/3/11	
MGA Zone	GDA94 50	546729 mE 7555428 mN	
Season	Poor (2010), Good (2011)		
Habitat	Minor drainage line (N-S)		
Soil	Pisolite over stony loam		
Rock Type	Blackish red Ironstone. Lag gravel of angular to sub-rounded shape		
Vegetation Description	<i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> low woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i> tall open scrub over <i>Triodia epactia</i> open hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> and <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471) very open tussock grassland		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> ^\tree\6\c;M+ ^ <i>Acacia tumida</i> var. <i>pilbarensis</i> ^\shrub\4\c;G ^ <i>Triodia epactia</i> , <i>Aristida holathera</i> var. <i>holathera</i> , <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)\^hummock grass, tussock grass\1\i		
Vegetation Condition	Very Good		
Fire Age	>5 years	No evidence of recent fire	
Notes	20% leaf litter, litter 1-5 cm deep, 75% bare ground, no weed cover Disturbance type: Clearing (track and pads either side of drainage line)		



Species	Cover of dominant species (%)
<i>Acacia adoxa</i> var. <i>adoxo</i>	
<i>Acacia dictyophleba</i>	
<i>Acacia maitlandii</i>	
<i>Acacia monticola</i>	
<i>Acacia tumida</i> var. <i>pilbarensis</i>	35
<i>Aristida holathera</i> var. <i>holathera</i>	3
<i>Boerhavia coccinea</i>	
<i>Bonamia rosea</i>	
<i>Cleome viscosa</i>	
<i>Corchorus</i> aff. <i>parviflorus</i>	
<i>Corymbia hamersleyana</i>	<2

Species	Cover of dominant species (%)
<i>Cucumis maderaspatanus</i>	
<i>Eragrostis</i> aff. <i>eriopoda</i>	
<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus gamophylla</i>	30
<i>Eulalia aurea</i>	
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Fimbristylis simulans</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia microptera</i>	
<i>Hibiscus leptocladus</i>	
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mnesithea formosa</i>	
<i>Mollugo molluginea</i>	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Paraneurachne muelleri</i>	
<i>Phyllanthus erwinii</i>	
<i>Polycarpaea holtzei</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus auriculifolius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus exaltatus</i>	
<i>Rhynchosia minima</i>	
<i>Scaevola parvifolia</i> subsp. <i>pilbarae</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna notabilis</i>	
<i>Solanum diversiflorum</i>	
<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)	2
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trianthera pilosa</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	10
<i>Yakirra australiensis</i> var. <i>australiensis</i>	



Site		FL1030	
Described by Re-score	LJA	29/05/10	Quadrat 50 m x 50 m
	JKN	27/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	546038 mE 7553765 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Red and black loamy sand with some rocks		
Rock Type	Unknown		
Vegetation Description	<i>Eucalyptus gamophylla</i> low open woodland over <i>Triodia epactia</i> hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> , <i>Paraneurachne muelleri</i> and <i>Eragrostis eriopoda</i> very open tussock grassland over <i>Bonamia rosea</i> very open herbland		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> ^tree\6\; G+ ^ <i>Triodia epactia</i> , <i>Aristida holathera</i> var. <i>holathera</i> , <i>Bonamia rosea</i> ^hummock grass, tussock grass, forb\2\i		
Vegetation Condition	Excellent		
Fire Age	<5 years	No evidence of recent fire	
Notes	5% leaf litter, litter 1-2 cm deep, 85% bare ground, no weed cover No evidence of human disturbance		



**Species**

**Cover of dominant species (%)**

*Acacia dictyophleba*

*Acacia pyrifolia* var. *pyrifolia*

*Acacia retivenea*

*Acacia tumida* var. *pilbarensis*

*Aristida holathera* var. *holathera*

3

*Bonamia rosea*

2

*Cleome viscosa*

*Corchorus lasiocarpus*

*Cucumis maderaspatanus*

*Dysphania rhadinostachya* subsp. *rhadinostachya*

*Eragrostis eriopoda*

1

Species	Cover of dominant species (%)
<i>Eucalyptus gamophylla</i>	8
<i>Eulalia aurea</i>	
<i>Euphorbia australis</i>	
<i>Gomphrena cunninghamii</i>	
<i>Goodenia microptera</i>	
<i>Gossypium australe</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	
<i>Heliotropium cunninghamii</i>	
<i>Hibiscus leptocladus</i>	
<i>Indigofera colutea</i>	
<i>Indigofera monophylla</i> (MJOPP-2)	
<i>Keraudrenia nephrosperma</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus exaltatus</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	
<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)	
<i>Tribulus hirsutus</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	12
<i>Waltheria virgata</i>	
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL1031	
Described by	HEH	28/05/10	Quadrat 50 m x 50 m
Re-score	HEH	30/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	547187 mE 7555490 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Blacky burgundy pisolite with red surface crust over stony loam		
Rock Type	Ironstone. Discontinuous small pebbles to cobbles		
Vegetation Description	<i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Eulalia aurea</i> , <i>Paraneurachne muelleri</i> , <i>Eragrostis</i> aff. <i>eriopoda</i> , <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471) and <i>Aristida</i> sp. tussock grassland with <i>Triodia epactia</i> scattered hummock grasses		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> \^tree\6\r;G+ ^ <i>Eulalia aurea</i> , <i>Aristida holathera</i> var. <i>holathera</i> , <i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)\^tussock grass\2 i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	8% leaf litter, litter 0-10 cm deep, 60% bare ground, no weed cover No evidence of human disturbance apart from being in close proximity to drill lines and pads		



**Species**

**Cover of dominant species (%)**

*Acacia elachantha*

*Acacia inaequilatera*

*Acacia pyrifolia* var. *pyrifolia*

*Acacia retivenea*

*Amaranthus interruptus*

*Amaranthus undulatus*

*Aristida holathera* var. *holathera*

4

*Bonamia rosea*

*Chrysopogon fallax*

*Cleome viscosa*

*Corchorus lasiocarpus* subsp. *parvus*

Species	Cover of dominant species (%)
<i>Corymbia hamersleyana</i>	2
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
<i>Cucumis maderaspatanus</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eragrostis</i> aff. <i>eriopoda</i>	5
<i>Eragrostis cumingii</i>	
<i>Eragrostis eriopoda</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus gamophylla</i>	6
<i>Eulalia aurea</i>	6
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>	
<i>Goodenia microptera</i>	
<i>Gossypium australe</i>	
<i>Hakea chordophylla</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Heliotropium</i> sp.	
<i>Hibiscus leptocladus</i>	
Indeterminant spp.	
<i>Indigofera colutea</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Paraneurachne muelleri</i>	
<i>Perotis rara</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea longiflora</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus auriculifolius</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna notabilis</i>	
<i>Setaria surgens</i>	
<i>Sida</i> aff. <i>echinocarpa</i> (MET 15,350)	
<i>Sida</i> sp. verrucose glands (F.H. Mollemans 2423)	
<i>Solanum horridum</i>	
<i>Themeda</i> sp. Mt Barricade (M.E. Trudgen 2471)	5
<i>Trianthema pilosa</i>	
<i>Tribulus macrocarpus</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	

**Species**

**Cover of dominant species (%)**

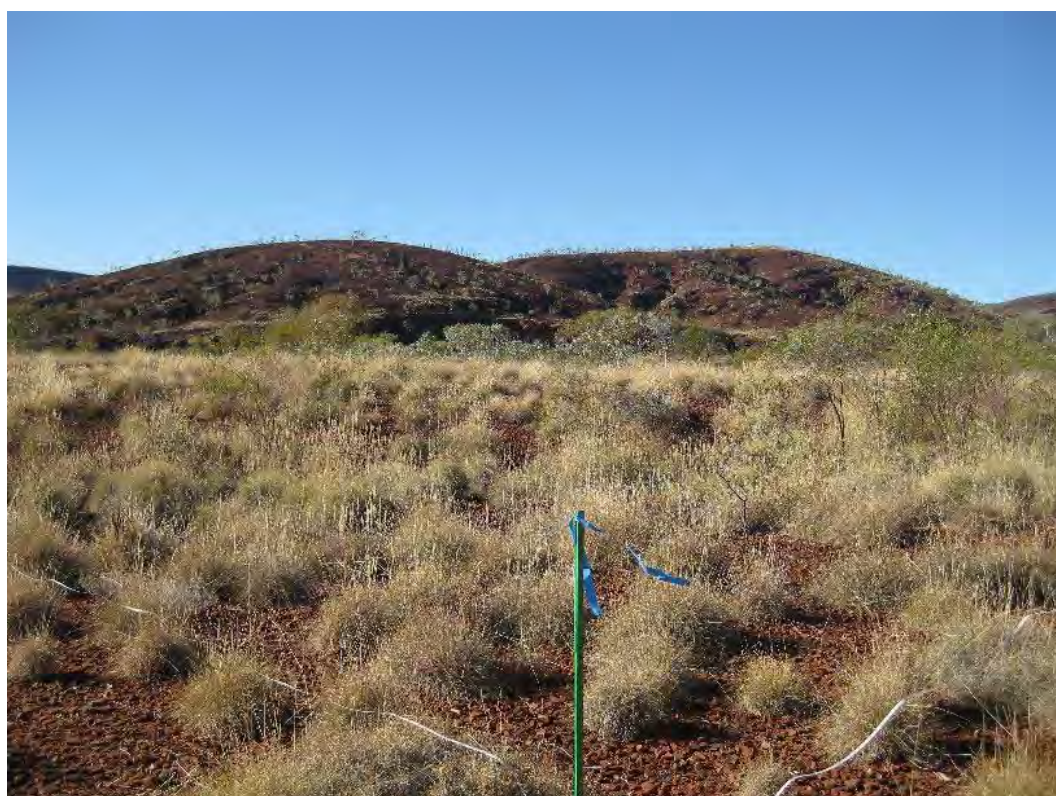
*Triodia epactia*

<2

*Triumfetta maconochieana*

*Yakirra australiensis* var. *australiensis*

Site		FL1032	
Described by	LJA	30/05/10	Quadrat 50 m x 50 m
Re-score	HEH	27/08/10	
	JKN	25/3/11	
MGA Zone	GDA94 50	546473 mE 7555270 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle north and east facing crest of minor rise		
Soil	Red skeletal clay loam with scattered		
Rock Type	Ironstone. > 90% red and black rocks of subrounded to subangular shape		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> and <i>T. wiseana</i> hummock grassland		
NVIS V	G+ ^ <i>Triodia</i> aff. <i>melvillei</i> , <i>T. epactia</i> ^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 85% bare ground, no weed cover No evidence of human disturbance Active mound of a Pebble Mound mouse Dead low shrubs		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia elachantha*

*Acacia maitlandii*

*Acacia monticola*

*Acacia pyrifolia* var. *pyrifolia*

*Aristida holathera* var. *holathera*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Clerodendrum floribundum* var. *angustifolium*

*Corymbia hamersleyana*

*Cucumis maderaspatanus*

*Cymbopogon ambiguus*

*Dampiera candidans*

Species	Cover of dominant species (%)
<i>Dodonaea coriacea</i>	
<i>Enneapogon lindleyanus</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus gamophylla</i>	<2
<i>Euphorbia australis</i>	
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	
<i>Fimbristylis simulans</i>	
<i>Goodenia stobbsiana</i>	
<i>Hakea chordophylla</i>	
<i>Hibiscus</i> aff. <i>coatesii</i> (site 693)	
<i>Indigofera monophylla</i>	
<i>Mnesithea formosa</i>	
<i>Mollugo molluginea</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus calostachyus</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	
<i>Senna notabilis</i>	
<i>Tephrosia</i> aff. <i>supina</i> (HD133-20)	
<i>Tephrosia</i> sp. Bungaroo Creek (M.E. Trudgen 11601)	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia</i> aff. <i>melvillei</i>	10
<i>Triodia wiseana</i>	2
<i>Waltheria virgata</i>	

Site		FL1033	
Described by	HEH	30/05/10	Quadrat 50 m x 50 m
Re-score	HEH	28/08/10	
	JKN	24/3/11	
MGA Zone	GDA94 50	542220 mE 7554811 mN	
Season	Poor (2010), Good (2011)		
Habitat	Very gentle upper slope of knoll		
Soil	No soil exposed		
Rock Type	Ironstone. Continuous red and black gravel of sub-angular to angular tabular shape		
Vegetation Description	<i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Triodia wiseana</i> mid-dense hummock grassland		
NVIS V	U ^ <i>Corymbia hamersleyana</i> , ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\6\;G+ ^ <i>Triodia wiseana</i> \^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	Surrounded by recent fire (Feb/Mar 2010)	
Notes	<1% leaf litter, litter <1 cm deep, 65% bare ground, no weed cover No evidence of human disturbance apart from the recent fire scar from Feb 2010		



**Species**

**Cover of dominant species (%)**

*Acacia adoxa* var. *adoxo*

*Acacia hilliana*

*Acacia pyrifolia* var. *pyrifolia*

*Bonamia* sp. Dampier (A.A. Mitchell PRP 217)

*Bulbostylis barbata*

*Cleome viscosa*

*Clerodendrum floribundum* var. *angustifolium*

*Corymbia hamersleyana*

<2

*Cymbopogon ambiguus*

*Dampiera candidans*

*Eriachne aristidea*

*Eriachne ciliata*



Species	Cover of dominant species (%)
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	<2
<i>Euphorbia alsiniflora</i>	
<i>Fimbristylis simulans</i>	
<i>Goodenia triodiophila</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Keraudrenia nephrosperma</i>	
<i>Keraudrenia velutina</i> subsp. <i>elliptica</i>	
<i>Mnesithea formosa</i>	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Polygala</i> aff. <i>isingii</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus fusiformis</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Triodia</i> aff. <i>melvillei</i>	
<i>Triodia wiseana</i>	35
<i>Triumfetta maconochieana</i>	
<i>Waltheria virgata</i>	

Site		FL1034	
Described by	LJA	30/05/10	Quadrat 50 m x 50 m
Re-score	HEH	28/08/10	
	JKN	24/3/11	
MGA Zone	GDA94 50	543043 mE 7554626 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle to moderate north-west facing lower to midslope of spur below escarpment		
Soil	Red skeletal clay loam		
Rock Type	Ironstone. Red and black rocks of sub-rounded tabular to angular tabular shape with 2-10% outcropping		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Triodia wiseana</i> mid-dense hummock grassland over <i>Cymbopogon ambiguus</i> open tussock grassland		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> \^tree\6\r;G+ ^ <i>Triodia wiseana</i> , <i>Cymbopogon ambiguus</i> \^hummock grass, tussock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 60% bare ground, no weed cover No evidence of human disturbance Dead shrubs		



**Species**

**Cover of dominant species (%)**

- Acacia maitlandii*
- Acacia monticola*
- Acacia pruinocarpa*
- Amyema* sp.
- Bulbostylis barbata*
- Cleome viscosa*
- Corchorus lasiocarpus*
- Corymbia hamersleyana*
- Cucumis maderaspatanus*
- Cymbopogon ambiguus*
- Dampiera candidans*

1

Species	Cover of dominant species (%)
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	2
<i>Goodenia cusackiana</i>	
<i>Gossypium australe</i>	
<i>Hakea chordophylla</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mnesithea formosa</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea holtzei</i>	
<i>Polycarpaea longiflora</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna notabilis</i>	
<i>Themeda triandra</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia wiseana</i>	40
<i>Triumfetta maconochieana</i>	

Site		FL1035	
Described by Re-score	HEH	30/05/10	Quadrat 85 m x 30 m
	JKN	28/08/10	
	HEH	25/03/11	
MGA Zone	GDA94 50	543198 mE 7553516 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate to steep gorge		
Soil	Red-black stony soil		
Rock Type	Ironstone		
Vegetation Description	<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> and <i>Ficus brachypoda</i> low open woodland over <i>Triodia epactia</i> and <i>T. wiseana</i> open hummock grassland over <i>Themeda triandra</i> , <i>Enneapogon lindleyanus</i> , <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i> open tussock grassland with <i>Corchorus crozophorifolius</i> , <i>Capparis spinosa</i> var. <i>nummularia</i> scattered shrubs over Indeterminant sp. scattered herbs		
NVIS V	U ^ <i>Corymbia ferritcola</i> subsp. <i>ferritcola</i> , <i>Ficus brachypoda</i> \^tree\6;r;M ^ <i>Corchorus crozophorifolius</i> , <i>Capparis spinosa</i> var. <i>nummularia</i> \^shrub\3\i;G+ ^ <i>Triodia epactia</i> , <i>T. wiseana</i> , <i>Themeda triandra</i> \^hummock grass, tussock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	10% leaf litter, litter 0-60 cm deep, 60% bare ground, no weed cover No evidence of human disturbance		



#### Species

#### Cover of dominant species (%)

*Abutilon dioicum*

*Abutilon* sp. (FL1035)

*Acacia monticola*

*Acacia pruinocarpa*

*Acacia pyrifolia* var. *pyrifolia*

*Alectryon oleifolius* subsp. *oleifolius*

1

*Amaranthus undulatus*

*Astrotricha hamptonii*

*Bidens bipinnata*

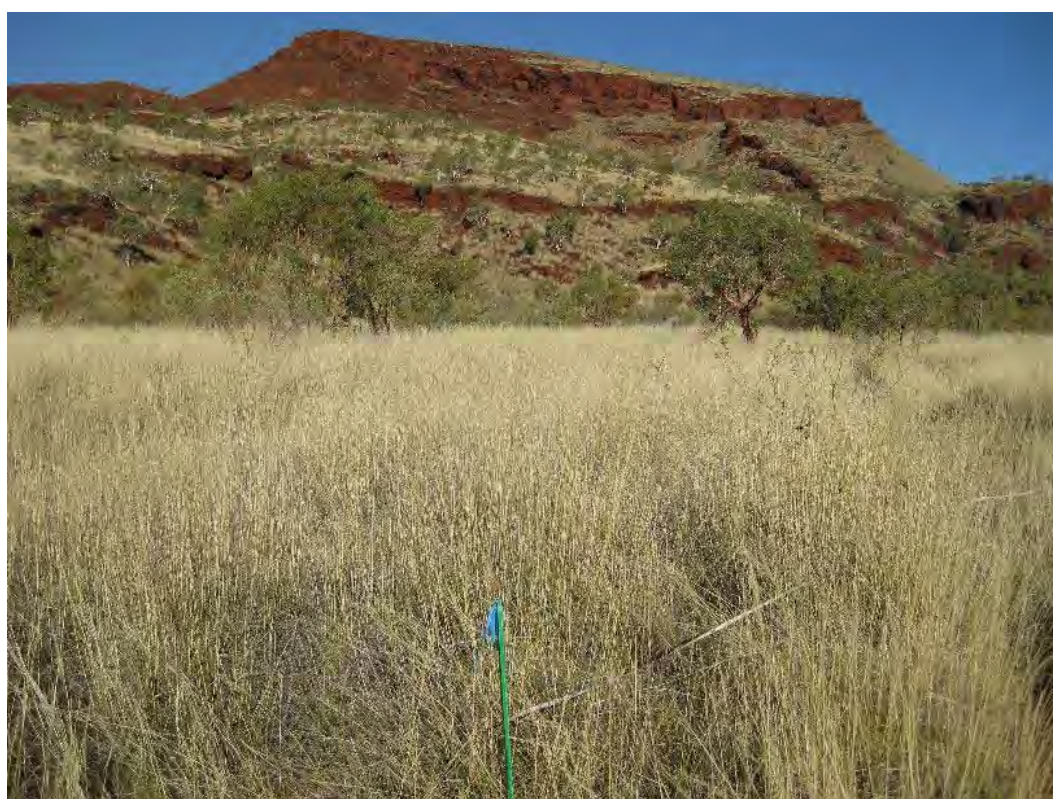
*Capparis spinosa* var. *nummularia*

<2

Species	Cover of dominant species (%)
<i>Cleome viscosa</i>	
<i>Corchorus crozophorifolius</i>	<1
<i>Corymbia ferritcola</i> subsp. <i>ferritcola</i>	7
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	<2
Cyperaceae sp.	
<i>Duperreya commixta</i>	
<i>Ehretia saligna</i> var. <i>saligna</i>	
<i>Enneapogon lindleyanus</i>	
<i>Eriachne mucronata</i> (typical form)	6
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Ficus brachypoda</i>	2
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	
<i>Gomphrena cunninghamii</i>	
<i>Gossypium robinsonii</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	<2
<i>Indigofera monophylla</i>	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Marsdenia australis</i>	
<i>Nicotiana</i> sp.	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Oldenlandia crouchiana</i>	
<i>Paspalidium tabulatum</i>	
<i>Phyllanthus maderaspatensis</i>	
<i>Polycarpaea longiflora</i>	
<i>Pterocaulon ?serrulatum</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus obovatus</i>	
<i>Rhagodia eremaea</i>	
<i>Rhynchosia bungarensis</i>	
<i>Rhynchosia minima</i>	
<i>Rostellularia adscendens</i> var. <i>latifolia</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Setaria surgens</i>	
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	
<i>Sigesbeckia orientalis</i>	
<i>Stemodia grossa</i>	
<i>Themeda triandra</i>	6
<i>Tinospora smilacina</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	

Species	Cover of dominant species (%)
<i>Trichosanthes cucumerina</i> var. <i>cucumerina</i>	
<i>Triodia epactia</i>	10
<i>Triodia wiseana</i>	5
<i>Tylophora flexuosa</i>	
<i>Ventilago viminalis</i>	
<i>Wedelia</i> sp. Hamersley (A.S. Weston 8444)	1

Site		FL1036	
Described by	LJA	30/05/10	Quadrat 50 m x 50 m
Re-score	JKN	28/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	542991 mE 7554070 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Red skeletal clay loam with surface stones		
Rock Type	Unknown		
Vegetation Description	<i>Triodia epactia</i> closed hummock grassland over <i>Eriachne mucronata</i> with <i>Corymbia hamersleyana</i> scattered low trees		
NVIS V	U ^ <i>Corymbia hamersleyana</i> ^tree\6\r; G+ ^ <i>Triodia epactia</i> , <i>Eriachne mucronata</i> ^hummock grass, tussock grass\2\d		
Vegetation Condition	Very Good		
Fire Age	>25 years	No evidence of recent fire	
Notes	5% leaf litter, litter <1 cm deep, 2% bare ground, no weed cover Vehicle tyre tracks have had no impact on species composition however there is flagging indicating clearing is likely for a drill line straight through the north west quarter of the quadrat		



#### Species

#### Cover of dominant species (%)

*Abutilon dioicum*

*Acacia dictyophleba*

*Acacia pyrifolia* var. *pyrifolia*

*Acacia retivenea*

*Amaranthus undulatus*

*Bidens bipinnata*

*Bulbostylis barbata*

*Cleome viscosa*

*Clerodendrum floribundum* var. *angustifolium*

*Corymbia hamersleyana*

1

*Eriachne mucronata* (typical form)

2

**Species****Cover of dominant species (%)***Euphorbia alsiniflora**Euphorbia australis**Evolvulus alsinoides* var. *villosicalyx**Gomphrena cunninghamii**Gossypium australe**Hakea lorea* subsp. *lorea*

Indeterminant spp.

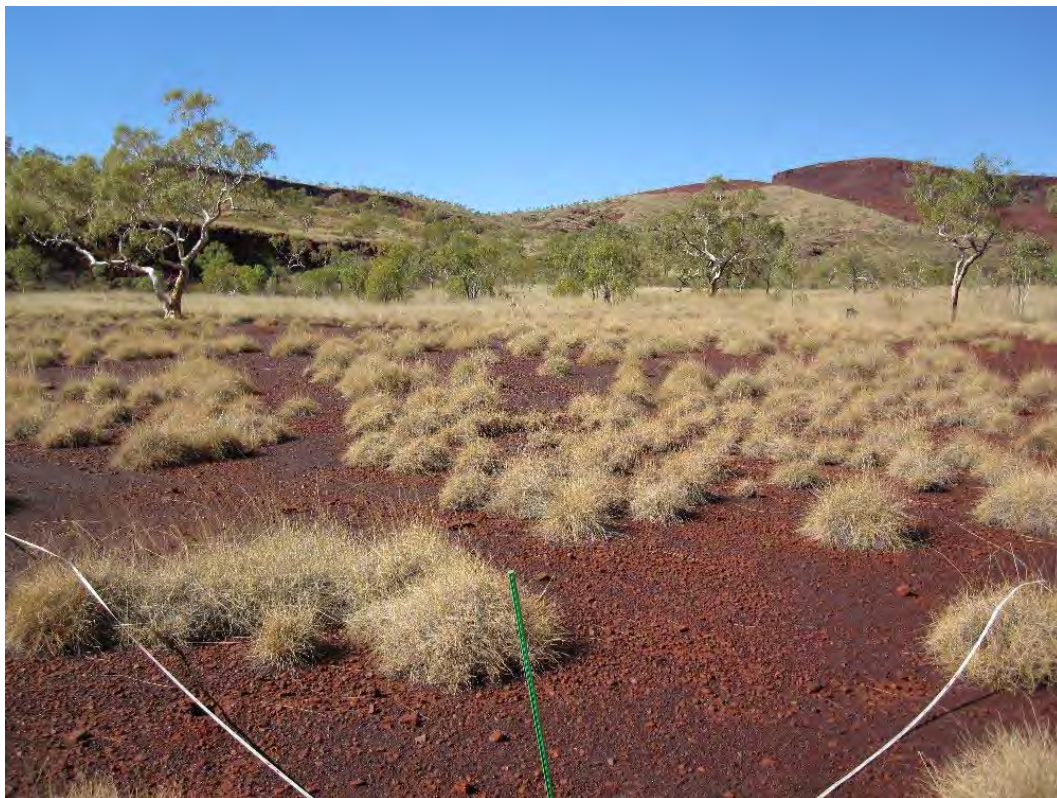
*Indigofera colutea**Indigofera monophylla**Jasminum didymum* subsp. *lineare**Mnesithea formosa**Oldenlandia crouchiana**Polycarpaea longiflora**Ptilotus astrolasius**Ptilotus fusiformis**Rhynchosia minima**Senna artemisioides* subsp. *oligophylla* x *helmsii**Senna glutinosa* subsp. *glutinosa**Stemodia grossa**Tephrosia densa**Themeda triandra**Trichodesma zeylanicum* var. *zeylanicum**Triodia epactia*

90

*Waltheria virgata*



Site		FL1037	
Described by Re-score	HEH	31/05/10	Quadrat 50 m x 50 m
	JKN	28/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	536786 mE 7554550 mN	
Season	Poor (2010), Good (2011)		
Habitat	Undulating valley floor		
Soil	Dark brown burgundy pisolite over stony soil		
Rock Type	Ironstone. Pisolite with red medium pebbles to large pebbles of subangular to sub angular tabular shape		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> ^tree\6\; G+ ^ <i>Triodia</i> aff. <i>melvillei</i> ^hummock grass\1\		
Vegetation Condition	Very Good		
Fire Age	>5 years	Small <i>Triodia</i>	
Notes	<1% leaf litter, litter <1 cm deep, 95% bare ground, no weed cover Disturbance type: Grazing and recent fire		



**Species**

**Cover of dominant species (%)**

<i>Acacia hilliana</i>	
<i>Acacia maitlandii</i>	
<i>Acacia tenuissima</i>	
<i>Aristida holathera</i> var. <i>latifolia</i>	
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Bulbostylis barbata</i>	
<i>Cleome viscosa</i>	
<i>Corymbia hamersleyana</i>	
<i>Dampiera candidans</i>	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	<2
<i>Euphorbia alsiniflora</i>	

**Species****Cover of dominant species (%)***Fimbristylis simulans**Goodenia microptera**Hakea chordophylla**Indigofera monophylla**Oldenlandia crouchiana**Polycarpaea holtzei**Ptilotus astrolasius**Ptilotus calostachyus**Ptilotus exaltatus**Ptilotus fusiformis**Schizachyrium fragile**Senna glutinosa* subsp. *glutinosa**Senna notabilis**Themeda triandra**Triodia ?pungens**Triodia* aff. *melvillei*

5

*Triodia epactia**Triodia wiseana**Yakirra australiensis* var. *australiensis*

Site		FL1038	
Described by	LJA	28/05/10	Quadrat 50 m x 50 m
Re-score	JKN	30/08/10	
	JKN	24/03/11	
Season	Poor (2010), Good (2011)		
Habitat	Flat to gently sloping valley floor to slope with very minor drainage channel through centre		
Soil	Red clay loam with surface stones		
Rock Type	Unknown		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> mid-dense hummock grassland with <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\6\; G+ ^ <i>Triodia</i> aff. <i>melvillei</i> \^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	2% leaf litter, litter <1 cm deep, 30% bare ground, no weed cover		



Species	Cover of dominant species (%)
<i>Acacia dictyophleba</i>	
<i>Acacia hilliana</i>	
<i>Amaranthus undulatus</i>	
<i>Aristida holathera</i> var. <i>holathera</i>	1
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Bulbostylis barbata</i>	
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	1
<i>Cymbopogon ambiguus</i>	
<i>Dampiera candidans</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eriachne mucronata</i> (typical form)	

**Species****Cover of dominant species (%)**

*Eriachne pulchella* subsp. *dominii*

*Eucalyptus leucophloia* subsp. *leucophloia*

*Euphorbia alsiniflora*

*Euphorbia australis*

*Euphorbia* sp. (site 1089)

*Fimbristylis simulans*

*Gompholobium* sp. Pilbara (N.F. Norris 908)

*Goodenia cusackiana*

*Hakea chordophylla*

*Hibiscus leptocladus*

*Hibiscus sturtii* var. *campylochlamys*

*Indigofera monophylla*

*Jasminum didymum* subsp. *lineare*

*Oldenlandia crouchiana*

*Paraneurachne muelleri*

1

*Ptilotus astrolasius*

*Ptilotus fusiformis*

*Senna glutinosa*

*Senna glutinosa* subsp. *glutinosa*

*Senna notabilis*

*Stemodia grossa*

*Themeda triandra*

*Tinospora smilacina*

*Trachymene oleracea* subsp. *oleracea*

*Trichodesma zeylanicum* var. *zeylanicum*

*Triodia ?pungens*

*Triodia* aff. *melvillei*

65

*Triodia epactia*

*Triodia wiseana*

*Yakirra australiensis* var. *australiensis*

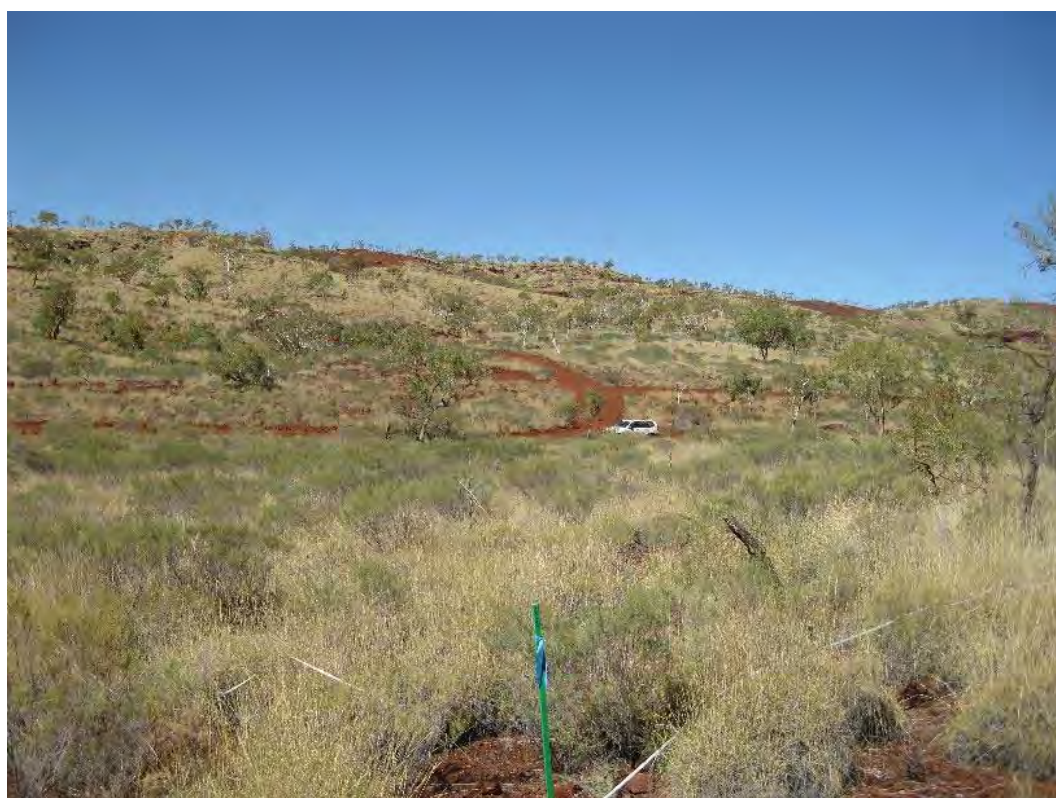
Site		FL1039	
Described by	HEH	31/05/10	Quadrat 50 m x 50 m
Re-score	JKN	29/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	536627 mE 7554785 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate east facing lower slope of large hill arm		
Soil	Red brown loam (not exposed)		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia orthocarpa</i> (atypical form) low open shrubland over <i>Triodia wiseana</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\6\r;M ^ <i>Acacia orthocarpa</i> (atypical form)\2\r;G+ ^ <i>Triodia wiseana</i> \^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	<5 years	Mosaic of burn scars including scar from Feb/Mar 2010	
Notes	<1% leaf litter, litter <1 cm deep, 75% bare ground, no weed cover No evidence of human disturbance although cattle were seen in the area (grazing wasn't observed)		



Species	Cover of dominant species (%)
<i>Acacia arida</i>	
<i>Acacia orthocarpa</i> (atypical form)	5
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Bulbostylis barbata</i>	
<i>Cleome viscosa</i>	
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	
<i>Cymbopogon ambiguus</i>	
<i>Dampiera candicans</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eriachne aristidea</i>	

Species	Cover of dominant species (%)
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Euphorbia alsiniflora</i>	
<i>Goodenia cusackiana</i>	
<i>Goodenia microptera</i>	
<i>Goodenia triodiophila</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mirbelia viminalis</i>	
<i>Mitrasacme connata</i>	
<i>Oldenlandia crouchiana</i>	
<i>Poaceae</i> sp. 2 (FL1039)	
<i>Polycarpaea holtzei</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	
<i>Senna notabilis</i>	
<i>Sida pilbarensis</i>	
<i>Solanum horridum</i>	
<i>Tephrosia</i> sp. (FL1039)	
<i>Triodia</i> aff. <i>melvillei</i>	
<i>Triodia wiseana</i>	25
<i>Waltheria virgata</i>	

Site		FL1040	
Described by	LJA	31/05/10	Quadrat 50 m x 50 m
Re-score	HEH	29/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	550942 mE	7556058 mN
Season	Poor (2010), Good (2011)		
Habitat	Gentle east facing slope of minor hill within valley		
Soil	Red skeletal clay loam		
Rock Type	Ironstone		
Vegetation Description	<i>Acacia orthocarpa</i> (atypical form) shrubland over <i>Triodia wiseana</i> , <i>T. epactia</i> and <i>T. aff. melvillei</i> mid-dense hummock grassland		
NVIS V	M ^ <i>Acacia orthocarpa</i> (atypical form)\^shrub\3\;G+ ^ <i>Triodia wiseana</i> , <i>T. epactia</i> and <i>T. aff. melvillei</i> \^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	Very old burnt logs	
Notes	5% leaf litter, litter <1 cm deep, 40% bare ground, no weed cover		

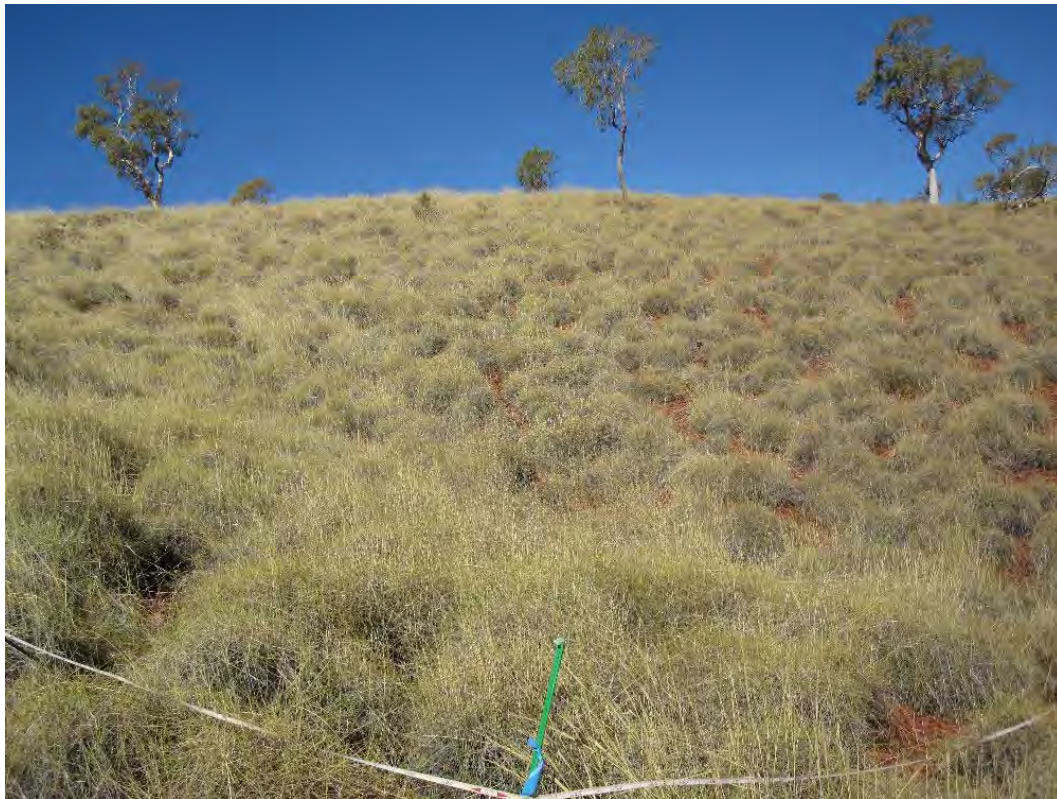


Species	Cover of dominant species (%)
<i>Acacia arida</i>	
<i>Acacia orthocarpa</i> (atypical form)	20
<i>Bonamia</i> sp. Dampier (A.A. Mitchell PRP 217)	
<i>Bulbostylis barbata</i>	
<i>Cleome viscosa</i>	
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	
<i>Corchorus lasiocarpus</i>	
<i>Corymbia hamersleyana</i>	
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	
<i>Eriachne aristidea</i>	
<i>Eriachne ciliata</i>	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	

Species	Cover of dominant species (%)
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia alsiniflora</i>	
<i>Euphorbia australis</i>	
<i>Goodenia cusackiana</i>	
<i>Goodenia stobbsiana</i>	
<i>Gossypium australe</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Hakea chordophylla</i>	1
<i>Hakea lorea</i> subsp. <i>lorea</i>	1
<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Mollugo molluginea</i>	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna notabilis</i>	
<i>Sida</i> sp. articulation below (A.A. Mitchell PRP 1605)	
<i>Solanum diversiflorum</i>	
<i>Solanum horridum</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Triodia</i> aff. <i>melvillei</i>	20
<i>Triodia epactia</i>	3
<i>Triodia wiseana</i>	50
<i>Yakirra australiensis</i> var. <i>australiensis</i>	



Site		FL1041	
Described by Re-score	HEH	31/05/10	Quadrat 50 m x 50 m
	JKN	29/08/10	
	JKN	24/03/11	
Season	Poor (2010), Good (2011)		
Habitat	Moderate to steep west facing upper slope and crest of hill		
Soil	No soil exposed		
Rock Type	Ironstone. Presence of outcropping		
Vegetation Description	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Triodia wiseana</i> mid-dense hummock grassland		
NVIS V	M ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> ^tree\3\i;G+ ^ <i>Triodia wiseana</i> \^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	With recent (Feb/Mar) fire scars nearby	
Notes	<1% leaf litter, litter <1 cm deep		
	No evidence of human disturbance		



**Species**

**Cover of dominant species (%)**

*Acacia dictyophleba*

*Amaranthus undulatus*

*Bulbostylis barbata*

*Cleome viscosa*

*Corymbia hamersleyana*

*Cymbopogon ambiguus*

*Eriachne ciliata*

*Eriachne mucronata* (typical form)

*Eriachne pulchella* subsp. *dominii*

*Eucalyptus leucophloia* subsp. *leucophloia*

<2

*Euphorbia alsiniflora*

*Goodenia triodiophila*

*Gossypium australe*

**Species****Cover of dominant species (%)***Hakea chordophylla**Indigofera monophylla**Mnesithea formosa**Oldenlandia crouchiana**Polycarpaea holtzei**Ptilotus fusiformis**Senna artemisioides* subsp. *oligophylla* x *glutinosa**Senna glutinosa* subsp. *glutinosa**Senna glutinosa* subsp. *pruinosa**Tephrosia stipuligera**Trachymene oleracea* subsp. *oleracea**Triodia wiseana*

65

Site		FL1042	
Described by	LJA	31/05/10	Quadrat 50 m x 50 m
Re-score	HEH	29/08/10	
	HEH	24/03/11	
MGA Zone	GDA94 50	540890 mE 7552849 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate west facing upper slope of spur separated from main slope by gully		
Soil	Red skeletal clay loam with loose stones and large rocks.		
Rock Type	Pisolite/Conglomerate. Blackish red pebbles to rocks of rounded to sub-rounded shape with 20-30% outcropping		
Vegetation Description	<i>Acacia orthocarpa</i> (atypical form) open shrubland over <i>Triodia epactia</i> mid-dense hummock grassland over <i>Triumfetta maconochieana</i> and <i>Corchorus lasiocarpus</i> subsp. <i>parvus</i> low open shrubland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low scattered trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Corymbia hamersleyana</i> ^tree\6\bi;M ^ <i>Acacia orthocarpa</i> (atypical form), <i>Triumfetta maconochieana</i> , <i>Corchorus lasiocarpus</i> subsp. <i>parvus</i> \^shrub, forb\2\i;G+ ^ <i>Triodia epactia</i> ^hummock grass\2\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	Old fire scars on trees	
Notes	5% leaf litter, litter <1 cm deep, 60% bare ground, no weed cover Dead Malvaceae species		



Species	Cover of dominant species (%)
<i>Acacia monticola</i>	
<i>Acacia orthocarpa</i> (atypical form)	15
<i>Aristida contorta</i>	
<i>Bidens bipinnata</i>	
<i>Cleome viscosa</i>	
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	1
<i>Corymbia hamersleyana</i>	
<i>Cucumis maderaspatanus</i>	
<i>Cymbopogon ambiguus</i>	
<i>Dampiera candidans</i>	
<i>Dodonaea coriacea</i>	

**Species****Cover of dominant species (%)**

<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	
<i>Euphorbia alsiniflora</i>	
<i>Fimbristylis simulans</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Hybanthus aurantiacus</i>	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paspalidium clementii</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus fusiformis</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Sida</i> sp. articulation below (A.A. Mitchell PRP 1605)	
<i>Solanum horridum</i>	
<i>Solanum phlomoides</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	35
<i>Triumfetta maconochieana</i>	1
<i>Waltheria virgata</i>	1

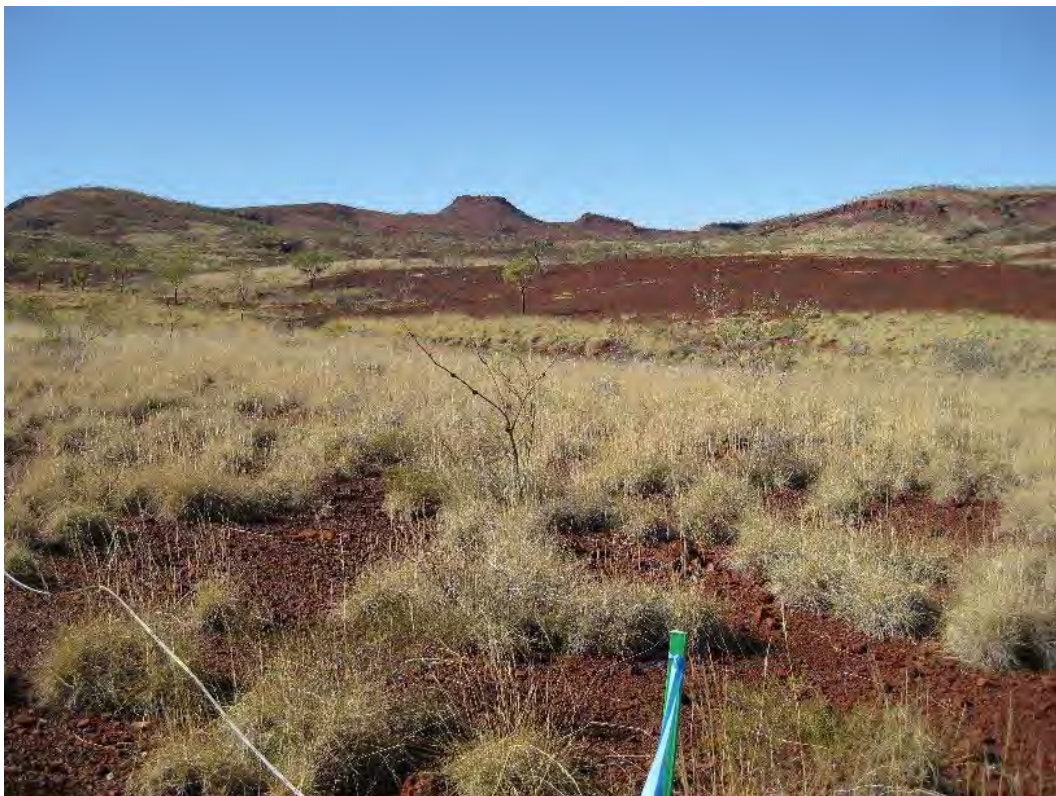
Site		FL1043	
Described by Re-score	HEH	31/05/10	Quadrat 50 m x 50 m
	HEH	29/08/10	
	HEH	24/03/11	
MGA Zone	GDA94 50	539402 mE 753785 mN	
Season	Poor (2010), Good (2011)		
Habitat	Valley floor		
Soil	Sandy loam		
Rock Type	Ironstone. 2-10% pebbles to cobbles on banks and drainage channel floor		
Vegetation Description	<i>Corymbia hamersleyana</i> open woodland over <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> low open shrubland over <i>Triodia epactia</i> mid-dense hummock grassland with <i>Grevillea pyramidal</i> subsp. <i>leucadendron</i> and <i>Gossypium robinsonii</i> scattered tall shrubs over mixed Poaceae spp. scattered tussock grasses		
NVIS V	U ^ <i>Corymbia hamersleyana</i> \^tree\6\r;M ^ <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Grevillea pyramidal</i> subsp. <i>leucadendron</i> and <i>Gossypium robinsonii</i> \^shub\3\r;G+ ^ <i>Triodia epactia</i> , Poaceae spp.\^hummock grass, tussock grass\2\c		
Vegetation Condition	Good		
Fire Age	>5 years	With recent 2010 fire scars nearby	
Notes	15% leaf litter, litter 0-2 cm deep, 60% bare ground, no weed cover Disturbance type: Heavy grazing and fire A lot of dead plants, shrubs and grasses and/or eaten by cattle		



Species	Cover of dominant species (%)
<i>Acacia acradenia</i>	
<i>Acacia dictyophleba</i>	
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	4
<i>Alternanthera nana</i>	
<i>Amaranthus undulatus</i>	
<i>Bidens bipinnata</i>	1
<i>Boerhavia coccinea</i>	
<i>Brachyachne convergens</i>	
<i>Cleome viscosa</i>	
<i>Corchorus crozophorifolius</i>	
<i>Corchorus tridens</i>	

Species	Cover of dominant species (%)
<i>Corymbia hamersleyana</i>	6
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>	
<i>Eragrostis cumingii</i>	
<i>Eulalia aurea</i>	
<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	
<i>Fimbristylis simulans</i>	
<i>Goodenia microptera</i>	
<i>Goodenia nuda</i>	
<i>Gossypium australe</i>	
<i>Gossypium robinsonii</i>	
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	
<i>Grevillea wickhamii</i> subsp. <i>hispidula</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera monophylla</i>	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Melhania</i> sp. (CH15-39)	
<i>Mollugo molluginea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Paraneurachne muelleri</i>	
<i>Perotis rara</i>	
<i>Phyllanthus maderaspatensis</i>	
<i>Pluchea dentex</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polygala</i> aff. <i>isingii</i>	
<i>Polymeria</i> aff. <i>ambigua</i> (PAN 26B-20)	
<i>Portulaca oleracea</i>	
<i>Pterocaulon ?serrulatum</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Rhynchosia minima</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	
<i>Senna notabilis</i>	
<i>Setaria surgens</i>	
<i>Stemodia grossa</i>	
<i>Streptoglossa decurrens</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Themeda triandra</i>	
<i>Triodia epactia</i>	35
<i>Triumfetta maconochieana</i>	

Site		FL1044	
Described by	LJA	01/06/10	Quadrat 50 m x 50 m
Re-score	HEH	29/08/10	
	HEH	24/03/11	
MGA Zone	GDA94 50	540109 mE 7552144 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gentle south facing lower slope of minor rise in valley		
Soil	Red skeletal clay loam		
Rock Type	Channel Iron Deposit		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> mid-dense hummock grassland		
NVIS V	G+ ^ <i>Triodia</i> aff. <i>melvillei</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	2% leaf litter, litter <1 cm deep, 50% bare ground, no weed cover No evidence of human disturbance		



**Species**

**Cover of dominant species (%)**

- Acacia adoxa* var. *adoxo*
- Acacia hilliana*
- Clerodendrum floribundum* var. *angustifolium*
- Corymbia hamersleyana*
- Eriachne ciliata*
- Fimbristylis simulans*
- Gompholobium* sp. Pilbara (N.F. Norris 908)
- Goodenia stobbsiana*
- Goodenia triodiophila*
- Grevillea wickhamii* subsp. *hispidula*
- Hakea chordophylla*
- Indeterminant spp.
- Jasminum didymum* subsp. *lineare*

**Species****Cover of dominant species (%)***Mollugo molluginea**Polycarpha holtzei**Ptilotus calostachyus**Senna artemisioides* subsp. *oligophylla**Senna glutinosa* subsp. *pruinosa**Triodia* aff. *melvillei**Triodia wiseana*

50



Site		FL1045	
Described by	HEH	01/06/10	Quadrat 85 m x 30 m
Re-score	HEH	29/08/10	
	HEH	24/03/11	
MGA Zone	GDA94 50	540093 mE 7551408 mN	
Season	Poor (2010), Good (2011)		
Habitat	Gorge		
Soil	Stony sandy loam		
Rock Type	Dark red, orangey brown alluvial pebbles to stones of subangular tabular to subrounded tabular shape		
Vegetation Description	<i>Eucalyptus victrix</i> open woodland over <i>Acacia monticola</i> , <i>Dodonaea lanceolata</i> var. <i>lanceolata</i> and <i>Gossypium robinsonii</i> tall shrubland over <i>Stemodia grossa</i> low open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Eulalia aurea</i> , <i>Eriachne mucronata</i> open tussock grassland with <i>Ficus brachypoda</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees over <i>Rhynchosia bungarensis</i> scattered herbs		
NVIS V	U ^ <i>Eucalyptus victrix</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Ficus brachypoda</i> ^tree\7\r;M ^ <i>Acacia monticola</i> , <i>Gossypium robinsonii</i> , <i>Dodonaea lanceolata</i> var. <i>lanceolata</i> ^shrub\4\i;G+ ^ <i>Triodia epactia</i> , <i>Eulalia aurea</i> , <i>Eriachne mucronata</i> ^hummock grass, tussock grass\2\i		
Vegetation Condition	Very Good		
Fire Age	>5 years	Recent fire scar close by. Charred termite mound	
Notes	30% leaf litter, litter 0-5 cm deep, 45% bare ground, no weed cover Disturbance type: Grazing and recent fire		



Species	Cover of dominant species (%)
<i>Abutilon dioicum</i>	
<i>Acacia holosericea</i>	
<i>Acacia maitlandii</i>	
<i>Acacia monticola</i>	10
<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	
<i>Acacia tenuissima</i>	
<i>Amaranthus undulatus</i>	
<i>Astrotricha hamptonii</i>	
<i>Bidens bipinnata</i>	
<i>Capparis spinosa</i> var. <i>nummularia</i>	

Species	Cover of dominant species (%)
<i>Corchorus crozophorifolius</i>	
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	
<i>Corchorus tridens</i>	
<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	
<i>Cucumis melo</i> subsp. <i>agrestis</i>	
<i>Cymbopogon procerus</i>	
<i>Cyperus vaginatus</i>	1
<i>Dodonaea lanceolata</i> var. <i>lanceolata</i>	1
<i>Duperreya commixta</i>	
<i>Eragrostis cumingii</i>	
<i>Eriachne mucronata</i> (typical form)	1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Eucalyptus victrix</i>	7
<i>Eulalia aurea</i>	12
<i>Euphorbia biconvexa</i>	
<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	
<i>Ficus brachypoda</i>	<2
<i>Fimbristylis simulans</i>	
<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	
<i>Gomphrena cunninghamii</i>	
<i>Gossypium australe</i>	
<i>Gossypium robinsonii</i>	1
<i>Hakea chordophylla</i>	
<i>Hybanthus aurantiacus</i>	
Indeterminant spp.	
<i>Indigofera</i> sp. Bungaroo Creek (S. van Leeuwen 4301)	
<i>Jasminum didymum</i> subsp. <i>lineare</i>	
<i>Melhania</i> sp. (CH15-39)	
<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)	
<i>Oldenlandia crouchiana</i>	
<i>Perotis rara</i>	
<i>Pluchea dentex</i>	
<i>Polycarpaea holtzei</i>	
<i>Polymeria</i> aff. <i>ambigua</i> (PAN 26B-20)	
<i>Rhagodia eremaea</i>	
<i>Rhynchosia bungarensis</i>	<2
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	
<i>Senna notabilis</i>	
<i>Setaria surgens</i>	
<i>Sida</i> sp. articulation below (A.A. Mitchell PRP 1605)	
<i>Solanum phlomoides</i>	
<i>Stemodia grossa</i>	3
<i>Streptoglossa decurrens</i>	
<i>Tephrosia rosea</i> var. <i>glabrior</i>	
<i>Themeda triandra</i>	12

**Species****Cover of dominant species (%)***Trichodesma zeylanicum* var. *zeylanicum**Trichosanthes cucumerina* var. *cucumerina**Triodia epactia*

14

*Triodia wiseana*

&lt;2

*Ventilago viminalis*

Site		FL1046	
Described by	LJA	01/06/10	Quadrat 50 m x 50 m
Re-score	HEH	29/08/10	
	HEH	24/03/11	
MGA Zone	GDA94 50	538583 mE 7552892 mN	
Season	Poor (2010), Good (2011)		
Habitat	Slight east facing crest of minor rise in valley		
Soil	Red skeletal clay loam with surface stones,		
Rock Type	Ironstone. Continuous red rocks of rounded to sub-angular tabular shape with <2% outcropping		
Vegetation Description	<i>Triodia</i> aff. <i>melvillei</i> mid-dense hummock grassland with <i>Corymbia hamersleyana</i> scattered low trees		
NVIS V	U ^ <i>Corymbia hamersleyana</i> ^tree\6\r;G+ ^ <i>Triodia</i> aff. <i>melvillei</i> ^hummock grass\1\c		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	1% leaf litter, litter <1cm deep, 55% bare ground, no weed cover No evidence of human disturbance		



#### Species

#### Cover of dominant species (%)

*Acacia hilliana*  
*Corymbia hamersleyana*  
*Cucumis melo* subsp. *agrestis*  
*Cymbopogon ambiguus*  
*Dampiera candidans*  
*Eriachne ciliata*  
*Eriachne mucronata* (typical form)  
*Eucalyptus leucophloia* subsp. *leucophloia*  
*Fimbristylis simulans*  
*Goodenia stobbsiana*  
*Hakea chordophylla*  
*Mollugo molluginea*  
*Oldenlandia crouchiana*

**Species****Cover of dominant species (%)***Polycarpha holtzei**Polygala* aff. *isingii**Ptilotus fusiformis**Schizachyrium fragile**Senna glutinosa* subsp. *glutinosa**Triodia* aff. *melvillei**Triodia wiseana*

45

Site		FL1047	
Described by Re-score	LJA	28/05/10	Quadrat 50 m x 50 m
	JKN	30/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	553318 mE 7549876 mN	
Season	Poor (2010), Good (2011)		
Habitat	Moderate south facing scree slope		
Soil	Brown skeletal clay loam largely covered with stones		
Rock Type	Unknown		
Vegetation Description	<i>Acacia adoxa</i> var. <i>adoxo</i> low open shrubland over <i>Triodia wiseana</i> hummock grassland		
NVIS V	M ^ <i>Acacia adoxa</i> var. <i>adoxo</i> ^shrub\1\r;G+ ^ <i>Triodia wiseana</i> ^hummock grass\1\i		
Vegetation Condition	Excellent		
Fire Age	~2 years		
Notes	<1% leaf litter, litter <1 cm deep, 75% bare ground, no weed cover No evidence of human disturbance		



#### Species

*Acacia adoxa* var. *adoxo*  
*Acacia ancistrocarpa*  
*Acacia dictyophleba*  
*Acacia maitlandii*  
*Acacia monticola*  
*Acacia pyrifolia* var. *pyrifolia*  
*Acacia retivenea*  
*Acacia tenuissima*  
*Aristida holathera* var. *latifolia*  
*Corchorus lasiocarpus*  
*Corymbia hamersleyana*  
*Cymbopogon ambiguus*  
*Dodonaea coriacea*

#### Cover of dominant species (%)

2

**Species****Cover of dominant species (%)**

*Dysphania rhadinostachya* subsp. *rhadinostachya*

*Eriachne mucronata* (typical form)

*Eucalyptus leucophloia* subsp. *leucophloia*

*Evolvulus alsinoides* var. *villosicalyx*

*Fimbristylis simulans*

*Goodenia stobbsiana*

*Gossypium australe*

*Hakea chordophylla*

*Hibiscus* aff. *coatesii*

*Indigofera monophylla*

*Jasminum didymum* subsp. *lineare*

*Oldenlandia crouchiana*

*Polycarpaea holtzei*

*Polycarpaea longiflora*

*Polygala* aff. *isingii*

*Ptilotus astrolasius*

*Ptilotus auriculifolius*

*Ptilotus calostachyus*

*Ptilotus exaltatus*

*Ptilotus fusiformis*

*Schizachyrium fragile*

*Senna glutinosa* subsp. *glutinosa*

*Senna glutinosa* subsp. *glutinosa* x *luerssenii*

*Sida* aff. *pilbarensis* (EOB46-01B)

*Solanum phlomoides*

*Tephrosia supina*

*Trachymene oleracea* subsp. *oleracea*

*Trichodesma zeylanicum* var. *zeylanicum*

*Triodia wiseana*

25

Site		FL1048	
Described by	LJA	01/06/10	Quadrat 50 m x 50 m
	Re-score	JKN	
MGA Zone	GDA94 50	553224 mE 7549171 mN	
Season	Poor (2010), Good (2011)		
Habitat	Lower slope		
Soil	Brown skeletal clay loam with surface stones		
Rock Type	Unknown		
Vegetation Description	<i>Triodia wiseana</i> hummock grassland		
NVIS V	G+ ^ <i>Triodia wiseana</i> ^hummock grass\2\i		
Vegetation Condition	Excellent		
Fire Age	>5 years	No evidence of recent fire	
Notes	<1% leaf litter, litter <1 cm deep, 80% bare ground, no weed cover No evidence of human disturbance <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> characteristic of area despite none being captured within the quadrat		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*

*Acacia dictyophleba*

*Acacia elachantha*

*Acacia retivenea*

*Acacia tenuissima*

*Acacia tumida* var. *pilbarensis*

*Clerodendrum floribundum* var. *angustifolium*

*Corchorus lasiocarpus*

*Corymbia deserticola* subsp. *deserticola*

*Cucumis maderaspatanus*

*Cymbopogon ambiguus*

*Dodonaea coriacea*

*Eriachne ciliata*



**Species****Cover of dominant species (%)**

*Eriachne mucronata* (typical form)

*Eriachne pulchella* subsp. *dominii*

*Euphorbia boophthona*

*Fimbristylis simulans*

*Hakea chordophylla*

*Keraudrenia nephrosperma*

*Oldenlandia crouchiana*

*Polycarpaea corymbosa* var. *corymbosa*

*Polycarpaea holtzei*

*Polygala* aff. *isingii*

*Ptilotus calostachyus*

*Schizachyrium fragile*

*Senna artemisioides* subsp. *oligophylla*

*Senna glutinosa* subsp. *glutinosa*

*Senna glutinosa* subsp. *pruinosa*

*Sida* aff. *pilbarensis* (EOB46-01B)

*Tinospora smilacina*

*Trachymene oleracea* subsp. *oleracea*

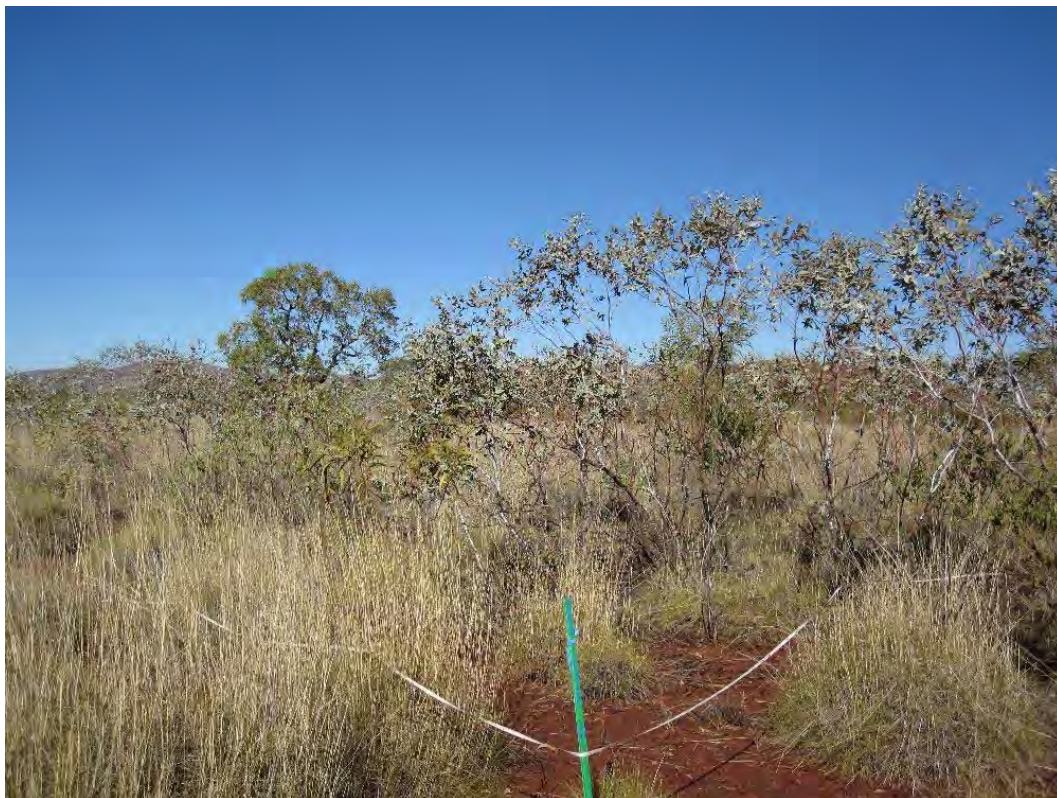
*Trichodesma zeylanicum* var. *zeylanicum*

*Triodia wiseana*

20

*Yakirra australiensis* var. *australiensis*

Site		FL1049	
Described by	HEH	01/06/10	Quadrat 50 m x 50 m
Re-score	HEH	26/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	550809 mE	7547584 mN
Season	Poor (2010), Good (2011)		
Habitat	Undulating plain		
Soil	Dark brown burgundy pisolite over sandy clay loam with surface		
Rock Type	Ironstone. Rocks of sub-rounded to subangular shape		
Vegetation Description	<i>Triodia epactia</i> hummock grassland with <i>Eucalyptus gamophylla</i> scattered mallees over <i>Acacia elachantha</i> , <i>A. ancistrocarpa</i> and <i>A. retivenea</i> scattered tall shrubs		
NVIS V	U ^ <i>Eucalyptus gamophylla</i> ^tree mallee\6\r;M ^^ <i>Acacia elachantha</i> , <i>A. ancistrocarpa</i> and <i>A. retivenea</i> ^shrub\4\r;G+ ^ <i>Triodia epactia</i> ^hummock grass\2\i		
Vegetation Condition	Very Good		
Fire Age	<10 years	Burnt logs and stags. Recent fire scar nearby (February/March)	
Notes	1-2% leaf litter, litter <1 cm deep, 70% bare ground, no weed cover Disturbance type: grazing (minimal) and fire		



**Species**

**Cover of dominant species (%)**

- Acacia ancistrocarpa*
- Acacia dictyophleba*
- Acacia elachantha*
- Acacia pyrifolia* var. *pyrifolia*
- Acacia retivenea*
- Aristida holathera* var. *holathera*
- Bonamia rosea*
- Bonamia* sp. Dampier (A.A. Mitchell PRP 217)
- Corymbia deserticola* subsp. *deserticola*
- Corymbia hamersleyana*
- Digitaria brownii*
- Dysphania rhadinostachya* subsp. *rhadinostachya*

Species	Cover of dominant species (%)
<i>Eucalyptus gamophylla</i>	<2
<i>Eulalia aurea</i>	
<i>Euphorbia australis</i>	
<i>Goodenia microptera</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Paraneurachne muelleri</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Pterocaulon sphacelatum</i>	
<i>Ptilotus astrolasius</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus fusiformis</i>	
<i>Ptilotus rotundifolius</i>	
<i>Schizachyrium fragile</i>	
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	
<i>Senna glutinosa</i> subsp. <i>luerssenii</i>	
<i>Senna notabilis</i>	
<i>Sida</i> aff. <i>echinocarpa</i> (MET 15,350)	
<i>Sida</i> aff. <i>pilbarensis</i> (EOB46-01B)	
<i>Solanum diversiflorum</i>	
<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia epactia</i>	25
<i>Yakirra australiensis</i> var. <i>australiensis</i>	

Site		FL1050	
Described by	HEH	01/06/10	Quadrat 50 m x 50 m
Re-score	HEH	26/08/10	
	JKN	24/03/11	
MGA Zone	GDA94 50	550931 mE 7548095 mN	
Season	Poor (2010), Good (2011)		
Habitat	Very gentle south facing lower hill slope		
Soil	Stony sandy loam		
Rock Type	Ironstone. Red small pebbles to large pebbles of angular tabular to subrounded tabular shape		
Vegetation Description	<i>Triodia wiseana</i> mid-dense hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees		
NVIS V	U ^ <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> \^tree\6\r; G+ ^ <i>Triodia wiseana</i> \^hummock grass\2\c		
Vegetation Condition	Very Good		
Fire Age	<10 years	Burnt logs and stags. Recent fire scar nearby (February/March)	
Notes	<1% leaf litter, litter <1 cm deep, 55% bare ground, no weed cover Area disturbance types: clearing (drill lines and pads) and fire		



#### Species

#### Cover of dominant species (%)

*Acacia adoxa* var. *adoxo*  
*Acacia dictyophleba*  
*Acacia elachantha*  
*Acacia maitlandii*  
*Acacia monticola*  
*Acacia retivenea*  
*Acacia tenuissima*  
*Bulbostylis barbata*  
*Corymbia deserticola* subsp. *deserticola*  
*Corymbia hamersleyana*  
*Cucumis maderaspatanus*  
*Cymbopogon obtectus*  
*Dysphania rhadinostachya* subsp. *rhadinostachya*

Species	Cover of dominant species (%)
<i>Eriachne ciliata</i>	
<i>Eriachne mucronata</i> (typical form)	
<i>Eriachne pulchella</i> subsp. <i>dominii</i>	
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	1
<i>Fimbristylis simulans</i>	
<i>Goodenia stobbsiana</i>	
<i>Hakea chordophylla</i>	
<i>Hakea lorea</i> subsp. <i>lorea</i>	
<i>Oldenlandia crouchiana</i>	
<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	
<i>Polycarpaea holtzei</i>	
<i>Ptilotus calostachyus</i>	
<i>Ptilotus exaltatus</i>	
<i>Ptilotus rotundifolius</i>	
<i>Schizachyrium fragile</i>	
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	
<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	
<i>Triodia wiseana</i>	45

## appendix seven: flora inventory















## appendix eight: threatened and priority flora report forms

# Threatened and Priority Flora Report Form

Version 1.0 January 2010

Please complete as much of the form as possible, with emphasis on those sections bordered in black.

<b>TAXON:</b> <u>Goodenia nuda</u>	<b>TPFL Pop. No.:</b> _____
<b>OBSERVATION DATE:</b> <u>26/05/10</u>	<b>CONSERVATION STATUS:</b> <u>P4</u> <input type="checkbox"/> New population
<b>OBSERVER/S:</b> <u>Lyn Atkins</u>	<b>PHONE:</b> <u>08 9430 8955</u>
<b>ROLE:</b> <u>Senior Environmental Scientist</u>	<b>ORGANISATION:</b> <u>Ecoscape</u>

**DESCRIPTION OF LOCATION** (Provide at least nearest town/named locality, and the distance and direction to that place): \_\_\_\_\_

approx 70km NW of Tom Price

<b>DEC DISTRICT:</b> _____	<b>LGA:</b> _____	<b>Reserve No.:</b> _____
<b>DATUM:</b>	<b>COORDINATES:</b> (If UTM coords provided, <b>Zone</b> is also required)	<b>METHOD USED:</b>
GDA94 / MGA94 <input checked="" type="checkbox"/>	DecDegrees <input type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>	GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>
AGD84 / AMG84 <input type="checkbox"/>	<b>Lat / Northing:</b> <u>7552705</u>	No. satellites: _____ Map used: _____
WGS84 <input type="checkbox"/>	<b>Long / Easting:</b> <u>538879</u>	Boundary polygon captured: <input type="checkbox"/> Map scale: _____
Unknown <input type="checkbox"/>	<b>ZONE:</b> <u>50</u>	
<b>LAND TENURE:</b>		
Nature reserve <input type="checkbox"/>	Timber reserve <input type="checkbox"/>	Private property <input type="checkbox"/>
National park <input type="checkbox"/>	State forest <input type="checkbox"/>	Pastoral lease <input checked="" type="checkbox"/>
Conservation park <input type="checkbox"/>	Water reserve <input type="checkbox"/>	UCL <input type="checkbox"/> SLK/Pole _____ to _____
		Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>
		MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>
		Specify other: _____

<b>AREA ASSESSMENT:</b> Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input type="checkbox"/>	Area observed (m <sup>2</sup> ): _____
<b>EFFORT:</b> Time spent surveying (minutes): _____	No. of minutes spent / 100 m <sup>2</sup> : _____
<b>POP'N COUNT ACCURACY:</b> Actual <input checked="" type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>	Count method: _____ (Refer to field manual for list)
<b>WHAT COUNTED:</b> Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>	
<b>TOTAL POP'N STRUCTURE:</b>	
	<b>Mature:</b> <b>Juveniles:</b> <b>Seedlings:</b> <b>Totals:</b>
Alive	
Dead	
	Area of pop (m <sup>2</sup> ): _____
	Note: Pls record count as numbers (not percentages) for database.
<b>QUADRATS PRESENT:</b> No. _____ Size _____ Data attached <input type="checkbox"/>	Total area of quadrats (m <sup>2</sup> ): _____
<b>Summary Quad. Totals:</b> Alive	
<b>REPRODUCTIVE STATE:</b> Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>	
Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/>	Percentage in flower: _____ %

**CONDITION OF PLANTS:** Healthy  Moderate  Poor  Senescent

**COMMENT:** \_\_\_\_\_

<b>THREATS - type, agent and supporting information:</b>	<b>Current impact (N-E)</b>	<b>Potential Impact (L-E)</b>	<b>Potential Threat Onset (S-L)</b>
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. <b>Specify agent</b> where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
• Grazing	<u>N</u>	<u>M</u>	<u>S</u>
• Clearing (mining)	<u>N</u>	<u>E</u>	<u>M</u>
• Fire	<u>L</u>	<u>H</u>	<u>S</u>

Please return completed form to DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

**RECORDS:** Please forward to **Administrative Officer, Flora, Species and Communities Branch.**

Record entered by: \_\_\_\_\_ Sheet No.: \_\_\_\_\_ Record Entered in Database

## appendix nine: regional floristic analysis

**Assignment of  
vegetation quadrats from the  
Flinders Mines' Pilbara Iron Ore Project  
Area – Blacksmith Flora and Vegetation  
survey to a regional floristic classification  
including data from adjoining areas**

**Prepared for**

**Ecoscape**

**by**

**E.A Griffin  
Consultant Botanist  
(Numerical analyses)**

**and**

**M.E. Trudgen  
Consultant Botanist  
(Report writing)**

**August 2011**



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## 1.0 INTRODUCTION

### *1.1 Purpose of this report*

The purpose of this report is to assign fifty vegetation quadrats (vegetation recording sites) recorded by Ecoscape in the Flinders Mines' Pilbara Iron Ore Project Area (from the Blacksmith leases) to the units defined in the floristic classification in Griffin and Trudgen (2009a and b), which is used as a reference classification. This floristic analysis included earlier data from the nearby Fortescue Metals Group Solomon Project Area and other data from across the Pilbara Bioregion (of Thackway and Cresswell, eds 1995). The presence of a significant number of sites from near the current survey area in the earlier analysis implies that the data the classification is based on should have sites in it that are similar to most of those in the new data, and from this most of the new sites should be able to be placed in the existing classification.

Referring the new sites from the Flinders Mines Pilbara Iron Ore Project Area to the units defined in the floristic classification in Griffin and Trudgen (2009a and b) has the advantage of not starting "from scratch" with a new classification. It also means that the all the sites from the Solomon Project Area and the regional sites referred in another report (Griffin and Trudgen 2010) to this classification can be used to interpret the conservation value of the vegetation of the Flinders Mines Pilbara Iron Ore Project Area as recorded in the new quadrats.

### *1.2 Location of the project area*



**Figure 1.** Location of Flinders Mines Blacksmith Leases vegetation recording sites in the Pilbara Bioregion.

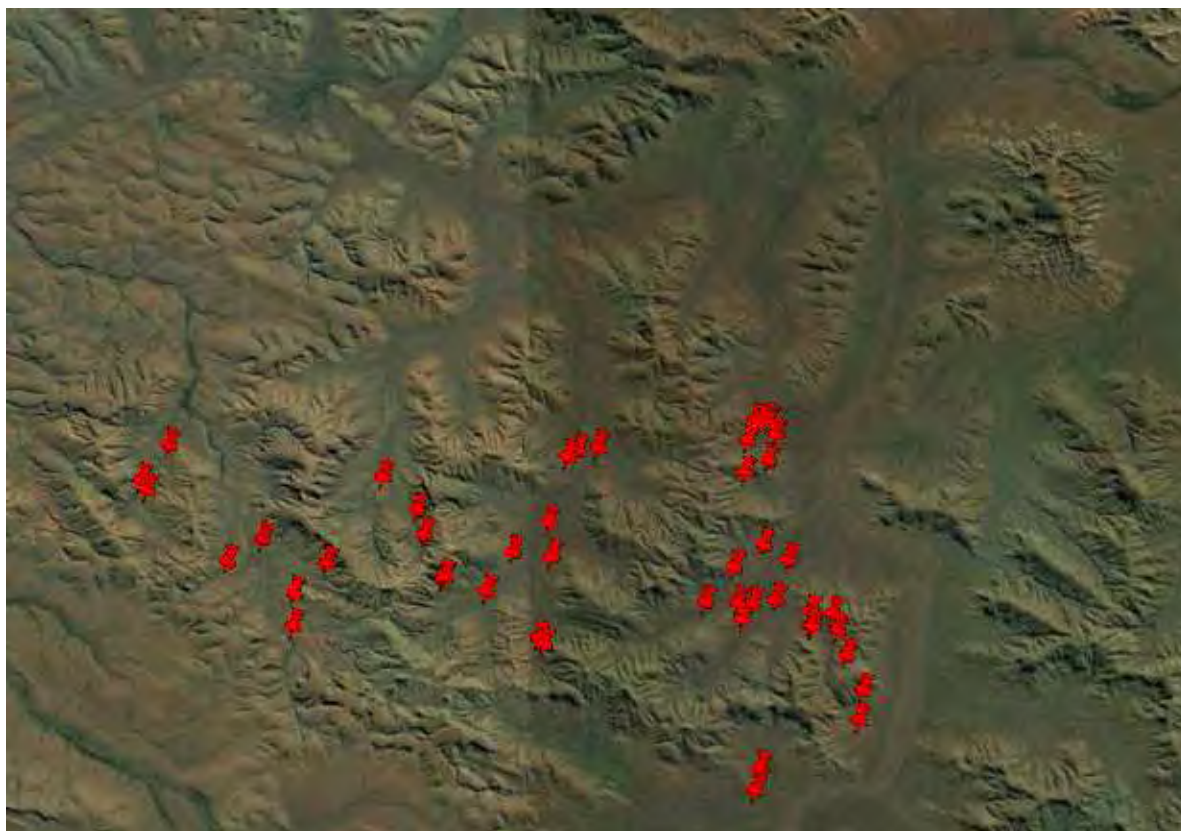
Notes: The sites are marked in red. Karratha is located on Nichol Bay, the bay on the east side of the Burrup Peninsula in the top left hand corner of the image. Image from Google Earth.

The Flinders Mines Pilbara Iron Ore Project Area is located in the Hamersley Ranges in the northwest of Western Australia. It lies to the west of Karijini National Park and about 175 kilometres southeast of the coastal town of Karratha. The general location is shown on Figure 1 on a satellite image.

The project area lies on the eastern side of the "Serenity" sub-area of the Fortescue metals Group "Solomon" project.

### ***1.3 The new sites***

The new sites are from one group and have the codes FL1001 to FL1050. Their distribution in the survey area is shown in Figure 2.



**Figure 2.** Location of vegetation recording sites (quadrats) in the Flinders Mines' Blacksmith Lease area

Notes. Sites marked as red pins. Image from Google Earth. The "Serenity" sub-area of the Fortescue metals Group "Solomon" project is located in the major drainage system immediately to the east of the eastern end of the Flinders Mines survey markers (the red pins).

### ***1.4 Features of the project area***

The Flinders Mines vegetation recording sites are shown on a satellite image in Figure 2. From this image it can be seen that the sites are located in a system of ridges in a fairly rugged part of the Hamersley Range.

While the Flinders Mines Blacksmith Leases Project Area lies on (and adjacent to) the eastern side of the "Serenity" sub-area of the Fortescue metals Group "Solomon" project it occurs on different parts of the landscape. The "Serenity" sub-area is focussed on the large creek system on the east side of the red markers on Figure 2. In contrast, the red markers show that the Flinders Mines project is focussed on lower to mid-slopes of the ranges.

It can also be seen from Figure 2 that the Flinders Mines' Blacksmith Leases Project Area sites are mainly on the valley floors or the lower slopes, rather than on the ridges, although a few are on the ridges. That is it only has a low to moderate range of habitats in a fairly uniform area of landscape.

## **2.0 METHODS**

### ***2.1 Data preparation***

The data from the earlier analysis (Griffin & Trudgen 2009a, b) incorporating sites from the Solomon Project Area and the new data was imported into a Microsoft Access database. The “queries” (short programs written using Microsoft Access) used to carry out the analyses were also incorporated into this database.

To make the data set as compatible as possible across the various projects used, reconciliation of flora species names used in the different projects was undertaken. This was necessary because of the potential for project specific variations in the use of names. To reduce this problem one of us (M.E. Trudgen, who has done the identifications for several of the larger projects in the database) checked the identifications of the specimens collected by Ecoscape.

### ***2.2 Analyses carried out***

Two types of analyses were used for the data from the new sites. Firstly, after data reconciliation, a classification was carried out by adding the new data to the regional data set and using the same steps as used in Griffin & Trudgen (2009a) to generate a dendrogram using the PATN analysis package. Such dendrograms are linear displays of the classification, as such they are limited in that they display in one dimension a much more complex set of relationships (these are indicated by the lines joining the sites, but these have to be understood as not joining the sites in a list from top to bottom).

The sites from the earlier classification (the reference classification) were annotated on this dendrogram with their unit numbers from this earlier classification and the location of the new sites in the dendrogram used to infer a unit for them from the earlier classification. The second analysis used was to identify the most similar sites ("Nearest Neighbour") to each of the new sites in the earlier dataset. The results of the two methods were then used to investigate the best assignment for the new sites.

A nearest neighbour analysis finds the site or sites that a new site is most similar to (in this case in the reference data set). This is done simply through finding the site or sites with the most similar flora list. This is a different procedure to finding related groups of sites through

a classification process. It has the limitation that the most similar sites in flora list may have species present that are not informative in a classification and mask real relationships.

Through the floristic group of each of the “nearest” reference sites, an inference can be made to the most likely floristic group for the new sites. The less similar these reference sites, the less certain the interpretation from this method.

While the reference classification had groups defined at several levels, the intention here is to assign the Flinders sites to the 600-group level of that classification. This is the level that is most appropriate for conservation assessment.

### 3.0 LIMITATIONS

All exercises such as those carried out for this report using the PATN package (Belbin 1987 and later dates) have limitations, including those related to data quality (see below), data density, data distribution and size of the total data set used. Experience with analyses similar to those carried out here has shown that the quality of field observation (which is related to the effort expended and the level of expertise available) has a significant influence on the classification obtained from the analyses, with poor data degrading results. However, the results of any analysis are influenced not only by the data quality, but also by the techniques employed.

Limitations in the quality of data can come about through:

- Deficiencies in site (quadrat) selection and size - poor site selection can mean that the data recorded does not represent one vegetation type, but is mixed, muddying the classification produced. Inadequate quadrat size means that the size of the area sampled is not adequate to get the appropriate data;
- Inadequate numbers of sites or poor sampling strategy, leading to not all types being sampled, or some types appearing less common than they really are, or more common than they really are;
- Inadequate searching of quadrats, leading to only part of the flora present being recorded and poor definition of the groups defined, or poor assignment of sites;
- Inaccurate identification of specimens, leading to poor definition of the groups defined, or poor assignment of sites;
- Over reliance on field identification of species, leading to errors in the species recorded for quadrats and consequent poor definition of the groups defined, or poor assignment of sites;
- Seasonal conditions such as drought can significantly affect the flora that can be recorded and recent fire can also significantly affect the flora that can be recorded.
- How carefully the data was entered into the database, how well the database is maintained over time to keep use of names of species consistent.

Over a number of years, the authors of this report have come to the conclusion that there is a widespread lack of recognition of the level of skill and determination needed to reduce such errors to the point where they do not have an undue effect on the data provided to them to process for reports such as the current report.

A number of these issues are also undoubtedly related to inadequate time being allowed for survey work, we are aware that this comes about partly through underestimation of time required by consultants themselves and partly through the timeframes of proponents and the times they allow for work (ie, the budgets they allow).

Obviously, variations in seasonal conditions at the time of survey can affect the quality of data collected, as less species will be available in dry periods rather than after good rainfall (when better material, enabling better identifications can also be obtained). The new data from the Blacksmith Leases provided for this report was recorded in a good year and has good species richness compared to data from the same general area (see Table 1) and are reasonably consistent with the reference data. If anything, the sites are richer than the reference data (this could cause minor problems for the analysis). Variation in the standard of identifications can also affect data quality between data sets. To reduce the effect of this problem in the current analyses, the identifications of the specimens collected by Ecoscape were checked for identification errors by one of us (MET). However, this checking cannot correct field identification errors.

Other sources of difference in data quality between the projects in the data set are the differences in experience of those undertaking the primary observations. The issue of significance is that data for the sorts of analysis carried out need to be of good quality, or analyses are much more difficult and there is a risk that significant environmental variation relevant to environmental impact assessment may not be discriminated.

**Table 1.** Frequency distribution of species richness at sites by projects

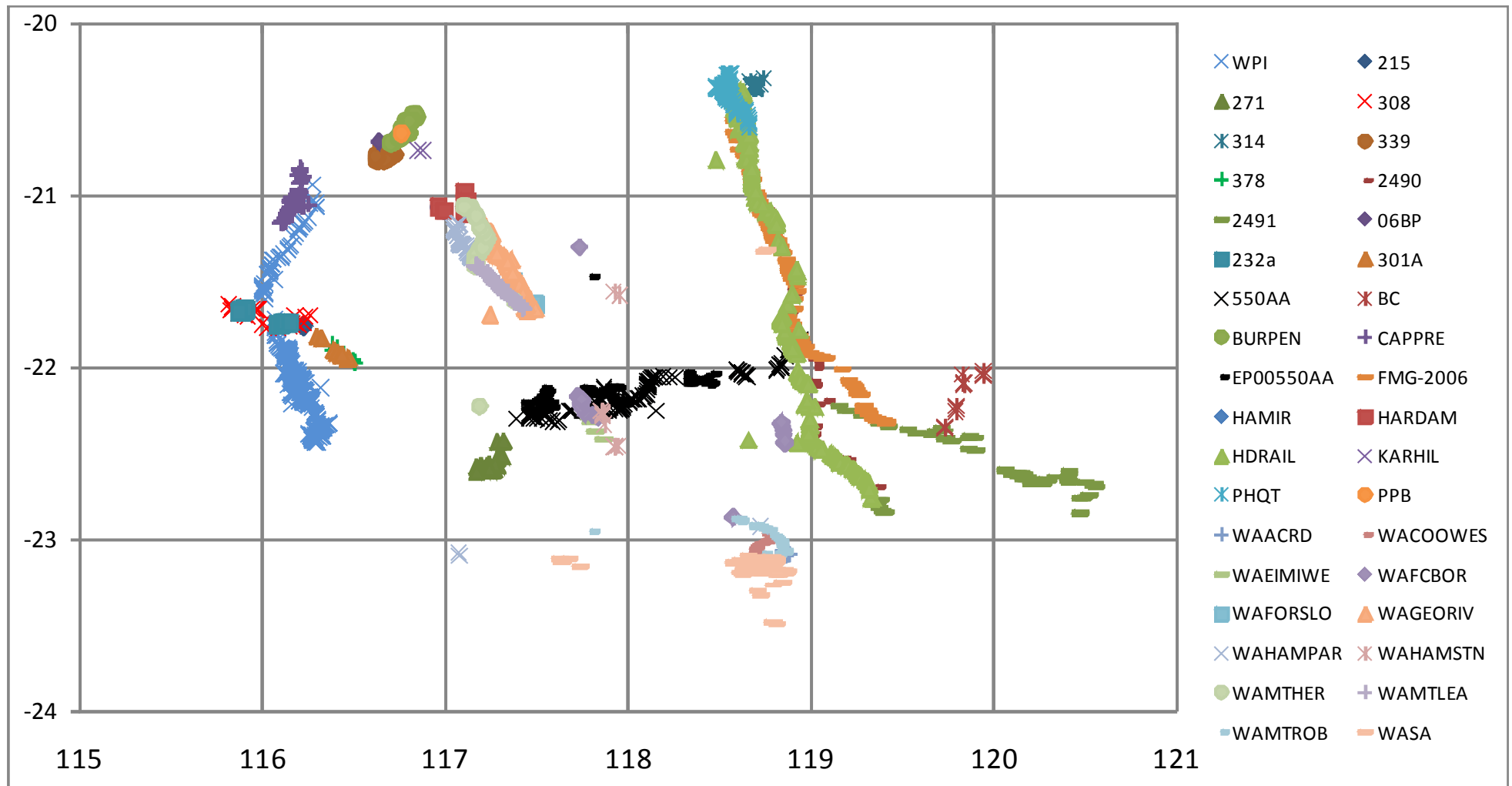
PROJ	Av	sites	% of sites in richness classes									
			0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	100-109
<b>Flinders</b>	<b>42</b>	<b>51</b>			<b>5</b>	<b>18</b>	<b>15</b>	<b>6</b>	<b>6</b>		<b>1</b>	
550AA	25	135	10	45	38	23	12	7				
EP00550AA	29	268	6	68	71	61	43	16	3			
WPI	22	427	13	234	84	45	28	17	5	1		
HDRAIL	33	192	6	20	40	66	42	14	3	1		
FMG-2006	22	151	12	57	50	20	9	2	1			
2490	37	45		5	11	13	8	6		1		1
BC	21	14		6	6	2						
WAFCBOR	29	41		12	9	11	6	3				



An approach sometimes used in an attempt to reduce the impact of differences due to season is to include only the perennial species in the dataset analysis. This has not been done with this case, as it was not used in the analyses for the reference classification.

Limitations in data density and distribution (see Map 1) for the classification from Griffin and Trudgen 2009a & b) used for the analyses carried out for this report are also going to have an impact on the results produced, as there is significant clustering of the data (into project areas) rather than an even spread, and variation in the density (and therefore the number of replicates in different geological/habitat types in different projects) of data in different projects. Such limitations could lead to some of the units defined being poorly sampled and, therefore, appearing to be less common than they actually are, others could be more heavily sampled than in an even spread of sites and appear to be more common than they actually are.

Bearing in mind the limitations in the data discussed above, it is obvious that there must be limitations in the definition of the units defined, as it is acknowledged that the data on which they are based on is not ideal. Further, depending on the level of the group defined it should be recognised that the composition of the groups defined by these analyses should not necessarily be interpreted as communities that can be recognised in the field. This may be possible for a proportion of the lower order groups defined, but an extensive process of review and refinement, aided by field knowledge and checking would be required to extend the analysis to such a point for all such groups at the lowest level.



**Map 1.** Location of the quadrats and releves used in the reference data set and classification used for this report colour coded to show the project they were recorded for.

Note: Degrees of latitude and longitude on the axes, the sites are spread across the Pilbara Bioregion. Abbreviations for projects given in Table 3 of Trudgen and Griffin (2009a). The black sites at about 117.5\* are the sites in the FMG Solomon survey area.

It should be noted that the level of classification used in the reference set (600 groups) is a value judgement, albeit one based on considerable experience. So, too are aspects of the inference of most likely group drawn from the nearest neighbour analysis. This is particularly the case in attempting to distinguish the difference between genuinely new floristic groups and results that appear to be such, but are in fact artefacts caused by poor data.

Experience with a similar situation (Griffin and Trudgen 2010) to the current task (fitting new sites to the reference classification), where sites were referred to the reference classification indicated that under these circumstances that the analyses carried out would give answers that were frequently near (or include) the correct unit to assign a new site to, but that it might be necessary to compare the vegetation descriptions and flora lists for the new sites to a number of the units in the classification to make decision as to which to finally assign each site to. The better quality data in the current case might make this unnecessary.

These limitations in the data mean that the assignment of sites to the previous classification will have a level of error, it is not possible to define this as a proportion of the sites; however it is not thought to be very high.

As the new sites are from outside the immediate area of the Solomon Project Area, the possibility of quadrats representing units not sampled by the classification used is fairly obvious. As the new sites sample different habitat to the adjoining Serenity sub-area of the Solomon Project Area, this reinforces the possibility.

## 4.0 RESULTS

### ***4.1 Results from the classification of the Flinders data with the reference data set***

An important result of the classification of the Flinders data with the data from the reference data set is that virtually all of the new sites join with sites from the Fortescue Metals Group Solomon area projects (projects EP00550AA and 550AA in the reference data set). As the Solomon sites (especially the Serenity sub-area sites) are from close by, this demonstrates that at the regional scale the same floristic groupings are present in both datasets. This shows that any differences in the data quality between the new and reference data sets is not so high that regional patterns are obscured and suggests that the data should be able to give a reasonable result with one or other form of analysis.

The new sites are shown in context with the sites to which they were joined in the dendrogram in Table 2. Most of the new sites group in a single block in the dendrogram, although a few do not. When additional data groups like this in a dendrogram, it can indicate that the new data has a systematic difference from the earlier data. This can either be a real difference (reflecting differences in vegetation sampled) or it can be due to seasonal or other factors (see limitations section above). Given how close the new survey area is to the various FMG Solomon project areas, it is likely that the dendrogram is not a reliable method for assigning the sites that are in the large block. However, for those new sites that occur scattered through the classification (dendrogram) this method is likely to be reasonably reliable in this case.

As with many similar analyses comparing new sites to an existing data set, the new sites tend to be more similar to each other than to the reference sites, due to survey specific factors (season, identification differences, different workers). It is presumed that the large block of sites referred to above has occurred due to such factors. Thus an analysis using nearest neighbour analysis is given in the next section using the inferred groups to help infer the more likely floristic group of some sites, particularly those in the large block.

Table 2. Extracts from the dendrogram showing the classification of the Flinders data with the reference data set

Notes. Only those segments of the dendrogram that show how the new sites join to the reference sites are shown. The pale grey rows indicate breaks in the dendrogram. The column headed "600-gp" has the 600-group level units for the sites in the 2009 classification. The adjacent column (#) is the number of species at each site.

PROJ	site	#	600-gp	data
				0.0000    0.2444    0.4889    0.7333    0.9778    1.2222    1.4667    1.7111    1.9556    2.2000
WAMTLEA	0416	22	196	
550AA	RAIL008b	24	293	
EP00550AA	SERN063	22	293	
EP00550AA	CG004	20	291	
EP00550AA	SERN028	36	293	
EP00550AA	SERN031	40	293	
EP00550AA	SERN042	20	293	
EP00550AA	CG005	18	293	
EP00550AA	SERN046	18	293	
Flinders	FL1014	29		
EP00550AA	SERN043	31	293	
EP00550AA	SERN 101	29	293	
EP00550AA	SERN018	34	293	
EP00550AA	SERN026	28	293	
WAFCBOR	1068	20	282	
550AA	KR004	22	284	
WAFCBOR	1069	13	284	
EP00550AA	VOQ26	20	285	
Flinders	FL1046	20		
EP00550AA	VOQ008	17	284	
550AA	5RAIL033	14	284	
EP00550AA	VOQ21	17	284	
EP00550AA	VOQ30	11	285	
EP00550AA	VOQ39	16	285	
Flinders	FL1024	27		
EP00550AA	VOQ32	19	285	
EP00550AA	VOQ43	22	285	
550AA	5RAIL032	10	284	
EP00550AA	VOK018	15	284	
EP00550AA	SERN019	21	296	

PROJ	site	#	600- gp	data																	
				0.0000	0.2444	0.4889	0.7333	0.9778	1.2222	1.4667	1.7111	1.9556	2.2000								
EP00550AA	SERN106	17	296																		
EP00550AA	SERN-CV1	17	296																		
EP00550AA	VOK027	26	296																		
EP00550AA	TRIN015	29	296																		
550AA	5RAIL034	24	289																		
EP00550AA	VOQ29	15	289																		
EP00550AA	VOK009	23	289																		
EP00550AA	TRIN011	13	290																		
EP00550AA	TRIN011A	24	290																		
WAFCBOR	1065	31	287																		
550AA	7RAIL048	37	287																		
EP00550AA	SERN044	30	295																		
EP00550AA	VOK015	30	295																		
EP00550AA	SERN076	29	288																		
EP00550AA	SERN100	29	288																		
EP00550AA	SERN102	43	288																		
Flinders	FL1001	34																			
Flinders	FL1002	39																			
Flinders	FL1003	41																			
Flinders	FL1017	41																			
Flinders	FL1004	51																			
Flinders	FL1006	62																			
Flinders	FL1015	30																			
Flinders	FL1042	33																			
Flinders	FL1016	42																			
Flinders	FL1025	54																			
Flinders	FL1033	41																			
Flinders	FL1028	39																			
Flinders	FL1034	30																			
Flinders	FL1041	24																			
Flinders	FL1037	30																			
Flinders	FL1038	40																			
Flinders	FL1039	36																			
Flinders	FL1040	43																			
Flinders	FL1005	30																			

PROJ	site	#	600- gp	data																	
				0.0000	0.2444	0.4889	0.7333	0.9778	1.2222	1.4667	1.7111	1.9556	2.2000								
Flinders	FL1008	33																			
Flinders	FL1050	31																			
Flinders	FL1047	38																			
Flinders	FL1018	30																			
Flinders	FL1013	40																			
Flinders	FL1048	33																			
Flinders	FL1021	34																			
Flinders	FL1020	33																			
Flinders	FL1032	43																			
EP00550AA	SERN112	37	293																		
Flinders	FL1010	30																			
Flinders	FL1011	32																			
Flinders	FL1007	52																			
Flinders	FL1019	51																			
Flinders	FL1022	60																			
Flinders	FL1023	45																			
Flinders	FL1029	51																			
Flinders	FL1012	35																			
Flinders	FL1009	37																			
Flinders	FL1030	39																			
Flinders	FL1031	56																			
Flinders	FL1049	36																			
Flinders	FL1036	34																			
EP00550AA	SERN029	41	298																		
EP00550AA	VOK012	50	298																		
EP00550AA	SERN109	47	298																		
EP00550AA	VOK021	45	298																		
EP00550AA	VOK002	29	298																		
EP00550AA	VOK007	36	298																		
EP00550AA	VOK011	42	298																		
WAMTLEA	0489	8	277																		
550AA	KR002	10	277																		
Flinders	FL1044	19																			
EP00550AA	FT13	23	277																		

PROJ	site	#	600- gp	data
				0.0000    0.2444    0.4889    0.7333    0.9778    1.2222    1.4667    1.7111    1.9556    2.2000
EP00550AA	FT17	15	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
EP00550AA	FT05	12	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
EP00550AA	FT12	12	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
EP00550AA	FT19	17	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
EP00550AA	FT20	19	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
EP00550AA	FT18	9	277	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
WPI	BOR095	14	148	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL_RIP	18		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
HDRAIL	H045	25	155	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
HDRAIL	H285	42	126	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
550AA	6RAIL010	44	301	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
550AA	6RAIL011	56	301	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
550AA	7RAIL039	59	172	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
550AA	RAIL007	42	172	_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL1026	63		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL1027	78		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL1035	55		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL1045	57		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
Flinders	FL1043	52		_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
				_____  _____  _____  _____  _____  _____  _____  _____  _____  _____
				0.0000    0.2444    0.4889    0.7333    0.9778    1.2222    1.4667    1.7111    1.9556    2.2000



## 4.2 Results from Nearest Neighbours analysis of the Flinders data with the reference data set

The inferred floristic group from the nearest neighbour analysis tended to be consistent with that of the reference sites to which the joined. The exception to this was a large block of new sites (see above). Table 3 gives the inferred floristic group for each of the new sites. Only a few of the assignments appeared significantly uncertain.

**Table 3.** Allocation of new sites to the 600-group level floristic groups of the reference classification.

Notes. The two left part of the table gives the data in site order, the right hand part in unit order, in the latter case the different units are colour coded. A question mark in the hand columns headed "Q" indicates that the Nearest Neighbours analysis suggests that the assignment is not particularly strong. Column "NNB unit" = unit allocation from Nearest Neighbours analysis.

SITE	ORDER						UNIT	ORDER				
Site	NNB unit	Q	Site	NNB	Q		Site	NNB unit	Q	Site	NNB	Q
FL_RIP	257	?	FL1026	301			FL1043	171		FL1002	299	
FL1001	299		FL1027	301			FL1029	174		FL1003	299	
FL1002	299		FL1028	298			FL1031	174		FL1004	299	
FL1003	299		FL1029	174			FL_RIP	257	?	FL1016	299	
FL1004	299		FL1030	321			FL1044	277		FL1017	299	
FL1005	293		FL1031	174			FL1005	293		FL1034	299	
FL1006	298		FL1032	293			FL1008	293		FL1037	299	
FL1007	321		FL1033	300			FL1010	293		FL1039	299	
FL1008	293		FL1034	299			FL1011	293		FL1040	299	
FL1009	321		FL1035	301			FL1013	293		FL1041	299	
FL1010	293		FL1036	298			FL1014	293		FL1015	300	
FL1011	293		FL1037	299			FL1020	293		FL1018	300	
FL1012	321		FL1038	298			FL1021	293		FL1033	300	
FL1013	293		FL1039	299			FL1024	293		FL1046	300	
FL1014	293		FL1040	299			FL1032	293		FL1026	301	
FL1015	300		FL1041	299			FL1047	293		FL1027	301	
FL1016	299		FL1042	298			FL1048	293		FL1035	301	
FL1017	299		FL1043	171			FL1050	293		FL1045	301	?
FL1018	300		FL1044	277			FL1006	298		FL1007	321	
FL1019	298		FL1045	301	?		FL1019	298		FL1009	321	
FL1020	293		FL1046	300			FL1025	298		FL1012	321	
FL1021	293		FL1047	293			FL1028	298		FL1022	321	
FL1022	321		FL1048	293			FL1036	298		FL1023	321	
FL1023	321		FL1049	321			FL1038	298		FL1030	321	
FL1024	293		FL1050	293			FL1042	298		FL1049	321	
FL1025	298						FL1001	299				

Table 4 (and the second half of Table 3) shows that the fifty-one (51) new sites were allocated to ten floristic groups at the 600-group level of the reference classification. Nearly three-quarters of the sites were allocated to just four of these units. This is considered likely to be due (see Figure 2 above) to the fact that the survey area has a limited range of habitat, being located in a fairly repetitive series of ridges and intervening valleys. Table 4 also shows that of these ten floristic groups only one was not from the Solomon projects (EP00550AA and 550AA) and only two others had sites in the reference set that occurred in other projects. This reaffirms that the new sites are most related to the floristic communities of the Solomon area.

It should be noted that these nine floristic groups represent a small proportion of the 96 groups at the 600 group level that have been recorded in the Solomon projects. About 60 of these rarely if at all are in other projects. Thus, it is reasonable to assume that the current inference process may have “over looked” occurrences of some of these groups. Never the less, the 7 groups (dark highlighting in Table 4) that were only in the Solomon projects are amongst the more common floristic communities so far recognised in the Solomon area.

**Table 4.** Summary of allocation of new sites to the 600-group level of the reference floristic classification

Notes. The table shows all projects from the reference data set to which groups in the new data belong and the number of sites. The shading indicates the relative localisation of the reference sites in the Solomon area (projects EP00550AA and 550AA)

gp50	gp100	gp200	gp400	gp600	Flinders	Reference Sites				
						All	550AA	EP00550AA	WPI	WAMTLEA
10	29	57	110	171	1	32	1	31		
10	29	58	112	174	2	21		21		
17	42	90	170	257	1	18			18	
20	45	96	183	277	1	10	1	7		2
21	46	100	192	293	13	12	1	11		
21	46	101	194	299	11	8	1	7		
21	46	101	194	298	7	7		7		
21	46	101	195	300	4	6		6		
21	47	102	196	301	4	8	5		3	
23	49	107	209	321	7	30	9	21		

An extract of data from the records for each site in each of these groups are provided in Appendix 1. This allows inferences about the vegetation and habitat for each of these groups.

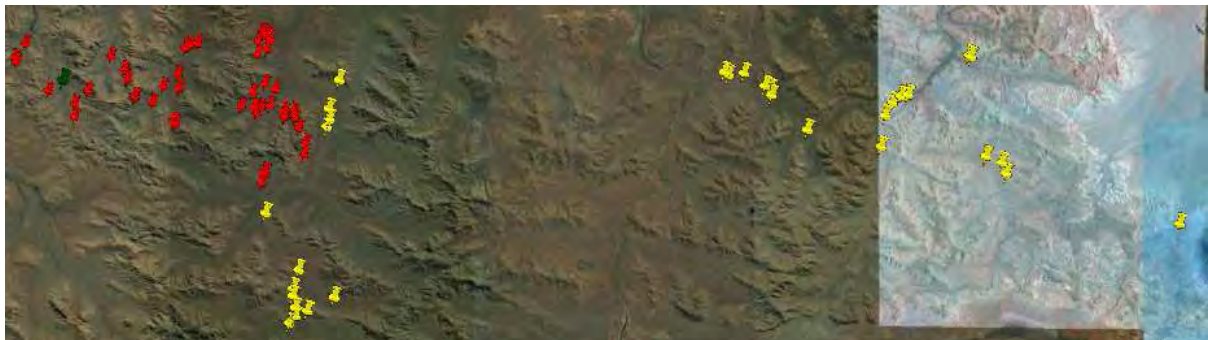
### ***4.3 Distribution of the groups at the 600-group level of the reference classification identified in the Flinders data***

A series of distribution maps of the groups at the 600-group level identified in the Flinders data are given below as Figure 3. These show the Flinders sites in each group as green markers, the reference sites for the group as yellow markers and the other Flinders sites as red markers

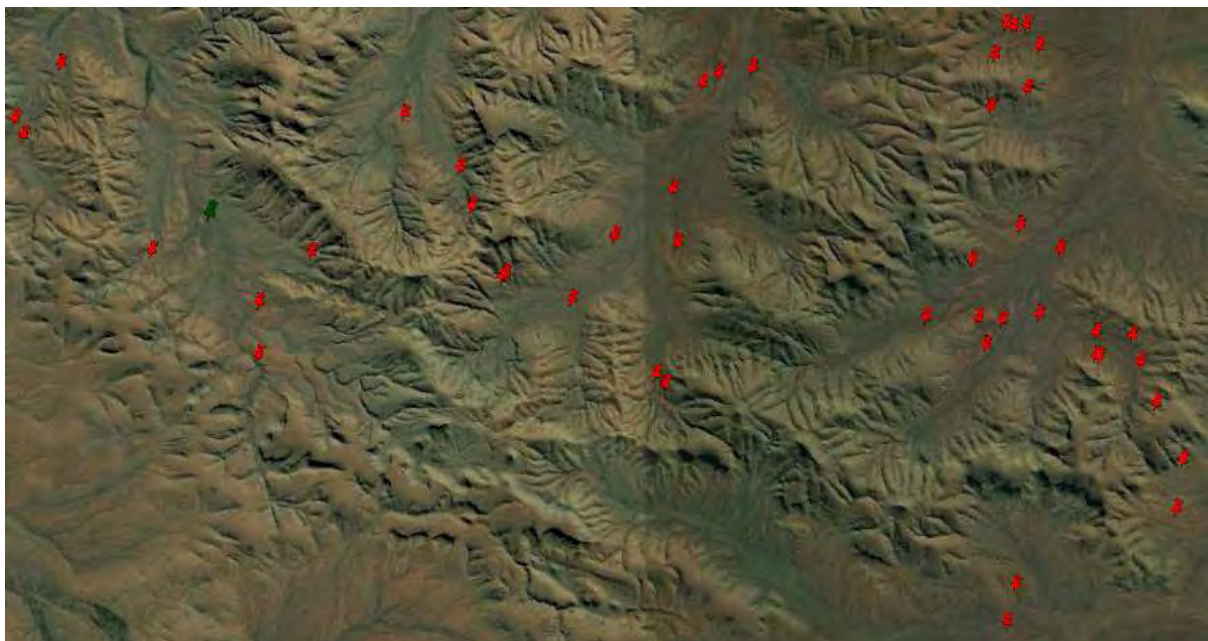
Figure 3. Distribution of sites from the floristic groups (at the 600 group level of the reference classification) in the Flinders data

A regional (all sites) and a local (Flinders sites) map is given for each unit except for units 257, 293 and 299. Images from Google Earth.

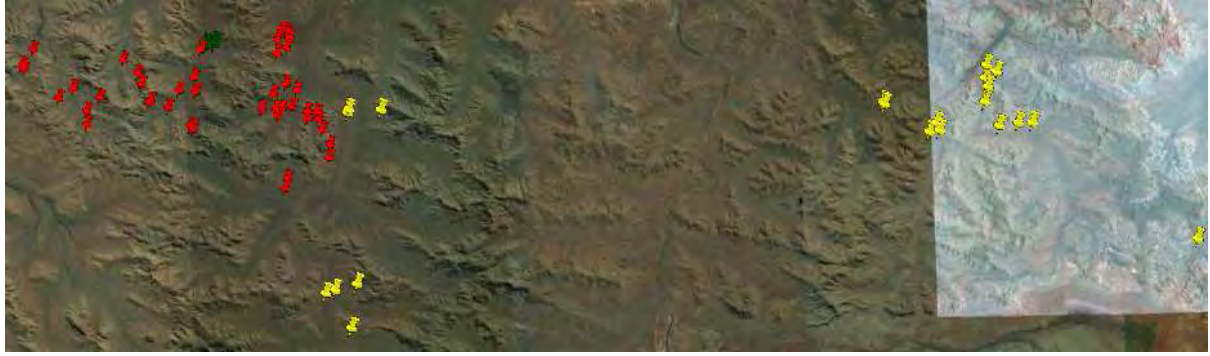
#### **Group 171 regional distribution**



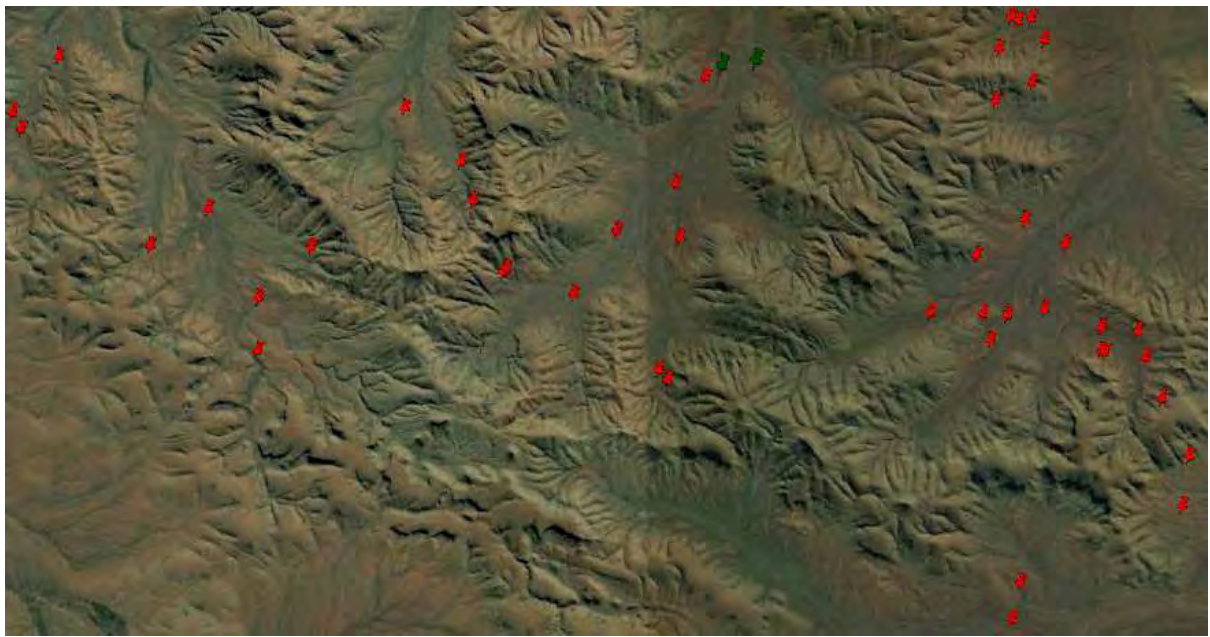
#### **Group 171 local distribution**



**Group 174 regional distribution**

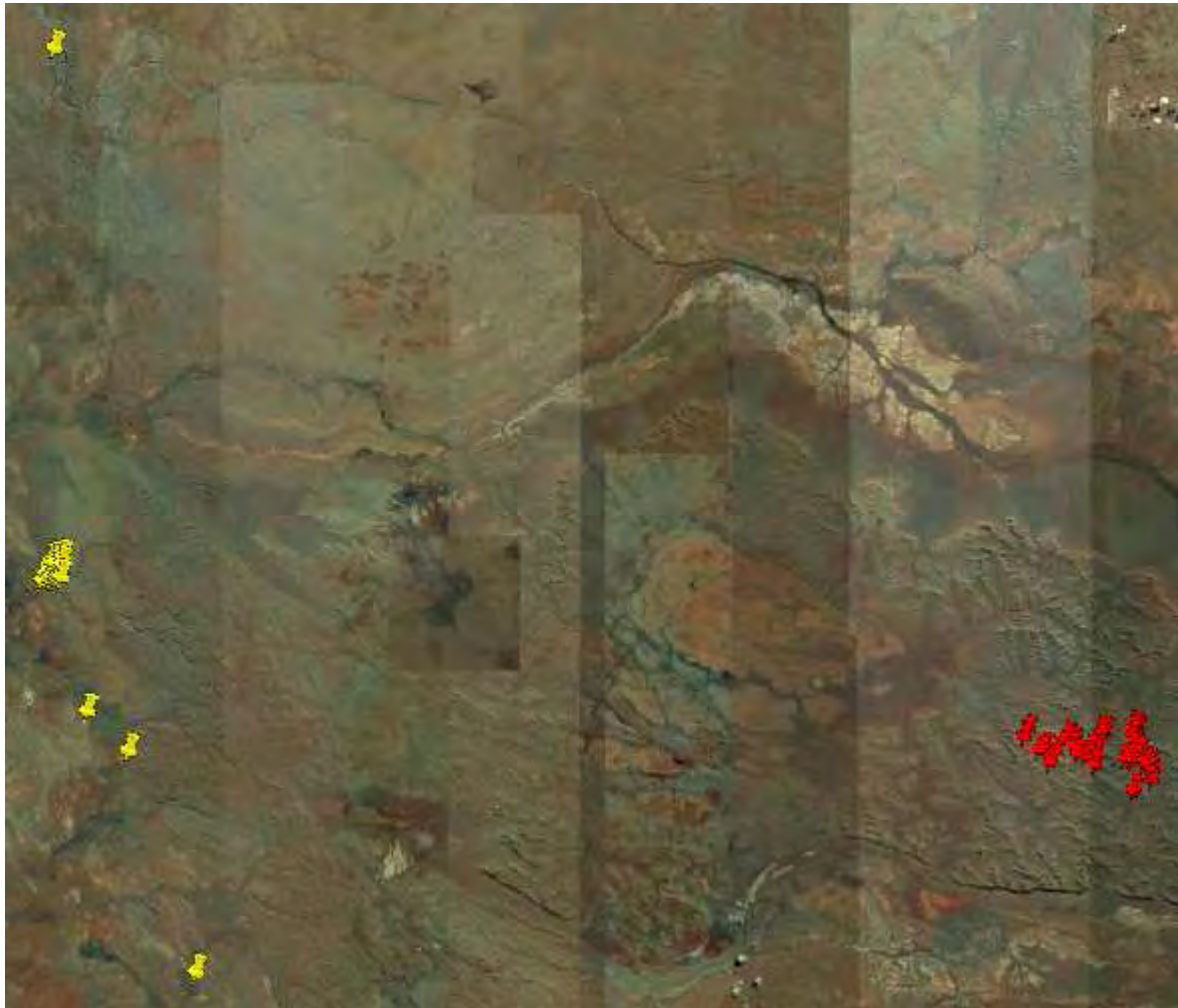


**Group 174 local distribution**

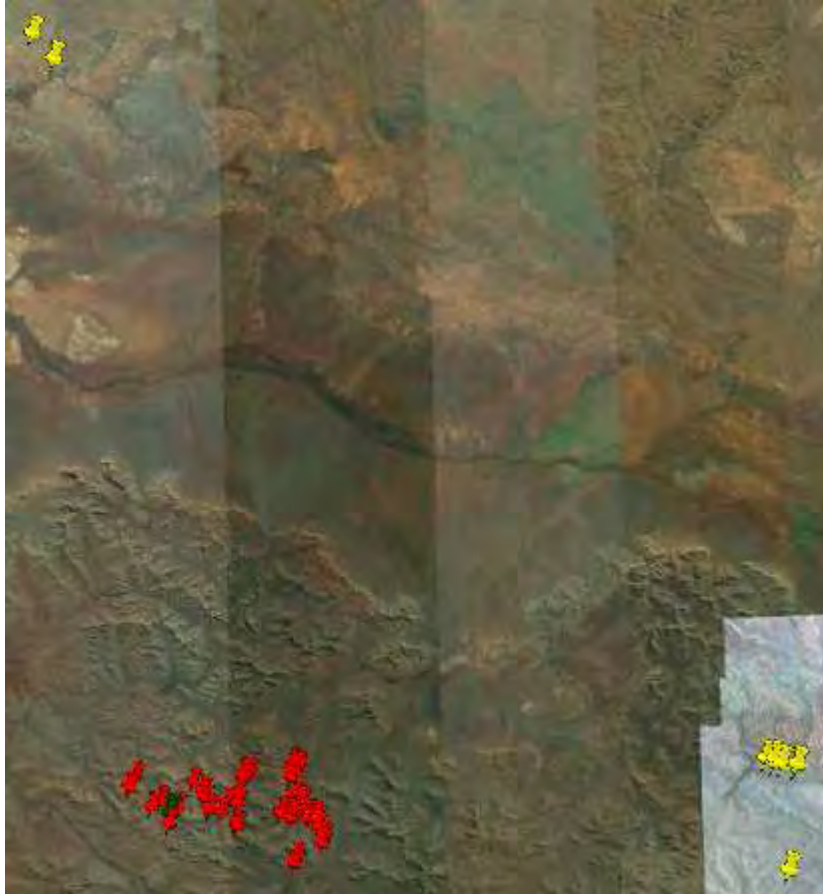


**Group 257 regional distribution**

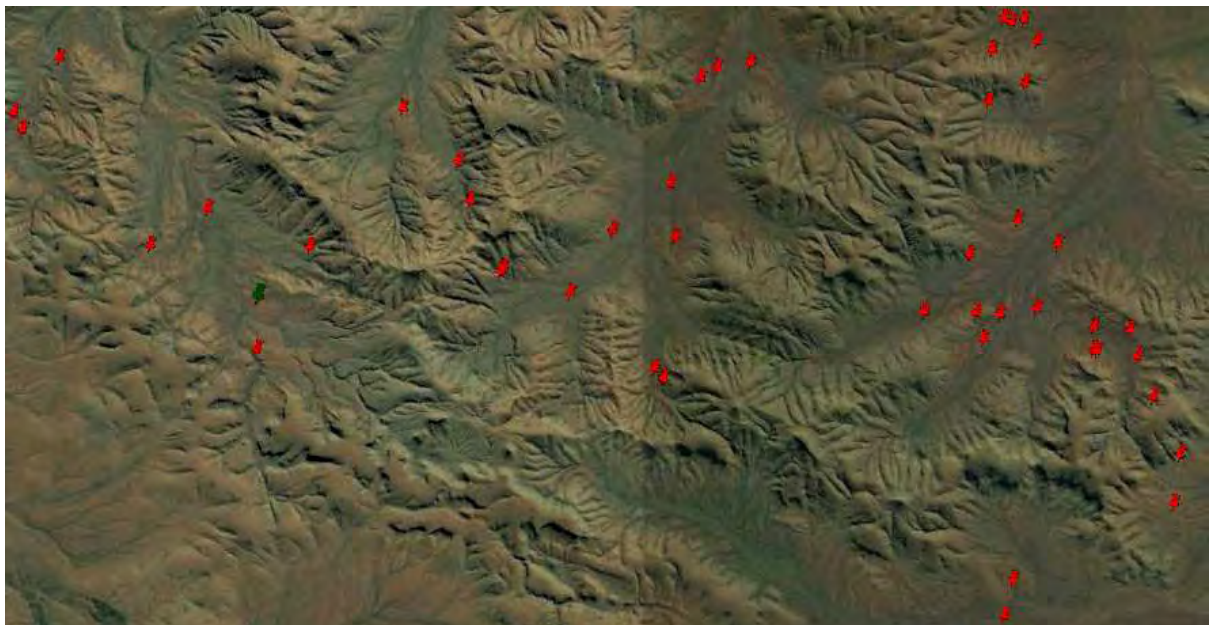
(No coordinates were provided for one of the new sites.)



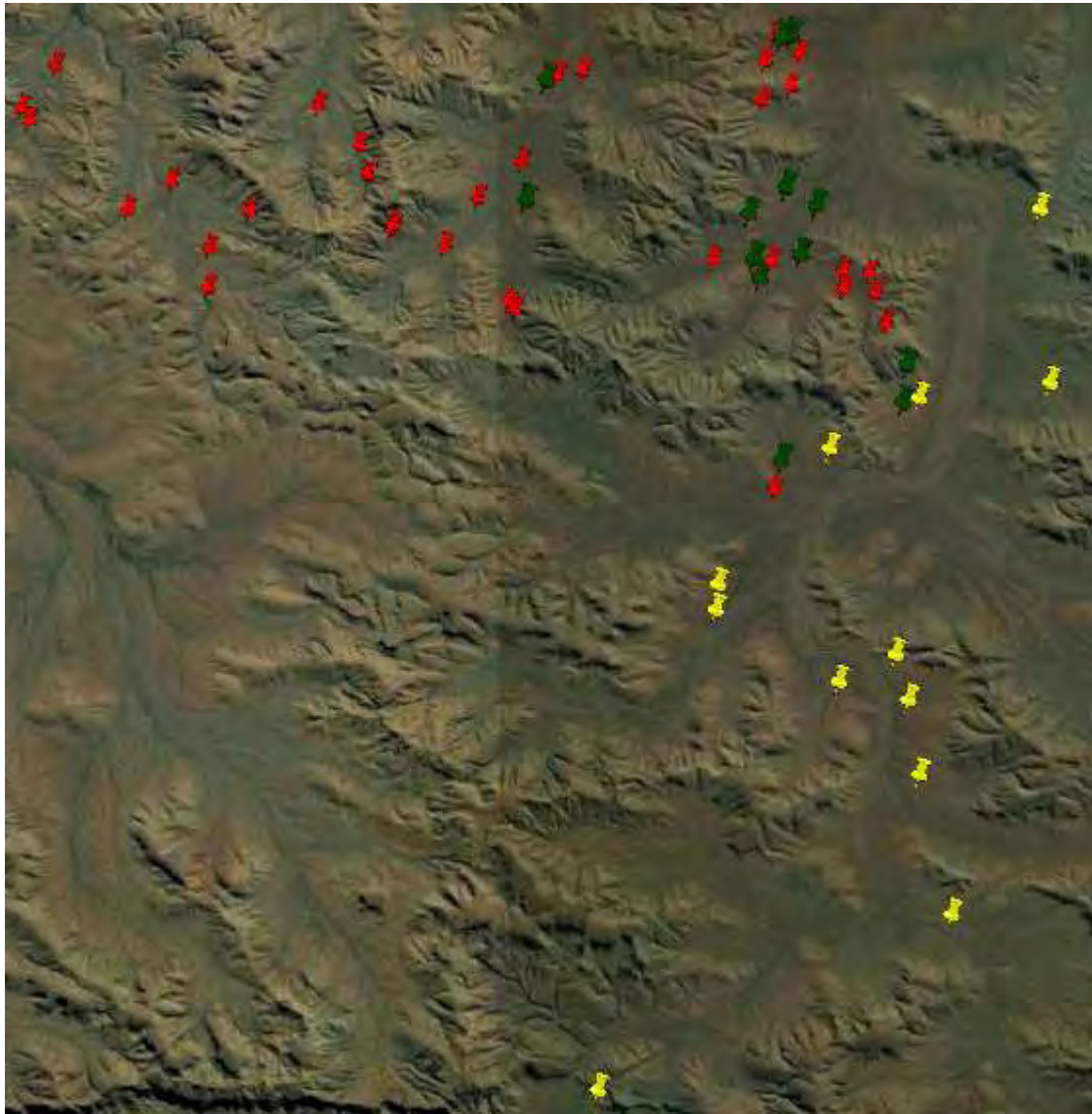
**Group 277 regional distribution**



**Group 277 local distribution**



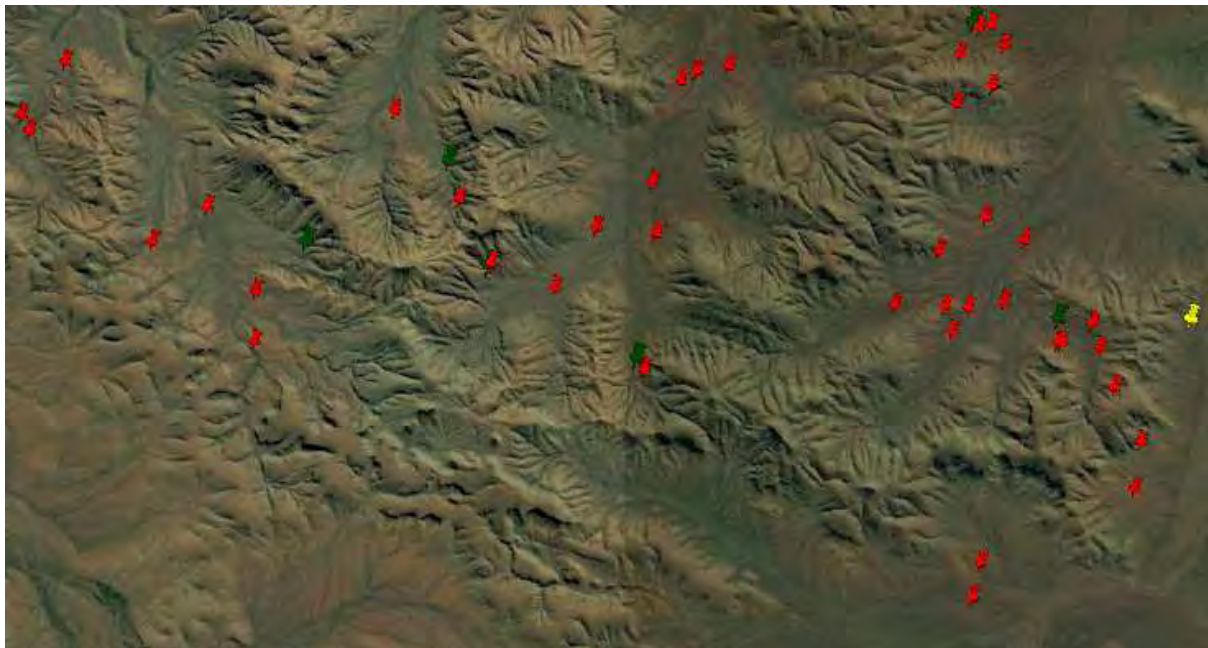
**Group 293 regional distribution**



**Group 298 regional distribution**

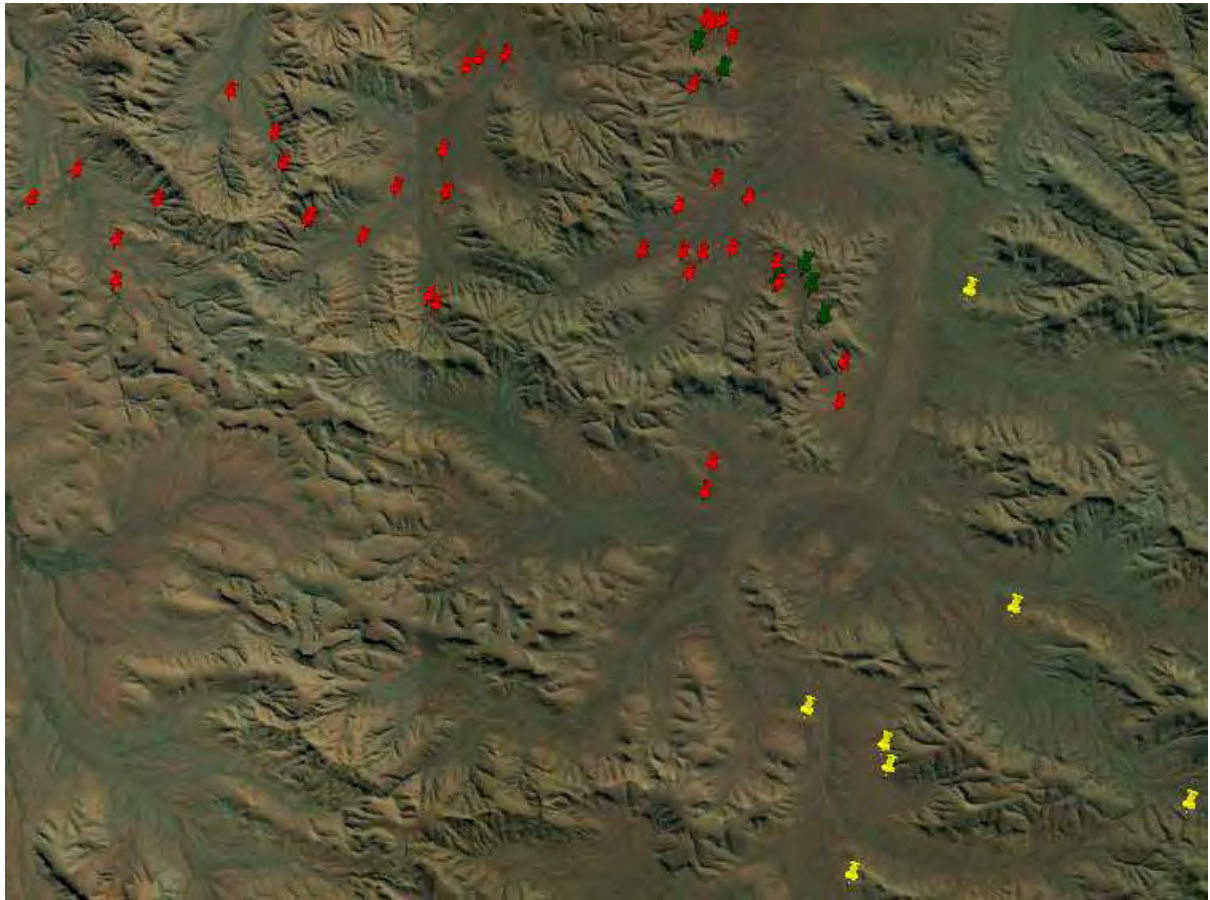


**Group 298 local distribution**

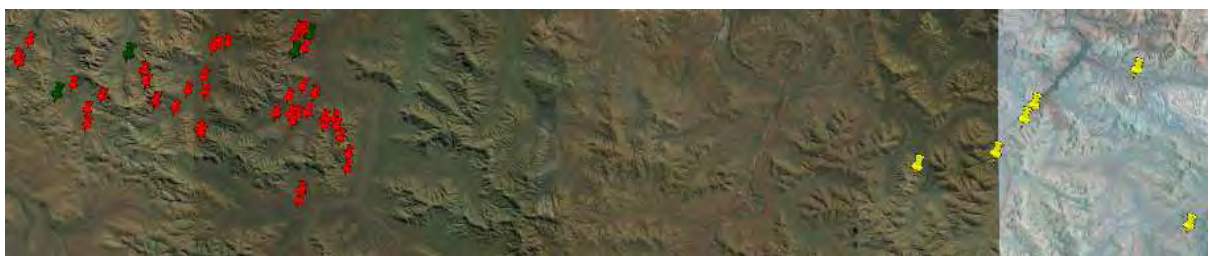




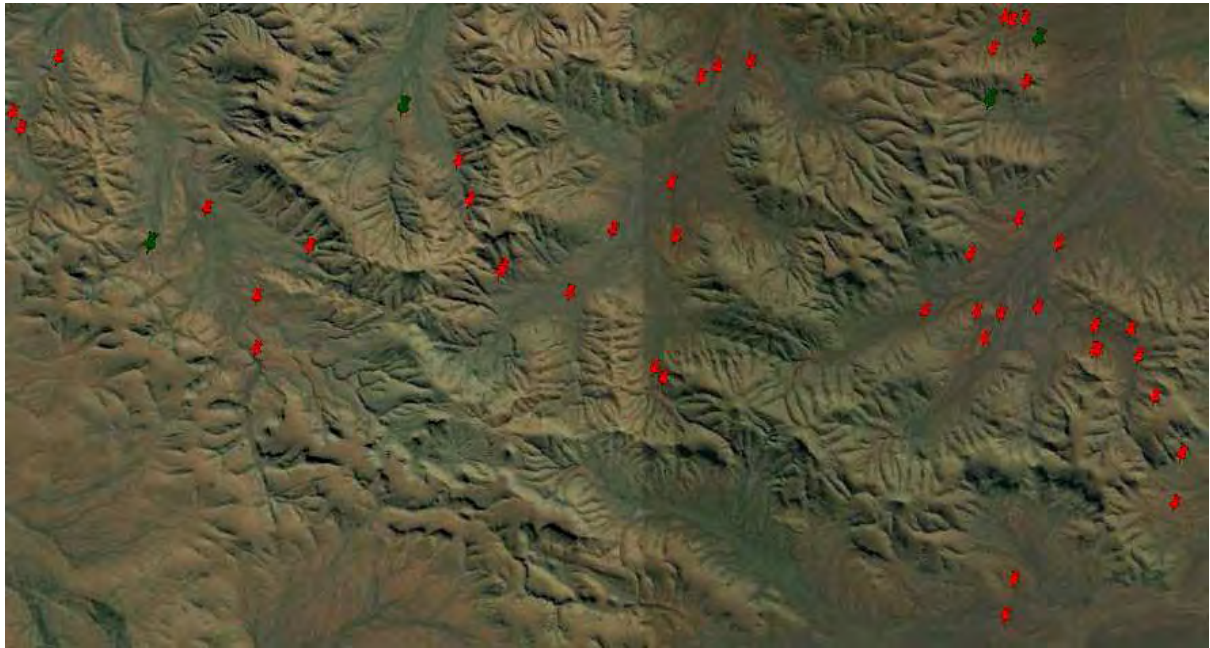
**Group 299 regional distribution**



**Group 300 regional distribution**



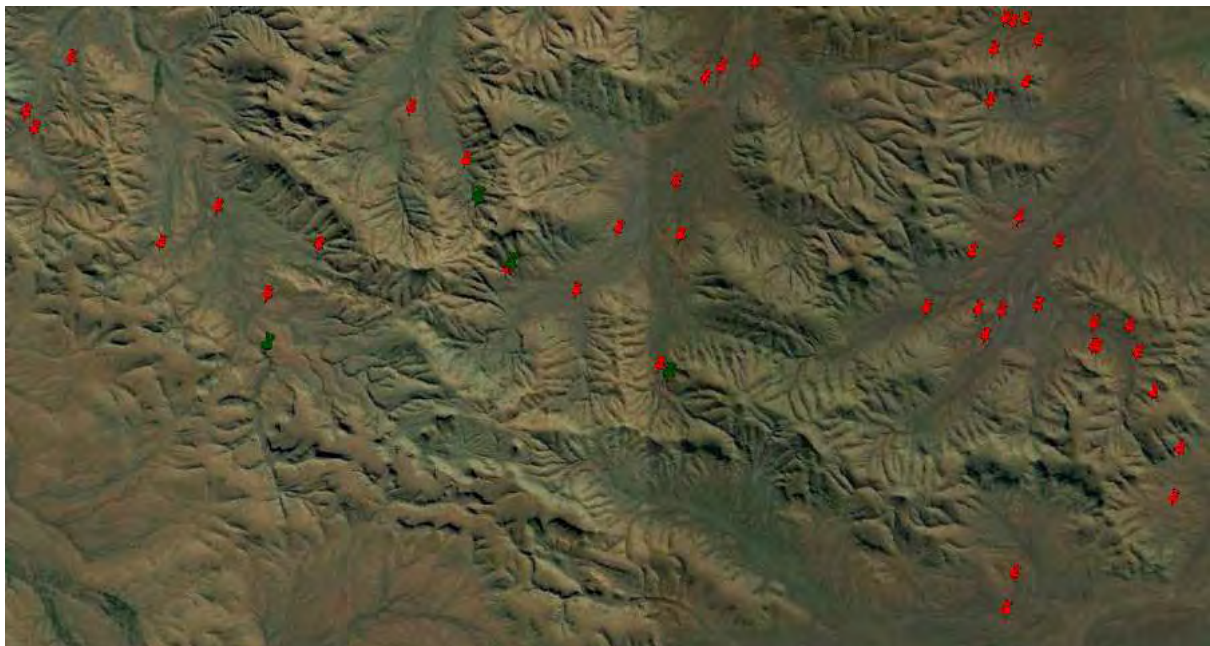
**Group 300 local distribution**



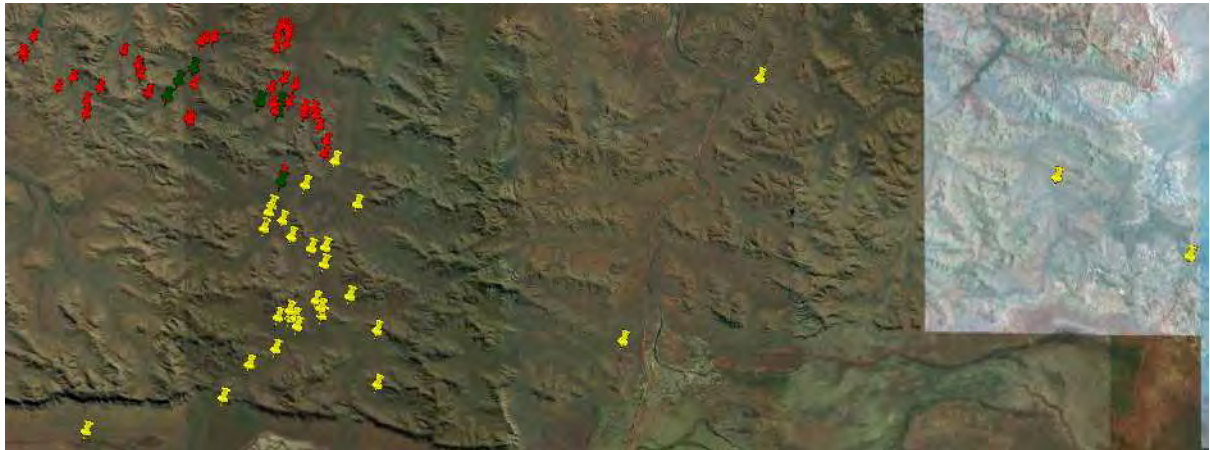
**Group 301 regional distribution**



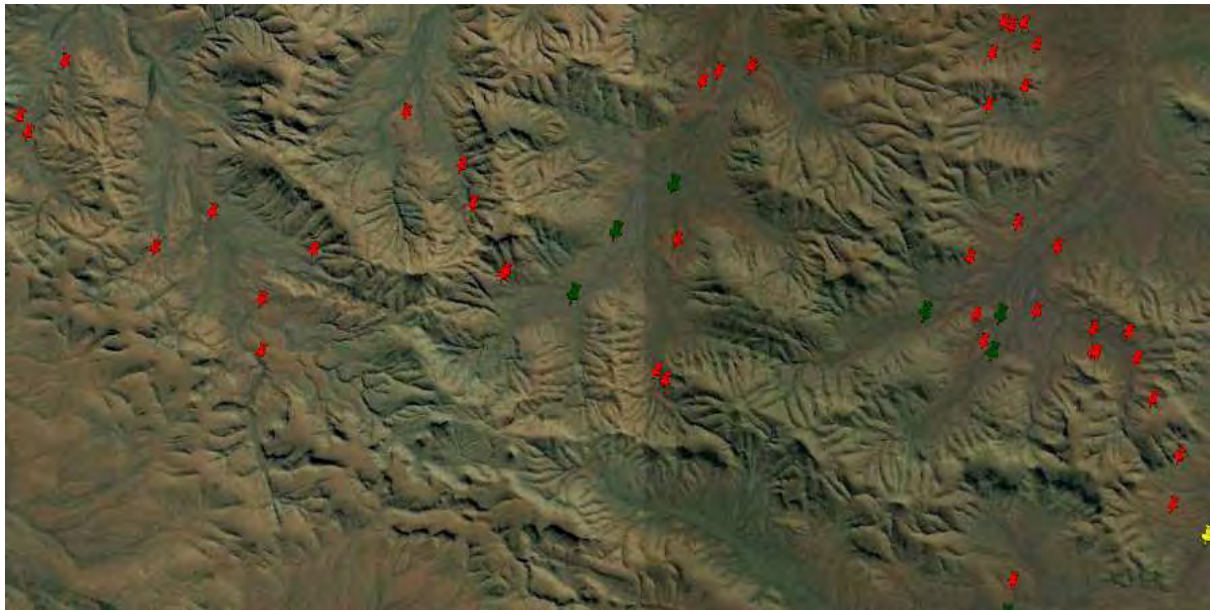
**Group 301 local distribution**



**Group 321 regional distribution**



**Group 321 local distribution**



## 5.0 REFERENCES

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## 6.0 APPENDICES

### *Appendix 1. Sites recorded in the 600-group floristic groups that are present in the Flinders Mines' Blacksmith leases data with habitat and vegetation descriptions.*

Note the Flinders sites are highlighted and the descriptions are truncated.

600-group number	Site	HABITAT	VEGETATION
171	FL1043	Valley floor	Corymbia hamersleyana open woodland over Acacia pyrifolia low open shrubland over Triodia epactia mid-dense hummock grassland with Corymbia hamersleyana scattered low mallees over Grevillea pyramidalis and Gossypium australe scattered tall shrubs over Poaceae spp. (sp. 1 & aff. Themeda) scattered tussock grasses
171	VOK029	Wide major drainage line	Open Woodland of Corymbia hamersleyana to 12m over Scattered Tall Shrubs of Acacia tumida var. pilbarensis, Grevillea wickhamii subsp. hispidula and Gossypium robinsonii to 4m over Scattered Shrubland of Tephrosia rosea var. glabrior and Santalum lanceolatum to 2m over Open Hummock of Triodia aff. epactia to 1.3m over Very Open Tussock Grassland to Scattered Tussock Grasses of Themeda triandra to 1.2m.
171	SERN103	major creek + 1.0m of upper bank	Scattered Low Shrubs of Tephrosia rosea var. glabrior to 0.45m over Scattered Hummock Grasses of Triodia aff. epactia to 1.35m over Scattered Tussock Grasses of Themeda triandra and Eriachne tenuiculmis to 1.1m over Very Open Herbland of Phyllanthus small, Cleome viscosa and Waltheria indica to 0.7m.
171	SERN104	Valley floor in wetter area next to creek line to the west, in between two creek lines	Scattered Trees of Corymbia hamersleyana and Eucalyptus camaldulensis to 15m over Scattered Shrubs of Acacia pyrifolia var. pyrifolia to 1.1m over Mid Dense Hummock Grassland of Triodia epactia (Form 4) to 1.2m over Scattered Herbs of Cleome viscosa to 0.45m.
171	VOK004	Valley floor sloping gently to	Scattered Trees of Corymbia hamersleyana to 11m over Tall Shrubland of Acacia pyrifolia var. pyrifolia to 4m over Mid-Dense Hummock Grassland of Triodia wiseana to 1.4m over Open Tussock Grassland of

600-group number	Site	HABITAT	VEGETATION
		the north-west	<i>Cenchrus ciliaris</i> , <i>Digitaria brownii</i> and <i>Themeda triandra</i> to 1.2m.
171	TRIN001	Low lying some drainage flat valley floor	Open Woodland of <i>Corymbia hamersleyana</i> to 10m over Tall Open Scrub of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia inaequilatera</i> and <i>Atalaya hemiglauca</i> to 3m over Shrubland of <i>Acacia pruinocarpa</i> , <i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/1990) and <i>Eremophila longifolia</i> to 2m over Low Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Ptilotus obovatus</i> , <i>Indigofera monophylla</i> , <i>Gossypium australe</i> (Burrup Peninsula Form), <i>Sida rohlenae</i> var. <i>rohlenae</i> , <i>Bonamia rosea</i> , <i>Sida</i> sp. verrucose Glands and <i>Solanum lasiophyllum</i> to 1m over Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Open Tussock Grassland of <i>Themeda triandra</i> and <i>Cenchrus ciliaris</i> to 1m over Open Herbland of <i>Cleome viscosa</i> , <i>Indigofera colutea</i> , <i>Crotalaria medicaginea</i> sub. <i>Neglecta</i> , <i>Corchorus tridens</i> , <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i> , <i>Malvastrum americanum</i> and <i>Melhania</i> sp. (CH 15-39) to 0.7m.
171	TRIN003a	Major drainage line E-W	Tall Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> to 2.5m over Tussock Grassland of <i>Cymbopogon procerus</i> , <i>Cenchrus ciliaris</i> , <i>Eriachne tenuiculmis</i> and <i>Digitaria ctenantha</i> to 1.2m over Shrubland of <i>Corchorus crozophorifolius</i> and <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 1.2m over <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Indigofera monophylla</i> , and <i>Phyllanthus aridus</i> " to 0.5m.
171	TRIN005	Minor drainage/ low lying	Low Open Woodland of <i>Corymbia hamersleyana</i> to 8m over Tall Open Scrub of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Eremophila longifolia</i> and <i>Atalaya hemiglauca</i> to 2m over Low Shrubland of <i>Crotalaria medicaginea</i> var. <i>neglecta</i> , <i>Ptilotus obovatus</i> , <i>Sida</i> sp. verrucose glands, <i>Gossypium australe</i> (Burrup Peninsula Form), <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Indigofera monophylla</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 1m over Closed Tussock Grassland of <i>Cenchrus setiger</i> , <i>Aristida ingrata</i> and <i>Themeda triandra</i> , <i>Urochloa subquadripara</i> and <i>Eragrostis cumingii</i> , <i>Perotis rara</i> and <i>Cymbopogon ambiguus</i> to 1.2m over Open Hummock Grassland of <i>Triodia wiseana</i> to 1m.
171	VOK013	Drainage Line running north-south	Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> to 4.5m over Open Tussock Grassland of <i>Cymbopogon ambiguus</i> , <i>Eriachne tenuiculmis</i> and <i>Themeda triandra</i> to 1.6m over Hummock Grassland of <i>Triodia wiseana</i> to 1.3m over Scattered Low Shrubs of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 1m.
171	SERN074	Wide drainage line	Low Open Woodland of <i>Corymbia hamersleyana</i> to 6m over Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Acacia pyrifolia</i> subsp. <i>pyrifolia</i> to 1.8m over Scattered Tussock Grasses of <i>Themeda triandra</i> to 1m over Low Open Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.6m.

600-group number	Site	HABITAT	VEGETATION
171	VOK026	Major drainage line	Open Woodland of <i>Corymbia hamersleyana</i> to 12m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Gossypium robinsonii</i> to 6m over Very Open Tussock Grassland of <i>Themeda triandra</i> to 1.2m over Open Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.1m over Low Open Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.8m.
171	SERN111	minor/major drainage line in valley	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 3.5m over Tall Shrubland of <i>Grevillea wickhamii</i> subsp. <i>macrodonata</i> to 3m over Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.6m over Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 1.5m over Open Tussock Grassland of <i>Aristida latifolia</i> to 0.6m over Low Shrubland of <i>Indigofera monophylla</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 1m over Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.5m over Open Tussock Grassland of <i>Aristida latifolia</i> to 0.5m.
171	VOQ100	Wide drainage line	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 6m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Acacia pyrifolia</i> subsp. <i>pyrifolia</i> to 4.5m over Hummock Grassland of <i>Triodia wiseana</i> to 1.4m over Open Tussock Grassland of <i>Cymbopogon procerus</i> , <i>Eriachne tenuiculmis</i> , <i>Digitaria brownii</i> and <i>Themeda triandra</i> to 1m over Low shrubland of <i>Corchorus crozophorifolius</i> , <i>Indigofera monophylla</i> , <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Cleome viscosa</i> to 0.5m
171	VOQ22	Wide shallow drainage line	Open Woodland of <i>Corymbia hamersleyana</i> to 6m over Tall Open Shrubland of <i>Grevillea wickhamii</i> subsp. ?, <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 3m over Tussock Grassland of <i>Cymbopogon procerus</i> , <i>Cenchrus ciliaris</i> , <i>Eriachne tenuiculmis</i> and <i>Aristida holathera</i> var. <i>latifolia</i> to 1.3m over Scattered Hummock Grasses of <i>Triodia wiseana</i> to 1m
171	VOQ23	Valley floor, gently undulating with very minor gullies	Open Woodland of <i>Corymbia hamersleyana</i> to 4m over Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 2m over Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.2m
171	VOQ24	Drainage line	Open Woodland of <i>Corymbia hamersleyana</i> to 6m over Tall Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 4m over Scattered Hummock Grasses of <i>Triodia wiseana</i> to 1m over Open Tussock Grassland of <i>Digitaria ctenantha</i> , <i>Cymbopogon ambiguus</i> , <i>Themeda triandra</i> and <i>Aristida holathera</i> var. <i>holathera</i> to 0.8m.
171	VOQ27	Wide drainage line	Scattered Low Trees of <i>Corymbia ham</i> to 4.5m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 3.5m over Low Open Shrubland of <i>Tephrosia rosea</i> var.

600-group number	Site	HABITAT	VEGETATION
			glabrior and <i>Corchorus crozophorifolius</i> to 1m over Very Open Tussock Grassland of <i>Eriachne tenuiculmis</i> and <i>Cymbopogon procerus</i> to 0.8m over Open Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 0.6m.
171	VOQ44	Drainage line	Open Woodland of <i>Corymbia hamersleyana</i> to 7m over Tall Shrubland of <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> , <i>Acacia pyrifolia</i> subsp. <i>pyrifolia</i> , <i>Acacia dictyophleba</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Acacia monticola</i> and <i>Gossypium robinsonii</i> to 2.5m over Open Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.2m over Tussock Grassland of <i>Themeda triandra</i> , <i>Eriachne tenuiculmis</i> , <i>Paraneurachne muelleri</i> , <i>Cymbopogon procerus</i> and <i>Digitaria brownii</i> to 1m over Low Open Shrubland of <i>Indigofera monophylla</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.8m.
171	VOQ45	Valley floor, low lying, gently sloping South, drainage line/floodplain	Open Woodland of <i>Corymbia hamersleyana</i> to 6m over Tall Open Shrubland of <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Acacia elacantha</i> (golden hairy variant) to 4.5m over Low Open Shrubland of <i>Indigofera monophylla</i> , <i>Sida</i> sp. (spiciform panicles), <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> and <i>Hibiscus sturtii</i> var. <i>platyklamys</i> to 1m over Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1m over Very Open Tussock Grassland of <i>Eriachne tenuiculmis</i> to 0.4m.
171	VOK023	Major drainage line	Open Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus gamophylla</i> to 11m over Tall Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Santalum lanceolatum</i> to 4.5m over Scattered Shrubs of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 2m over Mid-dense Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.5m.
171	SERN004	Drainage line	Low Open Woodland of <i>Corymbia hamersleyana</i> to 10m over Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Rulingia luteiflora</i> to 2m over Open Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.3m over Scattered Hummock Gasses of <i>Themeda triandra</i> to 0.8m.
171	TRIN003	low lying flat nex to drainage line	Tall Open Scrub of <i>Acacia inaequilatera</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Grevillea pyramidalis</i> to 6m over Closed Hummock Grassland of <i>Triodia wiseana</i> to 1.5m over Low Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Pentalepis trichodesmoides</i> , <i>Tephrosia rosea</i> var. <i>glabrior</i> , <i>Ptilotus obovatus</i> , <i>Indigofera monophylla</i> , <i>Gossypium australe</i> (Burrup Peninsula from), <i>Hibiscus sturtii</i> var. <i>platyklamys</i> <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Solanum lasiophyllum</i> , <i>Pimelea ammocharis</i> , <i>Corchorus crozophorifolius</i> , <i>Sida</i> sp. verrucose glands, <i>Eremophila longifolia</i> , <i>Crotalaria medicaginea</i> var. <i>neglecta</i> , "Hibiscus pink" and <i>Ptilotus astrolasius</i> var. <i>astrolasius</i> to 1m over Very Open Herbland of <i>Bidens bipinnata</i> to 0.3m.
171	SERN011	Drainage line	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 6m over Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Gossypium robinsonii</i> to 3m over Very Open Tussock



600-group number	Site	HABITAT	VEGETATION
			Grassland of <i>Cymbopogon procerus</i> , <i>Eriachne tenuiculmis</i> and <i>Digitaria brownii</i> to 1.3m over Open Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1m over Low Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Corchorus crozophorifolius</i> to 0.5m.
171	SERN037	Major drainage line with a bare creek bed.	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 8m (outside) over Scattered Tall Shrubs of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Gossypium robinsonii</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> to 3.8m over Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> and <i>Triodia wiseana</i> to 1.1m over Very Open Tussock Grassland of <i>Themeda triandra</i> to 1m over Scattered Low Shrubs of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.8m.
171	SERN009	Drainage line	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 10m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> to 2.5m over Scattered Hummock Grasses of <i>Triodia epactia</i> (Form 4) to 1m over Scattered Tussock Grasses of <i>Digitaria brownii</i> , <i>Themeda triandra</i> and <i>Cymbopogon procerus</i> to 1m over Low Open Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.6m.
171	SERN008	Wide shallow drainage	Open Woodland of <i>Corymbia hamersleyana</i> to 7m over Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> to 2.5m over Very Open Tussock Grassland of <i>Cymbopogon procerus</i> and <i>Digitaria brownii</i> to 1.4m over Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.2m over Low Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Corchorus incanus</i> to 0.8m.
171	SERN016	Valley floor with minor drainage lines/flowlines running north-south through quadrat	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 6m over Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 2m over Mid-Dense Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.5m over Open Tussock Grassland of <i>Digitaria brownii</i> , <i>Paranuerachne muellerii</i> , <i>Themeda triandra</i> , <i>Cenchrus ciliaris</i> and <i>Setaria verticillata</i> to 1m over Low Open Shrubland of <i>Indigofera monophylla</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.8m.
171	SERN003	Drainage line approximately 15m wide	Woodland of <i>Corymbia hamersleyana</i> to 8m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 2.5m over Scattered Shrubs of <i>Acacia inaequilatera</i> and <i>Gastrolobium grandiflorum</i> to 1.6m over Scattered Low Shrubs of <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Dodonaea lanceolata</i> var. <i>lanceolata</i> to 1m over Open Tussock Grassland of <i>Themeda triandra</i> , <i>Cymbopogon ambiguus</i> and <i>Eulalia aurea</i> to 1.2m over Open Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 0.8m.
171	FT02	Upper bank/part flow line of	Scattered Tall Shrubs of <i>Gossypium robinsonii</i> to 3m over Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 2m over Scattered Hummock Grasses of <i>Triodia wiseana</i> to 1.3m over Very Open Tussock Grassland of

600-group number	Site	HABITAT	VEGETATION
		major flood plain	Cenchrus ciliaris and Cymbopogon ambiguus to 1.2m over Low Open Shrubland of Tephrosia rosea var. glabrior to 0.5m.
171	FT01	flow lines/valley floor/major flood plain plus some upper slope of flow line	Open Shrubland of Acacia pyrifolia var. pyrifolia to 2m over Low Shrubland of Tephrosia rosea var. glabrior to 0.75m over Scattered Hummock Grassland of Triodia wiseana to 1.3m over Open Tussock Grassland of Cenchrus ciliaris to 0.5m.
171	CG002	Drainage line	Open Woodland of Corymbia hamersleyana to 10m over Scattered Shrubs of Gossypium robinsonii, Acacia elacantha (golden hairy variant), Acacia pyrifolia var. pyrifolia and Santalum (32) to 2m over Open Tussock Grassland of Themeda triandra, Cymbopogon procerus and Eulalia aurea to 1.4m over Open hummock Grassland of Triodia wiseana to 1.2m over Low Open Shrubland of Tephrosia rosea var. glabrior and Cleome viscosa to 0.5m.
171	SERN021	Major drainage line	Tall Shrubland of Acacia tumida var pilbarensis to 2.2m over Shrubland of Acacia pyrifolia var. pyrifolia and Corchorus sp. (HD260) and Eremophila longifolia to 1.6m over Open Hummock Grassland of Triodia epactia (Form 3) to 1.6m over Very Open Tussock Grassland of Cymbopogon procerus and Aristida contorta to 1.4m over Low Open heath of Tephrosia rosea var. glabrior to 0.6m
171	7RAIL036	Major drainage line running east-west	Scattered Low Trees of Eucalyptus victrix to 9m over Tall Open Shrubland of Acacia citrinoviridis and Grevillea wickhamii subsp. hispidula to 4.5m over Open Hummock Grassland of Triodia epactia (Form 3) to 1.4m over Scattered Low Shrubs of Tephrosia rosea var. glabrior to 0.8m over Scattered Tussock Grassland of Cenchrus ciliaris to 0.6m.
174	FL1031	Valley floor	Eucalyptus gamophylla and Corymbia hamersleyana low open woodland over Eulalia aurea, Paraneurachne muelleri, Eragrostis aff. eriopoda, Themeda sp. and Aristida sp tussock grassland with Triodia epactia scattered hummock grasses
174	FL1029	Minor drainage line (N-S)	Eucalyptus gamophylla and Corymbia hamersleyana low woodland over Acacia tumida var. pilbarensis tall open scrub over Triodia epactia open hummock grassland over Aristida sp. and Themeda sp. very open tussock grassland
174	VOK005	Gently sloping up to the west	Open Woodland of Eucalyptus leucophloia subsp. leucophloia to 11m over Scattered Tall Shrubs of Acacia tumida var. pilbarensis and Acacia inaequilatera to 3m over Mid-Dense Hummock Grassland of Triodia

600-group number	Site	HABITAT	VEGETATION
		to the base of the ranges. Minor drainage lines running east down the slope.	wiseana to 1.6m over Very Open Tussock Grassland of Themeda triandra, Digitaria brownii and Cenchrus ciliaris to 1.1m.
174	VOK022	Valley floor with small flowline running east-west	Open Woodland of Corymbia hamersleyana and Eucalyptus gamophylla to 10m over Tall Open Shrubland of Acacia tumida var. pilbarensis, Acacia dictyophleba and Eremophila longifolia to 4m over Hummock Grassland of Triodia aff. epactia to 1.4m over Tussock Grassland of Eulalia aurea, Themeda triandra, Chrysopogon fallax and Cenchrus ciliaris to 1.3m.
174	VOQ011	Drainage line, lower slope, valley floor, sloping South	Open Woodland of Corymbia hamersleyana to 7m over Tall Shrubland of Acacia tumida var. pilbarensis and Acacia inaequilatera to 3.5m over Open Hummock of Triodia epactia to 1.3m over Open Tussock Grassland of Paraneurachne muelleri, Aristida holathera var. latifolia, Cymbopogon obtectus, Themeda triandra and Setaria surgens to 1.2m
174	VOQ010	Valley floor, relatively flat, moderately lying	Open Woodland of Corymbia hamersleyana and Eucalyptus gamophylla to 5m over Open Shrubland of Acacia ancistrocarpa and Acacia pruinocarpa to 2m over Low Open Shrubland of Senna artemisioides subsp. oligophylla and Senna artemisioides subsp. helmsii to 2m over Hummock Grassland of Triodia epactia (Form 4) to 1.2m over Very Open Tussock Grassland of Paraneurachne muelleri, Aristida holathera var. latifolia and Eragrostis aff. eriopoda (WAS site 963) to 0.6m
174	SERN006	Valley floor, flat	Low Open Woodland of Corymbia hamersleyana to 6m over Open Shrubland of Acacia pyrifolia var. pyrifolia and Hakea lorea subsp. lorea to 2m over Hummock Grassland of Triodia epactia (Form 4) to 1.2m
174	VOK020	Valley floor, very gently sloping down to the south-west	Woodland to Open Woodland of Corymbia hamersleyana to 11m over Low Open Woodland of Eucalyptus gamophylla and Eucalyptus leucophloia subsp. leucophloia to 4m over Tall Shrubland of Acacia tumida var. pilbarensis, Acacia pyrifolia subsp. pyrifolia and Acacia dictyophleba to 4m over Tussock Grassland of Themeda triandra, Eulalia aurea and Paraneurachne muelleri to 1.3m over Open Hummock Grassland of Triodia aff. epactia to 1.1m.
174	VOK017	Major drainage line, runs east west.	Woodland to Open Woodland of Corymbia hamersleyana to 10m Tall Open Shrubland of Acacia tumida var. pilbarensis, Acacia dictyophleba and Gossypium robinsonii to 4m over Hummock Grassland of Triodia epactia (Form 3) to 1.6m over Open Tussock Grassland of Themeda triandra, Eulalia aurea to 1.2m over

600-group number	Site	HABITAT	VEGETATION
			Scattered Low Shrubs of <i>Tephrosia</i> var. <i>glabrior</i> to 1m.
174	VOK010	Valley floor, very gently sloping north-west	Open Woodland of <i>Corymbia hamersleyana</i> to 11m over Tall Open Shrubland of <i>Acacia inaequilatera</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> to 4m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.6m over Scattered Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> to 1.5m.
174	TRIN014	Flat low lying in valley same as TRIN012	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 5m over Tall Open Shrubland of <i>Hakea lorea</i> subsp. <i>lorea</i> , <i>Acacia inaequilatera</i> and <i>Acacia ancistrocarpa</i> to 5m over Open Heath of <i>Eremophila longifolia</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>glutinosa</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Gossypium australe</i> (Burrup Peninsula form) and <i>Sida</i> sp. spiciform panicles to 1.5m over Open Tussock Grassland of <i>Aristida ingrata</i> and <i>Aristida holathera</i> var. <i>holathera</i> to 1m over Low Open Shrubland of <i>Ptilotus obovatus</i> " <i>Ptilotus astrolasius</i> var. <i>astrolasius</i> to 0.4m over Mid Dense Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 0.4 over Low Open Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.3m.
174	TRIN013	Low lying in Valley flat	Low Open Woodland of <i>Corymbia</i> to 8m over Tall Open Scrub of <i>Acacia dictyophleba</i> and <i>Acacia inaequilatera</i> to 3m over Open Shrubland of <i>Eremophila longifolia</i> and <i>Capparis umbonata</i> to 2m over Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.1m over very Open Herbland of <i>Cleome viscosa</i> to 0.4m over Open Tussock Grassland of <i>Aristida ingrata</i> , <i>Themeda triandra</i> , <i>Eragrostis cummingii</i> , <i>Cenchrus ciliaris</i> and <i>Perostis rara</i> to 1m.
174	TRIN012	low lying flat in valley	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 6m over Tall Open Scrub of <i>Acacia dictyophleba</i> and <i>Acacia inaequilatera</i> to 3m over Open Heath of <i>Atalaya hemiglauca</i> , <i>Eremophila longifolia</i> , <i>Capparis umbonata</i> , <i>Sida</i> sp. spiciform panicles and <i>Gossypium australe</i> (Burrup Peninsula form) to 2m over Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.4m over Open Tussock Grassland of <i>Aristida ingrata</i> , <i>Aristida holathera</i> var. <i>holathera</i> , <i>Aristida contorta</i> and <i>Eulalia aurea</i> to 1.2m over Low Shrubland of <i>Ptilotus obovatus</i> , <i>Ptilotus astrolasius</i> var. <i>astrolasius</i> , <i>Sida</i> aff. <i>echinocarpa</i> (MET 15,350) and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 1m.
174	TRIN010	low lying flat in valley	Tall Open Scrub of <i>Acacia pruinocarpa</i> to 3m, <i>Hakea lorea</i> subsp. <i>lorea</i> , <i>Gossypium robinsonii</i> and <i>Acacia inaequilatera</i> to 3m over Open Heath of <i>Eremophila longifolia</i> , <i>Gossypium australe</i> (Burrup Peninsula Form), <i>Acacia tumida</i> var <i>pilbarensis</i> and <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 2m over Open Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Tussock Grassland of <i>Aristida ingrata</i> , <i>Themeda triandra</i> ,

600-group number	Site	HABITAT	VEGETATION
			Digitaria brownii, Eragrostis cumingii and Perotis rara to 1.1m over Low Open Heath of Senna artemisioides subsp. oligophylla x helmsii, Senna artemisioides subsp. oligophylla and Jasminum didyum subsp. linear to 1m.
174	TRIN009	low lying in valley, flat	OW of Corymbia hamersleyana to 11m over Tall Closed Scrub of Acacia pyrifolia var. pyrifolia, Acacia dictyophleba and Acacia tumida var. pilbarensis to 3m over Open Heath of Eremophila longifolia Gossypium australe (Burrup Peninsula) and Capparis umbonata to 1.5m over Hummock Grassland of Triodia aff. epactia to 1.3m over Low Open Heath of Bonamia rosea, Ptilotus astrolasius var. astrolasius, Sida sp. verrucose Glands, "Senna art oligo" Sida aff. fibulifera (oblong; MET 15 220), Hibiscus sturtii var. aff. grandiflorus, Crotalaria medicaginea var. neglecta to 1m over Very Open Tussock Grassland of Eulalia aurea and Chrysopogon fallax to 1m over Herbland of Goodenia forrestii and Malvastrum americanum to 0.4m.
174	SERN017	low lying in valley, flat	Low Woodland of Corymbia hamersleyana and Eucalyptus xerothermica to 3.1m over Mid Dense Hummock Grassland of Triodia wiseana and Triodia aff. epactia to 1.5m over Very Open Tussock Grassland of Aristida holathera var. latifolia and Themeda triandra to 1.1m over Shrubland of Acacia pruinocarpa and Hakea lorea subsp. lorea Senna glutinosa subsp. glutinosa and Acacia pyrifolia var. pyrifolia to 2m over Acacia dictyophleba, Bonamia rosea and Scaevola acacioides to 1m.
174	ZION033	Valley floor, very gently sloping down to the east with a slight rise in the north-west.	Low Open Woodland of Corymbia hamersleyana and Eucalyptus gamophylla to 6m over Tall Open Shrubland of Acacia pyrifolia var. pyrifolia to 4m over Open Shrubland of Acacia bivenosa and Eremophila longifolia to 2m over Closed Hummock Grassland of Triodia epactia (Form 4) to 1.6m over Very Open Tussock Grassland of Themeda triandra and Cenchrus ciliaris to 1.1m.
174	SERN020	Valley floor, very gently sloping to the east.	Scattered Low Trees of Corymbia hamersleyana and Eucalyptus xerothermica to 4.5m over Tall Open Shrubland of Gossypium robinsonii, Hakea lorea subsp. lorea, Acacia pyrifolia var. pyrifolia and Acacia inaequilatera to 4m over Scattered Shrubs of Gossypium australe (Burrup Peninsula Form) to 1.4m over Closed Hummock Grassland of Triodia wiseana to 1.1m.
174	SERN110	low lying/ drainage in valley	Low Woodland of Corymbia hamersleyana to 6m over Shrubland of Senna artemisioides subsp. oligophylla, Gossypium australe (Burrup peninsula) and Acacia elacantha (golden hairy variant) and Sida sp. Spiciforme panicles to 1.5m over Mid Dense Hummock Grassland of Triodia aff. epactia to 1.3m over Open Tussock Grassland of Eulalia aurea, Themeda triandra, Aristida holathera var. latifolia and

600-group number	Site	HABITAT	VEGETATION
			Paraneurachne muelleri to 1m over Low Open Shrubland of Indigofera monophylla, Crotalaria medicaginea var. neglecta, Bonamia rosea to 0.5m over Scattered Herbs of Swainsona formosa to 0.2m.
174	SERN107	flat low lying in valley	Low Open Forest of Woodland of Corymbia hamersleyana and Corymbia hamersleyana and Eucalyptus gamophylla to 5m over Tall Open Shrubland of Hakea lorea subsp. lorea to 2.1m over Scattered Shrubs of Gossypium australe (Burrup Peninsula Form) to 1.2m over Low Shrubland of Crotalaria medicaginea var. neglecta, Sida sp. Verrucose glands and Bonamia rosea to 0.5m over Closed Tussock Grassland of Eulalia aurea, Chrysopogon fallax, Cymbopogon obtectus, Aristida holathera var. holathera and Digitaria brownii to 1.1m over Very Open Herbland of Swainsona formosa, Indigofera linnaei and Indigofera colutea to 0.3m.
174	SERN101	Valley floor, relatively flat	Low Open Woodland of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia to 8m over Tall Open Woodland of Acacia elacantha (golden hairy variant), Acacia pyrifolia var. pyrifolia and Acacia dictyophleba to 3m over Hummock Grassland of Triodia aff. epactia to 1m (inferred veg type as burnt).
174	SERN015	low lying flat in valley	Woodland of Eucalyptus xerothermica and Corymbia hamersleyana to 6m over Open Heath of Acacia pyrifolia var. pyrifolia and Eremophila longifolia, Santalum lanceolata Hakea lorea subsp. lorea and Acacia inaequilatera to 2m over Mid-dense Hummock Grassland of Triodia epactia (Form 3) to 1.4m over Open Tussock Grassland of Themeda triandra, Chrysopogon fallax, Digitaria brownii and Eulalia uarea to 1m.
174	VOK003	Valley floor, very gently sloping east	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana and Corymbia deserticola subsp. deserticola to 6.5m over Tall Open Shrub of Acacia tumida var. pilbarensis, Acacia ancistrocarpa and Acacia pruinocarpa to 4m over Open Tussock Grassland of Themeda triandra and Digitaria brownii to 1.5m over Closed Hummock Grassland of Triodia wiseana to 1.2m over Low Open Shrub of Bonamia rosea, Senna artemisioides subsp. helmsii, Senna artemisioides subsp. oligophylla, Ptilotus rotundifolius and Indigofera monophylla to 1m.
257	CR008	Southwest facing creekline in between Cochrane and Farnum mesa	Eucalyptus leucophloia ssp leucophloia and Corymbia hamersleyana low open woodland over Acacia ancistrocarpa open shrubland over Triodia wiseana and T. sp. Robe River hummock grassland

600-group number	Site	HABITAT	VEGETATION
257	TR087	Gully	Acacia tumida high shrubland over Petalostylis labicheoides open shrubland over Triodia wiseana open hummock grassland
257	CR014	Upper slope, near to the top of the mesa on a southwest facing aspect	Eucalyptus leucophloia ssp. leucophloia scattered low trees over Acacia pruinocarpa high open shrubland over A. bivenosa open shrubland over Triodia wiseana and open hummock grassland
257	TsRR016	Mesa top	Acacia atkinsiana open scrub over A. bivenosa low open shrubland over Triodia sp. Robe River open hummock grassland
257	CR012	South southeast facing upper slope of mesa from a rounded crest to the beginning of a gully head	Eucalyptus leucophloia ssp. leucophloia low open woodland over Acacia bivenosa and Petalostylis labicheoides open shrubland over Triodia wiseana and T. sp. Robe River open hummock grassland
257	JW005	Drainage in gully on pediment/debris slope	Eucalyptus leucophloia ssp. leucophloia scattered low trees over Acacia bivenosa and Petalostylis labicheoides shrubland over Triodia wiseana hummock grassland
257	JW004	Upper slope	Eucalyptus leucophloia ssp. leucophloia low open woodland over Acacia bivenosa scattered shrubs over Triodia wiseana and T. sp. Robe River hummock grassland
257	FM020	Minor drainage line on mesa crest	2008: Acacia atkinsiana open shrubland over Triodia sp. Robe River and T. wiseana open hummock grassland 2009: Acacia atkinsiana and Acacia pruinocarpa open heath over Triodia sp. Robe River and Triodia wiseana open hummock grassland
257	JW001r	Mesa free face	Eucalyptus leucophloia ssp. leucophloia low open woodland over Acacia atkinsiana high open shrubland over Petalostylis labicheoides shrubland over Triodia wiseana and T. sp. Robe River open hummock grassland

600-group number	Site	HABITAT	VEGETATION
257	JW007	Drainage gully on mesa debris slope	Eucalyptus leucophloia ssp. leucophloia low woodland over Abutilon dioicum and Abutilon aff. dioicum open shrubland over Triodia sp. Robe River and Triodia wiseana hummock grassland
257	JW003	Flat top/crest of Jewel mesa, on the eastern end	Eucalyptus leucophloia ssp. leucophloia scattered low trees over Acacia pruinocarpa open shrubland over Triodia sp. Robe River and T. wiseana hummock grassland
257	CN006	Sloping mesa top	Triodia sp. Robe River open hummock grassland
257	CP199	Valley, dissected by an incised drainage line	Eucalyptus leucophloia sp. leucophloia low open woodland over Acacia ancistrocarpa, A. bivenosa and A. maitlandii open shrubland over Triodia wiseana and T. sp. Robe River hummock grassland
257	CP474	Base of gorge	Ficus brachypoda low open woodland over Triodia wiseana and T. sp. Robe River hummock grassland
257	CR001r	Southwest facing break away (free face)	Eucalyptus leucophloia ssp. leucophloia low open woodland over Acacia pruinocarpa high open shrubland over A. bivenosa open shrubland over Triodia sp. Robe River and T. wiseana open hummock grassland and Eriachne mucronata very open tussock grassland
257	CR003	Upper slope of mesa with a north facing slight slope	Acacia bivenosa open shrubland over Dampiera candidans low scattered shrubs over Triodia sp. Robe River and T. wiseana hummock grassland
257	CR006	South face of upper most debris slope, immediately below the first free face down to the mid slope of the mesa	Acacia bivenosa open shrubland over Triodia wiseana and T. sp. Robe River hummock grassland



600-group number	Site	HABITAT	VEGETATION
257	JW002r	Free face and debris slope	Eucalyptus leucophloia ssp. leucophloia low open woodland over Acacia pruinocarpa high open shrubland over Triodia sp. Robe River and T. wiseana very open hummock grassland and Eriachne mucronata (typical form) open tussock grassland
277	FL1044	Gentle south facing lower slope of minor rise in valley	Triodia aff. melvillei mid-dense hummock grassland
277	FT18	side of hill next to gully/ravine (cliff)	Scattered Hummock Grasses of Triodia aff. melvillei (10, 114) to 0.8m over Low Open Shrubland of Gompholobium sp. Hamersley and Acacia hilliana to 0.4m over Tussock Grassland of Amphipogon sericeus (Hamersley form) to 0.35m.
277	FT12	midslope hill	Scattered Low Trees of Eucalyptus leucophloia subsp. leucophloia to 4m over Mid Dense Hummock Grassland of Triodia aff. melvillei (MET 10, 114) and Triodia wiseana to 1m over Scattered Low Shrubs of Acacia hilliana and Acacia adoxa var. adoxa to 0.5m.
277	FT17	hilltop to upper slope	Scattered Low Trees of Eucalyptus leucophloia subsp. leucophloia to 4m over Low Shrubland of Acacia hilliana to 1m over Mid Dense Hummock Grassland of Triodia aff. melvillei (10, 114) and Triodia wiseana to 1m.
277	FT05	hilltop and midslope	Scattered Low Trees of Corymbia hamersleyana to 3.4m over Mid Dense Hummock Grassland of Triodia aff. melvillei (10, 114) and Triodia wiseana to 1m over Scattered Low Shrubs of Gompholobium sp. Hamersley to 1m.
277	FT19	lower slope next to major gully (cliff)	Low Open Woodland of Corymbia hamersleyana to 5m over Scattered Shrubs of Gompholobium sp. Hamersley to 1.2m over Hummock Grassland of Triodia aff. melvillei (MET 10, 114) and Triodia wiseana to 1.1m over Low Open Shrubland of Acacia hilliana to 0.6m
277	FT20	mid slope next to gully	Scattered Tall Shrubs of Hakea chordophylla to 4m over Low Open Shrubland of Acacia hilliana to 0.5m over Scattered hummock grasses of Triodia aff. melvillei (MET 10, 114) and Triodia wiseana to 1m over Grassland of Amphipogon sericeus (Hamersley Form) to 0.45
277	FT13	minor creekline/ slight gully running north to south	Scattered Low Trees of Corymbia hamersleyana to 5m over Mid Dense Hummock Grassland of Triodia wiseana to 1.1m.

600-group number	Site	HABITAT	VEGETATION
277	501	Flat-gently sloping hilltop.	Eucalyptus leucophloia scattered low trees over Acacia ancistrocarpa scattered shrubs over Plectrachne sp. (MET 10,114) open hummock grassland.
277	489	Flat topped hill.	Acacia hilliona low open shrubland over Plectrachne sp. (MET 10,114) open hummock grassland.
277	KR002	Hillslope, gently sloping eastward	Scattered Low Trees of Corymbia hamersleyana to 2.5m over Low Open Shrubland of Gompholobium karijini, Acacia hilliona and Mirbelia viminalis to 0.8m over Hummock Grassland of Triodia wiseana to 0.6m over Tussock Grassland of Eriachne sp. to 0.4m
293	FL1013	Gentle south east facing upper slope to crest of low undulating hill	Triodia wiseana mid-dense hummock grassland with Corymbia deserticola subsp. deserticola, C. hamersleyana, Eucalyptus leucophloia subsp. leucophloia and Hakea chordophylla low scattered trees with Acacia tenuissima scattered shrubs
293	FL1032	Gentle north and east facing crest of minor rise	Triodia aff. melvillei and T. wiseana hummock grassland
293	FL1005	Very gentle, south east facing, upper slope and crest of very low hill	Eucalyptus leucophloia subsp. leucophloia, Corymbia deserticola subsp. deserticola and C. hamersleyana low open woodland over Triodia wiseana mid-dense hummock grassland
293	FL1021	Undulating valley floor	Acacia maitlandii shrubland over Triodia wiseana and T. epactia hummock grassland with Corymbia hamersleyana scattered low trees
293	FL1014	Valley floor (no association with drainage)	Triodia epactia hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees over Eucalyptus gamophylla scattered low mallee over Acacia ancistrocarpa, A. tumida, A. tenuissima and A. pyrifolia scattered shrubs
293	FL1011	Valley floor	Eucalyptus gamophylla and E. leucophloia subsp. leucophloia low woodland over Acacia elachantha tall open shrubland over Mirbelia viminalis open shrubland over Triodia epactia mid-dense hummock grassland with Aristida holathera var. holathera scattered tussock grasses

600-group number	Site	HABITAT	VEGETATION
293	FL1010	Gentle south facing footslope of steep hill	Triodia wiseana mid-dense hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees
293	FL1008	Gentle mostly north facing upper slope to crest of low rise in valley	Triodia wiseana hummock grassland with Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia scattered low trees over Grevillea wickhamii subsp. hispidula scattered tall shrubs over Acacia maitlandii scattered shrubs
293	FL1024	Gentle south facing mid to upper slope of low hill	Triodia aff. melvillei mid-dense hummock grassland
293	FL1020	Valley floor	Triodia wiseana and T. epactia mid-dense hummock grassland with Acacia maitlandii scattered shrubs
293	FL1050	Very gentle south facing lower hill slope	Triodia wiseana mid-dense hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees
293	FL1047	Moderate south facing scree slope	Acacia adoxa low open shrubland over Triodia wiseana hummock grassland
293	FL1048	Lower slope	Triodia wiseana hummock grassland
293	SERN043	Lower slope with series of small flow lines dissecting site	Scattered Low Trees of Eucalyptus gamophylla to 2.2m over Tall Shrubland of Acacia monticola to 2.5m over Hummock Grassland of Triodia shinzi to 1.2m.
293	SERN028	flat plain side valley gently sloping SW	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana to 6m over Tall Open Shrubland of Hakea chordophylla, Acacia cowleana and Grevillea wickhamii subsp. aprica to 3m over Acacia maitlandii and Acacia tenuissima to 1.5m over Closed Hummock Grassland of Triodia

600-group number	Site	HABITAT	VEGETATION
			wiseana to 1.5m over Low Shrubland of <i>Ptilotus rotundifolius</i> , <i>Acacia adoxa</i> var. <i>adoxo</i> and <i>Ptilotus calostachyus</i> var. <i>calostachyus</i> to 1m.
293	RAIL008b	Lower slope of hillside with breakaway, moderately to steep sloping facing south	Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 7m over Scattered Tall Shrubs of <i>Hakea chordophylla</i> to 3m over Open Shrubland of <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Senna glutinosa</i> subsp. <i>pruinosa</i> , <i>Acacia tenuissima</i> and <i>Ptilotus rotundifolius</i> to 1.5m over Mid-dense Hummock Grassland of <i>Triodia wiseana</i> to 1m.
293	SERN 101	lower slope valley floor near site SERN 100 with minor flow line running roughly E-W in southern corner of quadrat	Low Open Woodland of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> to 6m over Open Shrubland of <i>Acacia tenuissima</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Mirbelia viminalis</i> to 1.7m over Hummock Grassland of <i>Triodia wiseana</i> to 1.4m
293	SERN112	flat low lying plain in valley	Scattered Low Trees of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> to 2m over Tall Shrubland of <i>Acacia monticola</i> and <i>Acacia ancistrocarpa</i> to 3m over Open Shrubland of <i>Acacia tenuissima</i> , <i>Acacia elacantha</i> (golden hairy variant), <i>Acacia dictyophleba</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 2m over Mid Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.1m over Scattered Herbs of <i>Ptilotus calostachyus</i> var. <i>calostachyus</i> to 1m over Scattered Sedges of <i>Fimbristylis simulans</i> 0.1m.
293	CG005	Valley floor, near base of hills, gently sloping South	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Euc gamophylla</i> to 8m over Tall Open Shrubland of <i>Acacia monticola</i> , <i>Acacia elacantha</i> (golden hairy variant) and <i>Hakea chordophylla</i> to 3m over Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.2m over Low Open Shrubland of <i>Gompholobium karrijini</i> , <i>Ptilotus rotundifolius</i> and <i>Acacia adoxa</i> var. <i>adoxo</i> to 0.8m.
293	SERN031	Flat low hill sloping down to the east and west	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> to 5m over Tall Open Shrubland of <i>Acacia ancistrocarpa</i> to 2.1m over Open Shrubland of <i>Senna symonii</i> , <i>Ptilotus rotundifolius</i> and <i>Acacia tenuissima</i> to 1.5m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.4m

600-group number	Site	HABITAT	VEGETATION
293	SERN046	flat plain on valley	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 7m over Tall Shrubland of <i>Acacia dictyophleba</i> to 3m over Open Shrubland of <i>Acacia monticola</i> , <i>Hakea lorea</i> subsp. <i>lorea</i> , <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Acacia elachantha</i> (golden hairy variant) to 2m over Closed Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.2m.
293	SERN042	flat in valley	Low Open Woodland of <i>Corymbia hamersleyana</i> to 5m over Shrubland of <i>Acacia ancistrocarpa</i> and <i>Acacia tenuissima</i> to 1.6m over Closed Hummock Grassland of <i>Triodia wiseana</i> to 1.4m.
293	SERN018	Valley floor, very gently sloping to the east.	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> to 5.5m over Tall Open Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> to 2.2m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> (Form 4) to 1.6m.
293	SERN026	low lying flat in valley	Low Woodland of <i>Corymbia deserticola</i> subsp.; <i>Deserticola</i> , <i>Eucalyptus gamophylla</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 4m over Open Heath of <i>Acacia ancistrocarpa</i> , <i>Acacia elachantha</i> (golden hairy variant) and <i>Acacia tenuissima</i> to 2m over Closed Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> and <i>Triodia wiseana</i> to 1.4m over <i>Mirbelia viminalis</i> , <i>Keraudrenia nephrosperma</i> , <i>Ptilotus astrolasius</i> var. <i>astrolasius</i> and <i>Acacia adoxa</i> var. <i>adoxo</i> to 1m
293	SERN063	Valley slope, sloping up to the south	Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 12m over Open Shrubland of <i>Senna glutinosa</i> subsp. <i>glutinosa</i> , <i>Mirbelia viminalis</i> , <i>Acacia tenuissima</i> and <i>Acacia maitlandii</i> to 2m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.3m over Scattered Low Shrubs of <i>Ptilotus rotundifolius</i> and <i>Acacia adoxa</i> var. <i>adoxo</i> to 0.6m.
298	FL1025	Moderate to steep mid slope of large hill arm	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low open woodland over <i>Triodia epactia</i> mid-dense hummock grassland
298	FL1019	Valley floor	<i>Corymbia hamersleyana</i> low open woodland over <i>Triodia wiseana</i> and <i>T. epactia</i> closed hummock grassland with <i>Acacia inaequilatera</i> tall scattered shrubs over <i>Acacia maitlandii</i> scattered shrubs
298	FL1006	Flat valley floor with some incised minor drainages	<i>Eucalyptus gamophylla</i> low open woodland over <i>Acacia melleodora</i> , <i>A. monticola</i> , <i>A. pyrifolia</i> and <i>A. atkinsiana</i> tall open shrubland over <i>Triodia epactia</i> and <i>T. wiseana</i> hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> and <i>Themeda</i> sp. very open tussock grassland with <i>Corymbia hamersleyana</i> scattered low trees

600-group number	Site	HABITAT	VEGETATION
298	FL1028	Gentle south facing upper slope of medium rise	Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana low open woodland over Triodia epactia mid-dense hummock grassland
298	FL1042	Moderate west facing upper slope of spur separated from main slope by gully	Acacia orthocarpa open shrubland over mixed Eriachne mucronata, Triumphetta maconochieana and Corchorus lasiocarpus low open shrubland over Triodia epactia mid-dense hummock grassland with Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana low scattered trees
298	FL1036	Valley floor	Triodia epactia closed hummock grassland over Eriachne mucronata with Corymbia hamersleyana scattered low trees
298	SERN109	minor drainage line running E-W	Low Woodland of Corymbia hamersleyana to 6m over Tall Shrubland of Acacia monticola, Acacia tumida var. pilbarensis and Gossypium robinsonii to 3m over Scattered Shrubs of Santalum lanceolatum to 2m over Mid-dense Hummock Grassland of Triodia wiseana to 1.4m over Low Shrubland of Indigofera monophylla to 1m over Tussock Grassland of Themeda triandra, Cymbopogon ambiguus and Paraneurachne muelleri to 1m over Herbland of Bidens bipinnata and Cleome viscosa to 0.4m.
298	VOK011	Small gully off the ranges	Scattered Low Trees of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana to 6m over Tall Open Shrubland of Acacia inaequilatera, Acacia dictyophleba and Acacia tumida var. pilbarensis to 4.5m over Closed Hummock Grassland of Triodia wiseana to 1.3m.
298	VOK021	Minor drainage line running east-west	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia, Eucalyptus gamophylla and Corymbia hamersleyana to 8m over Tall Shrubland of Acacia monticola and Grevillea wickhamii subsp. hispidula to 5.5m over Mid-Dense Hummock Grassland to Hummock Grassland of Triodia wiseana to 1.5m over Very Open Tussock Grassland of Themeda triandra and Cymbopogon ambiguus to 1m.
298	SERN029	Valley floor, very gently sloping up to the west	Low Woodland of Eucalyptus leucophloia subsp. leucophloia, Corymbia hamersleyana and Eucalyptus gamophylla to 6m over Tall Open Shrubland of Acacia pyrifolia var. pyrifolia, Acacia dictyophleba and Senna glutinosa subsp. glutinosa to 3.2m over Mid-Dense Hummock Grassland of Triodia epactia (Form 4) and Triodia wiseana to 1.4m.

600-group number	Site	HABITAT	VEGETATION
298	VOK012	Flowline/gully between two small hills	Low Open Woodland to Scattered Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 5m over Tall Open Shrubland of <i>Gossypium robinsonii</i> and <i>Acacia pruinocarpa</i> to 4m over Open Shrubland of <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 2m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.6m.
298	VOK007	Small drainage line/gully, moderately sloping to the east and the west. The drainage line/gully runs north-south.	Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 11m over Tall Open Shrubland of <i>Acacia inaequilatera</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 3.5m over Closed Hummock Grassland of <i>Triodia wiseana</i> to 1.3m.
298	VOK002	Gully/drainage line off the ranges, running down to the east	Scattered Low Trees of <i>Corymbia hamersleyana</i> to 5m over Tall Open Shrubland of <i>Acacia inaequilatera</i> to 4.5m over Shrubland of <i>Gossypium australe</i> (Whim Creek form) to 1.8m over Closed Hummock Grassland of <i>Triodia wiseana</i> to 1.5m.
299	FL1039	Moderate east facing lower slope of large hill arm	<i>Acacia orthocarpa</i> low open shrubland over <i>Triodia wiseana</i> hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> scattered low trees
299	FL1037	Undulating valley floor	<i>Triodia</i> aff. <i>melvillei</i> open hummock grassland with <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> scattered low trees
299	FL1040	Gentle east facing slope of minor hill within valley	<i>Acacia orthocarpa</i> shrubland over <i>Triodia wiseana</i> , <i>T. epactia</i> and <i>T. aff. melvillei</i> mid-dense hummock grassland

600-group number	Site	HABITAT	VEGETATION
299	FL1004	Moderate south facing lower slope with minor gully	Triodia epactia hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees over Grevillea pyramidalis subsp. leucadendron scattered tall shrubs
299	FL1003	Steep north facing lower scree slope of low hill	Triodia wiseana mid-dense hummock grassland over Cymbopogon ambiguus open tussock grassland with Hakea chordophylla and Senna glutinosa subsp. glutinosa x luerssenii scattered shrubs
299	FL1016	Moderate east facing upper slope of east west spur	Triodia wiseana hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees
299	FL1017	Moderate to steep north facing midslope of tall hill	Eucalyptus leucophloia ssp. leucophloia low open woodland over Triodia wiseana hummock grassland
299	FL1002	Very gently sloping north facing minor drainage channel on valley floor	Triodia wiseana closed hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered trees
299	FL1001	Moderate to steep north-west facing mid slope of high hill arm dissected by minor gullies	Eucalyptus leucophloia subsp. leucophloia low open woodland over Triodia wiseana mid-dense hummock grassland over Cymbopogon ambiguus open tussock grassland



600-group number	Site	HABITAT	VEGETATION
299	SERN082	Steep rocky hillside facing north-east	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 9m over Tall Open Shrubland of <i>Acacia pruinocarpa</i> , <i>Tephrosia spechtii</i> , <i>Acacia monticola</i> , <i>Gossypium robinsonii</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> to 4m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.1m over Low Open Shrubland of <i>Eremophila macmillaniana</i> , <i>Corchorus</i> sp. (HD260) and <i>Sida</i> sp. Barlee Range to 1m.
299	SERN025	moderately sloping hillside, sloping upwards to the east	Low Open Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 7m over Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>Tephrosia spechtii</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 2.9m over Scattered Shrubs of <i>Sida hackettiana</i> to 1.2m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Scattered Low Shrubs of <i>Corchorus incanus</i> subsp. <i>incanus</i> to 0.8m.
299	SERN024	hill top	Low Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 6m over Scattered Tall Shrubs of <i>Hakea chordophylla</i> to 2.5m over Shrubland of <i>Acacia monticola</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 1.8m over Mid Dense Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> and <i>Triodia wiseana</i> to 1.5m over Low Open Shrubland of <i>Acacia "spondio"</i> and <i>Keraudrenia nephrosperma</i> to 1m.
299	SERN022	sloping SW on side/bottom hill	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 6m over Tall Shrubland of <i>Acacia monticola</i> , <i>Acacia dictyophleba</i> , <i>Hakea chordophylla</i> , <i>Acacia dictyophleba</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3m over Shrubland of <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 1.8m over Mid-dense Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Low Shrubland of <i>Gompholobium karjini</i> and <i>Goodenia stobbsiana</i> to 1m over Very Open Tussock Grassland of <i>Paraneurachne muelleri</i> to 0.8m.
299	SERN012	Hillside, moderately sloping, facing in a westerly	Scattered Low Trees of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 5.5m over Scattered Tall Shrubs of <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> , <i>Hakea chordophylla</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 3.5m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Scattered Low Shrubs of <i>Acacia hilliana</i> to 0.8m.
299	SERN081	Hillside sloping moderately down to the west.	Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 10m over Scattered Shrubs of <i>Gossypium robinsonii</i> and <i>Acacia monticola</i> to 2m over Mid-Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.3m.
299	SERN105	RIDGE TO MID SLOPE BENEATH HILL	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 7m over Tall Open Shrubland of <i>Acacia monticola</i> and <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> to 2.5m over Mid Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Very Open Tussock Grassland of <i>Eriachne mucronata</i> (typical form) and

600-group number	Site	HABITAT	VEGETATION
			Eriachne ciliata to 0.25m.
299	RAIL008a	Hill slope, moderately sloping north-west, mid to lower slope	Low Open Woodland of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia to 8m over Open Shrubland of Tephrosia spechtii and Senna glutinosa subsp. glutinosa, to 1.6m over Low Open Shrubland of Acacia adoxa var. adoxa, Indigofera monophylla and Corchorus sp. (HD260) to 1.6m over Mid-dense Hummock Grassland of Triodia wiseana and Triodia aff. epactia to 1m
300	FL1015	Gentle to moderate east facing mid slope of tall hill	Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia low open woodland over Triodia epactia hummock grassland
300	FL1018	Gentle north facing lower slope	Acacia maitlandii shrubland over Triodia wiseana open hummock grassland with Eucalyptus leucophloia subsp. leucophloia scattered low trees
300	FL1033	Very gentle upper slope of knoll	Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia low open woodland over Triodia wiseana mid-dense hummock grassland
300	FL1046	Slight east facing crest of minor rise in valley	Triodia aff. melvillei mid-dense hummock grassland with Corymbia hamersleyana scattered low trees
300	VOK008	Hilltop and slopes, with a breakaway along the southern edge.	Scattered Low Trees of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia to 6m over Scattered Tall Shrubs of Acacia inaequilatera, Acacia pruinocarpa and Grevillea wickhamii subsp. aprica to 3m over Closed Hummock Grassland to Mid-Dense Hummock Grassland of Triodia wiseana to 1.2m.
300	ZION007	sloping north on side hill, gently undulating	Low Woodland of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia to 6m over Tall Open Shrubland of Grevillea wickhamii subsp. hispidula to 3m over Shrubland of Acacia retivena subsp. clandestina and Tephrosia spechtii to 2m over Mid-dense Hummock Grassland of Triodia wiseana to 1.1m over Low Open Heath of Acacia hilliana, Dampiera candidans, Indigofera monophylla, Corchorus

600-group number	Site	HABITAT	VEGETATION
			lasiocarpus var. parvus and Goodenia stobbsiana to 0.8m over Very Open Tussock grassland of Eriachne mucronata (typical From) and Eriachne pulchella subsp. dominii to 0.3m.
300	TRIN002	Mid-top of ridge-sloping greatly to north	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana to 7m over Shrubland of Acacia arida, Sida subspicata, Senna glutinosa subsp. glutinosa to 1.8m over Mid-dense Hummock Grassland of Triodia wiseana to 1.2m over Corchorus lasiocarpus var. parvus, Dampiera candicans, and Triumphetta maconochieana to 1m over Very Open Tussock Grassland of Aristida holathera var. latifolia, Aristida ingrata and Cymbopogon procerus to 0.8m.
300	TRIN007	hill side slope facing north	Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana to 7m over Tall Open Scrub of Acacia inaequilatera and Tephrosia spechtii to 2.8m over Closed Heath of Senna glutinosa subsp. glutinosa, Acacia arida and Ptilotus rotundifolius, Gossypium australe (Burrup Peninsula form) and Acacia pyrifolia var. pyrifolia to 2m over Low Open Heath of Corchorus lasiocarpus var. parvus, Ptilotus astrolasius var. astrolasius and "hibiscus scented" over Hummock Grassland of Triodia wiseana and Triodia epactia (Form 3) to 1.4m. over Open Tussock Grassland of Enneapogon polyphyllus, Digitalaria ctenantha, Enneapogon lindleyanus and Enneapogon caerulescens var. caerulescens to 0.3m.
300	VOQ40	Steep hill side, lower part of ranges, sloping North	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia to 6m over Scattered Tall Shrubs of Acacia trudgeniana and Grevillea wickhamii subsp. ? To 3m over Hummock Grassland of Triodia wiseana over Scattered Low Shrubs of Acacia hilliana and Corchorus lasiocarpus var. parvus to 0.6m.
300	FT32	hill top flat	Scattered Low Trees of Corymbia hamersleyana to 5m over Mid Dense Hummock Grassland of Triodia aff. melvillei (MET 10, 114) to 0.9m over Scattered Low Shrubs of Acacia hilliana to 0.5m.
301	FL1045	Gorge	Eucalyptus victrix open woodland over Acacia monticola, Dodonaea lanceolata var. lanceolata and Gossypium robinsonii tall shrubland over Stemodia grossa low open shrubland over Triodia epactia hummock grassland over Eulalia aurea, Themeda sp. and Eriachne mucronata open tussock grassland with Ficus brachypoda and Eucalyptus leucophloia subsp. leucophloia scattered low trees over Rhynchosia bungarensis scattered herbs
301	FL1035	Moderate to steep gorge	Corymbia ferriticola subsp. ferriticola and Ficus brachypoda low open woodland over Triodia epactia and T. wiseana open hummock grassland over Themeda sp., Enneapogon lindleyanus, Eriachne mucronata and Cymbopogon ambiguus open tussock grassland with Corchorus crozophorifolius, Capparis spinosa var. nummularia and Capparis spinosa scattered shrubs over HHF057 scattered herbs

600-group number	Site	HABITAT	VEGETATION
301	FL1027	Slight to steep rocky gorge	<i>Corymbia ferriticola</i> subsp. <i>ferriticola</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>E. small</i> aff. <i>ghost</i> HHF045 and <i>Brachychiton gregorii</i> low woodland over <i>Triodia epactia</i> hummock grassland over <i>Eulalia aurea</i> , <i>Cymbopogon ambiguus</i> , <i>Themeda</i> sp. and <i>Eragrostis</i> aff. <i>eriopoda</i> open tussock grassland with <i>Acacia monticola</i> scattered tall shrubs
301	FL1026	Steep to vertical east and west facing gully	<i>Eucalyptus ferriticola</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Acacia monticola</i> , <i>A. pruinocarpa</i> and <i>Gossypium robinsonii</i> tall open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Themeda</i> small CM037 and <i>Cymbopogon ambiguus</i> open tussock grassland
301	7RAIL038	Minor gully/drainage line/flow line	Tall Shrubland to Tall Open Shrubland of <i>Acacia bivenosa</i> , <i>Acacia inaequilatera</i> and <i>Acacia pruinocarpa</i> to 6m over Mid-dense Hummock Grassland of <i>Triodia wiseana</i> to 1.4m
301	TR021	Rocky gully	<i>Acacia citrinoviridis</i> low open forest over <i>Indigofera monophylla</i> , <i>Gossypium robinsonii</i> and <i>Senna glutinosa</i> ssp. <i>glutinosa</i> open shrubland over mixed very open herbs over <i>Triodia wiseana</i> very open hummock grassland
301	TR024	Minor drainage line on upper slope of mesa	Drainage line; <i>Corymbia hamersleyana</i> low open woodland over <i>Acacia adsurgens</i> and <i>Grevillea wickhamii</i> ssp. <i>hispidula</i> high open shrubland over <i>Acacia maitlandii</i> and <i>Senna artemisioides</i> ssp. <i>oligophylla</i> shrubland over <i>Triodia wiseana</i> hummock grassland Gully; <i>Eucalyptus leucophloia</i> ssp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> low woodland over <i>Acacia citrinoviridis</i> and <i>A. pruinocarpa</i> high open shrubland over <i>Triodia wiseana</i> open hummock grassland
301	6RAIL011	Gorge/gully approximately 12m high wall	Open Woodland of <i>Eucalyptus xerothermica</i> to 15m over Low Woodland of <i>Acacia citrinoviridis</i> , <i>Ehretia saligna</i> var. <i>saligna</i> and <i>Corymbia hamersleyana</i> to 10m over Tall Open Shrubland of <i>Gossypium robinsonii</i> , <i>Petalostylis labicheoides</i> and <i>Flueggea virosa</i> subsp. <i>melanthesoides</i> to 4m over Open Tussock Grassland of <i>Cymbopogon ambiguus</i> and <i>Themeda triandra</i> to 1m over Scattered Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> and <i>Triodia wiseana</i> to 0.8m.
301	6RAIL010	Minor creek and flood plain	Low Open Woodland of <i>Eucalyptus xerothermica</i> to 8m over Tall Open Scrub of <i>Acacia bivenosa</i> , <i>Grevillea wickhamii</i> subsp. <i>hispidula</i> and <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 4m over Mid-Dense Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.4m over Low Open Shrubland of <i>Tephrosia rosea</i> var. <i>glabrior</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> to 1m
301	6RAIL008	Hilltop sloping down on all	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 5.5m over Tall Shrubland of <i>Acacia acradenia</i> , <i>Acacia arida</i> , <i>Grevillea wickhamii</i> subsp. <i>macrodonata</i> and <i>Acacia bivenosa</i> to 3.5m over Mid-

600-group number	Site	HABITAT	VEGETATION
		sides, approximately 630m above sea level	Dense Hummock Grassland of <i>Triodia wiseana</i> to 1.6m.
301	6RAIL07a	Gully/gorge feeding into Rio Gorge, running east-west	Low Open Woodland of <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 8m over Tall Open Scrub of <i>Acacia</i> aff. <i>aneura</i> (narrow fine veined; site 1259), <i>Acacia bivenosa</i> , <i>Petalostylis labicheoides</i> , <i>Acacia maitlandii</i> , <i>Gossypium robinsonii</i> and <i>Acacia monticola</i> to 4m over Hummock Grassland of <i>Triodia wiseana</i> to 1.2m over Scattered Tussock Grassland of <i>Cymbopogon ambiguus</i> to 0.9m.
301	CW018	Gully (dissected drainage) running south west between two parts of the mesa	<i>Eucalyptus leucophloia</i> ssp. <i>leucophloia</i> low woodland over <i>Acacia citrinoviridis</i> and <i>A. tumida</i> var. <i>pilbarensis</i> high shrubland over <i>Triodia wiseana</i> hummock grassland
321	FL1049	Undulating plain	<i>Triodia epactia</i> hummock grassland with <i>Eucalyptus gamophylla</i> scattered mallees over <i>Acacia elachantha</i> , <i>A. ancistrocarpa</i> and <i>A. acradenia</i> scattered tall shrubs
321	FL1030	Valley floor	<i>Eucalyptus gamophylla</i> low open woodland over <i>Ptilotus astrolasius</i> low open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Aristida holathera</i> var. <i>holathera</i> tussock grass, <i>Paraneurachne muelleri</i> , JNFL079, JNFL080 very open tussock grassland over JNFL075 very open herbland
321	FL1023	Slightly undulating valley floor	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> (trees), <i>E. gamophylla</i> (mallees) and <i>Corymbia hamersleyana</i> (mallees) low open woodland over <i>Triodia epactia</i> hummock grassland over <i>Triodia</i> aff. <i>melvillei</i> , <i>Aristida holathera</i> var. <i>holathera</i> and <i>Poaceae</i> sp. very open tussock grassland
321	FL1007	Valley floor with minor drainage channels	<i>Acacia tumida</i> and <i>A. melleodora</i> tall open shrubland over <i>Triodia epactia</i> mid-dense hummock grassland
321	FL1009	Slightly undulating valley floor	<i>Eucalyptus gamophylla</i> and <i>E. leucophloia</i> subsp. <i>leucophloia</i> low open woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>A. elachantha</i> (silvery hairy variant) tall open shrubland over <i>Triodia epactia</i> hummock grassland over <i>Aristida</i> sp. very open tussock grassland with <i>Acacia melleodora</i> scattered shrubs

600-group number	Site	HABITAT	VEGETATION
321	FL1012	Valley floor	Eucalyptus gamophylla low open woodland over Acacia melleodora and A. retivenea tall open shrubland over Triodia epactia hummock grassland
321	FL1022	undulating valleyfloor adjacent to drainage channel	Acacia tumida and Grevillea wickhamii tall open shrubland over Triodia epactia open hummock grassland over Aristida holathera var. holathera tussock grass, Paraneurachne muelleri and Themeda triandra very open tussock grassland with Corymbia hamersleyana and C. deserticola subsp. deserticola scattered low trees
321	VOQ33	Valley floor, undulating with very minor gullies	Low Open Woodland of Corymbia hamersleyana and Eucalyptus leucophloia subsp. leucophloia to 8m over Tall Open Shrubland of Acacia elacantha (golden hairy variant), Acacia monticola and Acacia pyrifolia var. pyrifolia to 3m over Mid-dense Hummock Grassland of Triodia epactia (Form 4) and Triodia wiseana to 1.2
321	RAIL005	undulating in valley	Low Woodland of Eucalyptus gamophylla, Eucalyptus xerothermica and Corymbia hamersleyana to 5m over Tall Open Scrub of Acacia dictyophleba, Acacia inaequilatera and Acacia monticola to 5m over Open Shrubland of Acacia tenuissima and Acacia pyrifolia var. pyrifolia to 2m over Closed Hummock Grassland of Triodia wiseana and Triodia aff. epactia to 1.2m.
321	ZION040	Valley floor, very gently sloping downwards to the east.	Low Open Woodland of Eucalyptus xerothermica and Corymbia hamersleyana to 7m over Closed Hummock Grassland of Triodia aff. epactia to 1.6m over Scattered Shrubs of Acacia pyrifolia var. pyrifolia to 1.4m over Low Shrubland of Acacia adoxa var. adoxa and Indigofera monophylla to 0.8m.
321	SERN023	Valley floor, very gently sloping to the west	Low Open Woodland of Corymbia hamersleyana and Eucalyptus xerothermica to 7m over Tall Open Shrubland of Acacia pyrifolia var. pyrifolia and Acacia inaequilatera to 3.6m over Open Shrubland of Eremophila longifolia and Rhagodia eremaea to 1.6m over Mid-Dense Hummock Grassland of Triodia aff. epactia to 1.2m over Open Tussock Grassland of Chrysopogon fallax, Eulalia aurea and Themeda triandra to 1.2m.
321	RAIL009	Minor gully, valley floor	Low Open Woodland of Eucalyptus leucophloia subsp. leucophloia and Corymbia hamersleyana to 6m over Open Shrubland of Acacia cowleana, Acacia dictyophleba and Senna glutinosa subsp. glutinosa to 1.8m over Scattered Low Shrubs of Gompholobium karjini, Ptilotus rotundifolius and Indigofera monophylla to 1m over Mid-dense Hummock Grassland of Triodia wiseana and Triodia epactia (Form 3) to

600-group number	Site	HABITAT	VEGETATION
			1m.
321	4RAIL121	Valley floor	Low Open Woodland of <i>Corymbia hamersleyana</i> to 9m over Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 2.5m over Mid Dense Hummock Grassland of <i>Triodia epactia</i> (Form 4) and <i>Triodia wiseana</i> to 1.6m.
321	SERN013	Valley floor, lowlying, gently undulating	Open Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus gamophylla</i> to 6m over Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia elacantha</i> (golden hairy variant) to 1.5m over Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.3m over Very Open Tussock Grassland of <i>Chrysopogon fallax</i> and <i>Themeda triandra</i> to 1.1m.
321	SERN027	Valley floor	Low Open Woodland of <i>Corymbia hamersleyana</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>Eucalyptus gamophylla</i> to 8m over Tall Open Shrubland <i>Gastrolobium grandiflorum</i> and <i>Acacia elacantha</i> (Golden Hairy Variant) to 2.8m over Mid-Dense Hummock Grassland <i>Triodia epactia</i> (Form 3 ) and <i>Triodia wiseana</i> to 1.2m over Scattered Tussock Grassland <i>Eulalia aurea</i> and <i>Themeda triandra</i> to 0.9m.
321	SERN030	flat plain in valley	Low Open Forest of <i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> to 5m over Scattered Tall Shrubs of <i>Hakea lorea</i> subsp. <i>lorea</i> to 4m over Open Heath of <i>Acacia ancistrocarpa</i> , <i>Acacia tumida</i> and <i>Acacia dictyophleba</i> to 2m over Mid Dense Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.5m over Low Shrubland of <i>Bonamia rosea</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Senna symonii</i> and <i>Keraudrenia velutina</i> subsp. <i>elliptica</i> to 1m.
321	SERN010	Valley Floor	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Eucalyptus xerothermica</i> to 3.5m over Tall Open Shrubland of <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Acacia inaequilatera</i> to 3m over Mid-Dense Hummock Grassland of <i>Triodia epactia</i> (Form 4) to 1.4m over Low Open Shrubland of <i>Ptilotus rotundifolius</i> , <i>Ptilotus astrolasius</i> var. <i>astrolasius</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> to 1.1m.
321	SERN032	low lying vegetation/semi drainage	Low Open Forest of <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> and <i>Eucalyptus xerothermica</i> to 7m over Tall Open Scrub of <i>Acacia inaequilatera</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3m over Mid Dense Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> and <i>Triodia wiseana</i> to 1.5m over Tussock Grassland of <i>Eulalia aurea</i> and <i>Themeda triandra</i> to 1.3m over Low Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> , <i>Ptilotus rotundifolius</i> , <i>Acacia adoxa</i> var. <i>adoxo</i> , <i>Gompholobium karjini</i> , and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> to 1m.

600-group number	Site	HABITAT	VEGETATION
321	SERN033	Minor drainage line running east-west over the valley floor	Low Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus gamophylla</i> to 6m over Tall Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia inaequilatera</i> to 4.5m over Closed Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.3m over Very Open Tussock Grassland of <i>Eulalia aurea</i> and <i>Themeda triandra</i> to 1.2m.
321	BD002	Flat in valley	Low Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus gamophylla</i> to 5m over Low Open Shrubland of <i>Acacia dictyophleba</i> and <i>Acacia ancistrocarpa</i> to 1.8m over Closed Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.2m over Low Shrubland of <i>Bonamia rosea</i> , <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Senna glutinosa</i> subsp. <i>luerssenii</i> to 1m
321	RAIL002	relatively flat in valley	Low Open Forest of <i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Eucalyptus xerothermica</i> to 6m over Tall Open Scrub of <i>Acacia monticola</i> , <i>Acacia elachantha</i> (golden hairy variant) and <i>Acacia dictyophleba</i> to 3.5m over Shrubland of <i>Gastrolobium grandiflorum</i> to 1.8m over Closed Hummock Grassland of <i>Triodia epactia</i> (Form 4) and <i>Triodia wiseana</i> to 1.1m over Very Open Tussock Grassland of <i>Themeda triandra</i> , <i>Paraneurachne muelleri</i> and <i>Eulalia aurea</i> to 1m over Low Open Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Bonamia rosea</i> to 1m over Very Open Herbland of <i>Goodenia stellata</i> to 0.3m.
321	BD004	Flat in valley	Low Open Woodland of <i>Corymbia hamersleyana</i> to 5m over Tall Shrubland of <i>Acacia dictyophleba</i> , <i>Acacia inaequilatera</i> , <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> to 2.2m over Open Shrubland of <i>Acacia ancistrocarpa</i> to 1.6m over Closed Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1m over Scattered Tussock Grasses of <i>Themeda triandra</i> to 0.8m over Low Open Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> , <i>Bonamia rosea</i> and <i>Tephrosia rosea</i> var. <i>glabrior</i> to 0.8m
321	SERN080	Valley Floor, very gently sloping up to the north.	Low Woodland of <i>Eucalyptus gamophylla</i> , <i>Corymbia deserticola</i> subsp. <i>deserticola</i> and <i>Corymbia opaca</i> to 7m over Tall Shrubland of <i>Acacia elachantha</i> (Golden Hairy Variant) and <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3.2m over Tussock Grassland of <i>Eulalia aurea</i> and <i>Themeda triandra</i> to 1.1m.
321	KR009	Valley floor with minor flow lines. Site lies in a slight depression	Scattered Low Shrubs of <i>Acacia inaequilatera</i> to 3m over Mid-dense Hummock Grassland of <i>Triodia wiseana</i> to 1m



600-group number	Site	HABITAT	VEGETATION
321	KR010	Valley floor at base of range	Scattered Low Trees of <i>Eucalyptus gamophylla</i> to 3.5m over Open Shrubland of <i>Acacia atkinsiana</i> and <i>Acacia dictyophleba</i> to 2m over Mid Dense Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.2m
321	BD005	Sloping south into low lying area	Low Woodland of <i>Corymbia hamersleyana</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> , <i>Eucalyptus gamophylla</i> and <i>Eucalyptus xerothermica</i> to 5m over Open Heath of <i>Acacia elachantha</i> (golden hairy variant), <i>Gastrolobium grandiflorum</i> and <i>Acacia dictyophleba</i> to 2m over Closed Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.2m over Low Open Shrubland of <i>Acacia adoxa</i> var. <i>adoxo</i> to 0.4m.
321	VOK030	Valley Floor	Low Open Woodland of <i>Eucalyptus xerothermica</i> to 8m over Tall Open Shrubland of <i>Acacia dictyophleba</i> , <i>Acacia tumida</i> var. <i>pilbarensis</i> and <i>Acacia atkinsiana</i> to 4m over Mid-Dense Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.6m.
321	CG003	Valley floor, low lying, gently sloping south	Open Woodland of <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 10m over Open Shrubland of <i>Gastrolobium grandiflorum</i> and <i>Acacia elachantha</i> (golden hairy variant) to 2m over Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia epactia</i> (Form 5) to 1.2m over Low Open Shrubland of <i>Indigofera monophylla</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> to 0.8m over Very Open Tussock Grassland of <i>Paraneurachne muelleri</i> , <i>Themeda triandra</i> and <i>Eulalia aurea</i> to 0.6m.
321	SERN007	Valley floor, low lying, very gently sloping south, floodplain	Open Woodland of <i>Corymbia hamersleyana</i> to 7m over Tall Open Shrubland of <i>Acacia inaequilatera</i> , <i>Acacia dictyophleba</i> , <i>Hakea lorea</i> subsp. <i>lorea</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3.5m over Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.3m over Very Open Tussock Grassland of <i>Themeda triandra</i> and <i>Chrysopogon fallax</i> to 1.1m over Low Open Shrubland of <i>Senna artemisioides</i> aff. subsp. <i>oligophylla</i> (thinly sericeous) and <i>Ptilotus obovatus</i> to 1m.
321	SERN056	Valley Floor	Scattered Low Trees of <i>Corymbia hamersleyana</i> and <i>Eucalyptus gamophylla</i> to 5m over Tall Open Shrubland of <i>Acacia elachantha</i> (golden hairy variant) and <i>Hakea lorea</i> subsp. <i>lorea</i> to 3m over Scattered Shrubs of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> to 1.4m over Mid-dense Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1.4m over Very Open Tussock Grassland of <i>Paraneurachne muelleri</i> , <i>Digitaria brownii</i> and <i>Themeda triandra</i> to 1m.
321	SERN036	small rise in valley/plain	Low Open Forest of <i>Eucalyptus gamophylla</i> , <i>Corymbia hamersleyana</i> and <i>Eucalyptus xerothermica</i> to 7m over Tall Shrubland of <i>Acacia inaequilatera</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3m over Open Shrubland of <i>Senna artemisioides</i> subsp. <i>oligophylla</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>glutinosa</i> and

600-group number	Site	HABITAT	VEGETATION
			<i>Senna glutinosa</i> subsp. <i>luerssenii</i> to 2m over Closed Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.2m over Very Open Tussock Grassland of <i>Cymbopogon obtectus</i> to 1m over Low Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> to 1m.
321	SERN039	Lower slope leading onto a valley floor	Low Woodland of <i>Eucalyptus gamophylla</i> to 3m over Scattered Shrubs of <i>Acacia atkinsiana</i> to 1.3m over Mid Dense Hummock grassland of <i>Triodia epactia</i> (Form 3) to 1.3m.
321	SERN049	Valley floor	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> to 6m over Tall Shrubland of <i>Acacia tumida</i> var. <i>pilbarensis</i> to 3m over Mid Dense Hummock Grassland of <i>Triodia epactia</i> (Form 3) to 1.35m.
321	SERN002	Valley floor, relatively flat	Low Open Woodland of <i>Corymbia hamersleyana</i> and <i>Corymbia deserticola</i> subsp. <i>deserticola</i> to 6m over Tall Open Shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> and <i>Acacia dictyophleba</i> to 3m over Open Shrubland of <i>Acacia ancistrocarpa</i> , <i>Acacia elacantha</i> (golden hairy variant) and <i>Acacia tenuissima</i> to 2m over Hummock Grassland of <i>Triodia</i> flat (1) to 1.3m
321	SERN001	Valley floor, gently undulating	Open Woodland of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> , <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> and <i>Corymbia hamersleyana</i> to 8m over Tall Open Shrubland of <i>Acacia dictyophleba</i> , <i>Acacia cowleana</i> , <i>Acacia inaequilatera</i> and <i>Acacia ancistrocarpa</i> to 2.5m over Mid-dense Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1m.
321	SERN-CV2	Valley floor	Low Open Woodland of <i>Eucalyptus gamophylla</i> and <i>Corymbia hamersleyana</i> to 5.5m over Tall Open Shrubland of <i>Acacia inaequilatera</i> to 5m over Mid-Dense Hummock Grassland of <i>Triodia</i> aff. <i>epactia</i> to 1.3m over Scattered Tussock Grasses of <i>Themeda triandra</i> to 1m over Low Open Shrubland of <i>Bonamia rosea</i> , <i>Indigofera monophylla</i> and <i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i> to 0.8m.
321	BD003	Low-lying flat in valley	Low Woodland of <i>Corymbia deserticola</i> subsp. <i>deserticola</i> , <i>Corymbia hamersleyana</i> and <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> to 6m over Tall Closed Scrub of <i>Acacia cowleana</i> and <i>Gastrolobium grandiflorum</i> to 3m over Scattered Shrubs of <i>Acacia tenuissima</i> to 2m over Closed Hummock Grassland of <i>Triodia wiseana</i> and <i>Triodia</i> aff. <i>epactia</i> to 1m over Scattered Tussock Grasses of <i>Themeda triandra</i> to 1m over Scattered Low Shrubs of <i>Acacia adoxa</i> var. <i>adoxo</i> to 0.6m