# Marillana Tenement
# Targeted Flora Survey

**Prepared for BHP Billiton Iron Ore Pty Ltd**
**July 2016**

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# EXECUTIVE SUMMARY

BHP Billiton Iron Ore Pty Ltd (BHP Billiton Iron Ore) commissioned Onshore Environmental Consultants Pty Ltd (Onshore Environmental) to undertake a targeted flora survey of the Marillana tenement (herein referred to as the study area), situated in the south-east Pilbara region of Western Australia. The objective of the survey was to identify any conservation significant flora and introduced weed species present within the study area.

The field survey was completed over four days between the 4th and 16th November 2015. None of the plant taxa recorded from the study area were gazetted as Threatened Flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1950* (WC Act), or listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Two Priority flora taxa were recorded from the study area; *Synostemon hamersleyensis* (Priority 1) and *Eremophila magnifica* subsp. *magnifica* (Priority 4).

*Synostemon hamersleyensis* was recorded from 28 locations associated with steep and very steep upper hillslopes, breakaway slopes, gorges and cliff lines. Plants were typically present at low density ranging from one to ten individuals. Vegetation in which it occurred, was non-specific but characterised by a Low Woodland (to Low Open Woodland) strata of low trees, High Open Shrubland of tall shrubs, with Hummock Grassland (to Open Hummock Grassland) of variable spinifex species, occasionally with Open Tussock Grassland.

*Eremophila magnifica* subsp. *magnifica* was recorded as an estimated 50 to 100 plants from the summit of a rocky gorge and cliff line at one location within the study area. The associated vegetation was described as Hummock Grassland of *Triodia wiseana* with High Shrubland of *Acacia arida* and *Acacia inaequilatera* and Very Open Mallee of *Eucalyptus gamophylla.*

A total of eight introduced weed species were recorded from the study area. None of these taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), and all are common weeds in the Pilbara.

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# 1.0 INTRODUCTION

## 1.1 Preamble

Onshore Environmental was commissioned by BHP Billiton Iron Ore to undertake a targeted flora survey of the Marillana tenement in November 2015. The survey did not assess any specific development proposed by BHP Billiton Iron Ore.

BHP Billiton Iron Ore currently operates the Marillana (Yandi) open pit iron ore mine, located approximately 100 km north-west of the town of Newman in the south-east Pilbara region of Western Australia (Figure 1). The study area is situated approximately 10 km north-east of the Marillana (Yandi) Mine.

## 1.2 Previous Surveys

A total of 45 previous flora and vegetation surveys have been completed within, or in close proximity to, the study area, including three previous flora and vegetation surveys within the study area boundary:

- Onshore Environmental (2013a) Flora and Vegetation Survey Marillana ML70/270);
- ENV Australia (2008) RGP5 M270SA Flora and Vegetation Assessment; and
- Ecologia (2007) Marillana ML70/270 SA Sec 2 Flora and Vegetation Survey.

The remaining 43 surveys were associated with BHP Billiton Iron Ore's Yandi (Marillana), Mindy, Coondiner and Fortescue Marsh tenements, associated infrastructure including railway corridors and camp sidings, as well as Marillana Creek and Weeli Wolli Creek. There is also a publically available report for Rio Tinto's Koodaideri tenement situated north-west of the study area.

The previous flora and vegetation surveys are outlined further in Section 3.1.1 and Appendix 1.

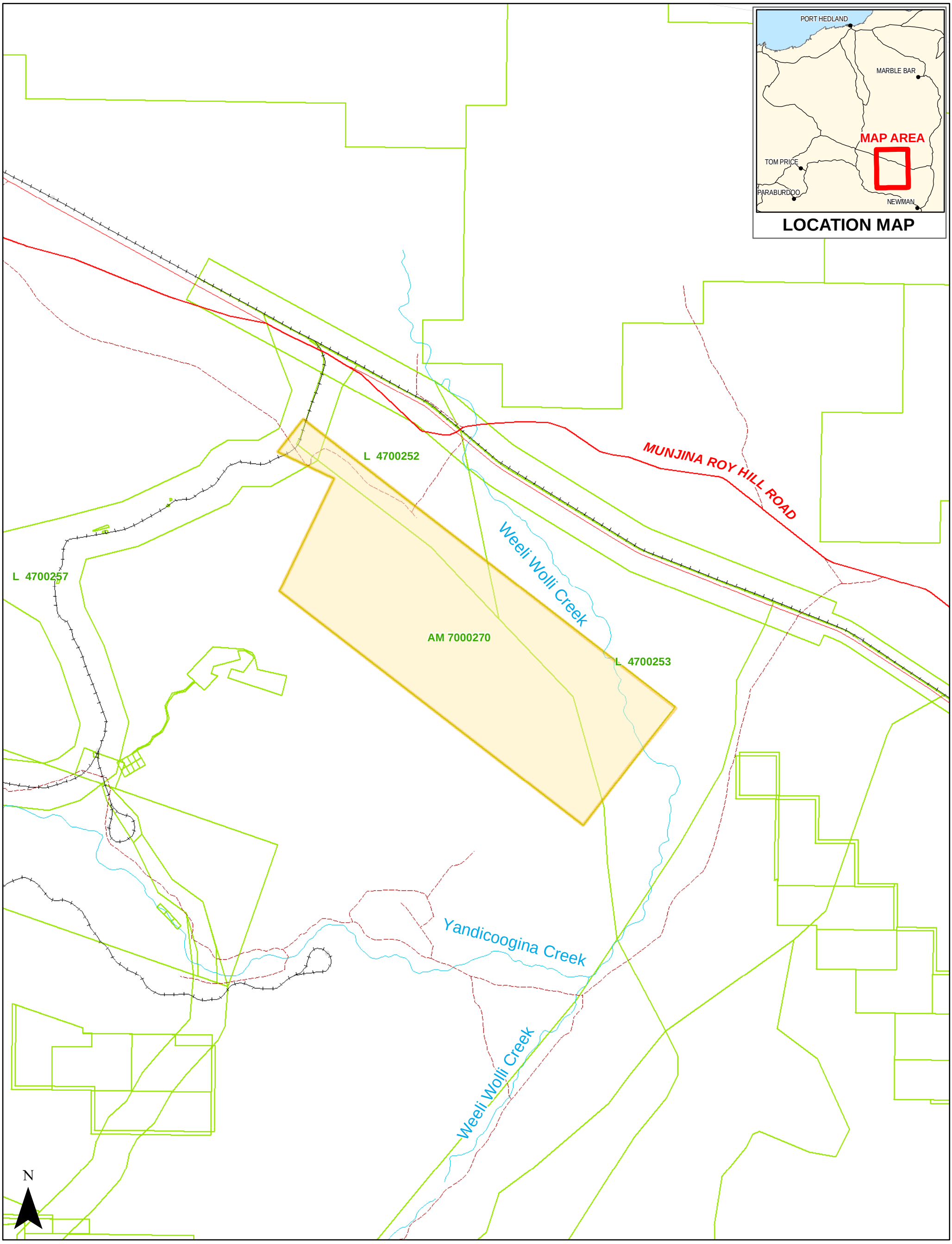


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**FIGURE 1**

Location of the study area

0 2 4 6 8 10
Kilometers
1:150,000

Datum: GDA94
Projection: MGA Zone 50

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**Legend**

- Study Area - Marillana Tenement
- Tenements

## 1.3 Climate

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

Annual average rainfall for the Pilbara ranges from 180 mm to over 400 mm (Beard 1975). The long-term average for the nearby Marillana Weather Station is 318.5 mm. Most of the annual precipitation occurs between the four months from December to March. The average maximum summer temperatures typically range between 38ºC and 40ºC, while winter maximum temperatures range from 28ºC to 30.5ºC (BOM 2015).

There was significant autumn rainfall received prior to the November 2015 survey. The months of January and February 2015 received average monthly falls, with March, April and May 2015 all received more than double the long term average (Figure 2, BOM 2015). While the three months prior to the November 2015 field survey were relatively dry, limited to 23.5 mm in October, seasonal conditions were rated as *fair* owing to the above average rainfall received through to May.

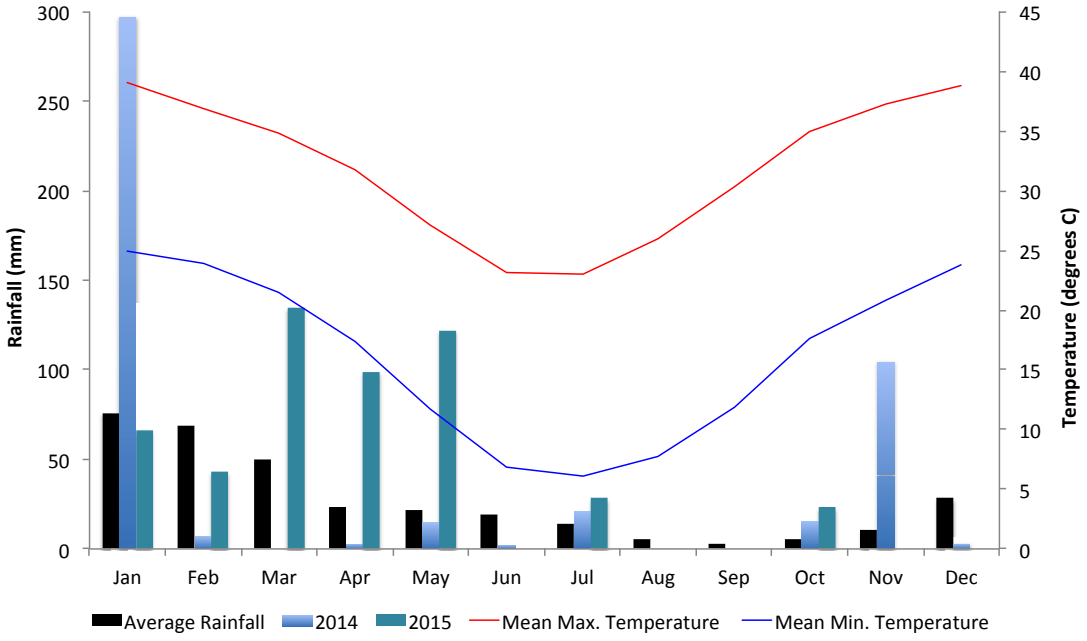



**Figure 2** **Rainfall and climatic data recorded at Newman Airport between January 2014 and October 2015 (BOM 2015).**

## 1.4 Biogeographic Regions

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

System.

Within the Pilbara bioregion there are four sub-regions: Chichester, Fortescue, Hamersley and Roebourne. The study area is located in the Hamersley sub-region (PIL3) which is described as mountainous areas of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite) (Kendrick 2001). It contains Mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges.

## 1.5 Existing Land Use

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

The study area is situated on Marillana pastoral lease and approximately 60 km east of Karijini National Park.

## 1.6 Landforms

The study area lies within the northern Hamersley Range, which is dominated by rounded hills and ranges. The Hamersley Range is characterised by long strike ridges rising from valley floors reaching a height of up to 300 m. The flat valley floors consist of Cainozoic sediments. Drainage flows to the north-east towards the Fortescue Valley. The major drainage line of Weeli Wolli Creek is situated to the east of the study area.

## 1.7 Soils

Tille (2007) classified the most recent and detailed mapping of Western Australia's Rangelands and Arid Interior into a hierarchy of soil-landscape mapping units. The study area is located within the Hamersley Plateaux Zone:

- 285 – Hamersley Plateaux Zone, located in the Fortescue Province is described as having stony soils with red shallow loams and some red/brown non-cracking clays and red loamy earths.

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

- My55: Gently sloping outwash plains generally flanking the northern face of the Hamersley Range; coarse surface gravels are extensive: chief soils are neutral red earths (Gn2.12) with some (Gn2.11) and (Dr2.33) soils; and
- Fa13: Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations; some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.

## 1.8 Geology

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

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

The main geological features of the Yandi area have been described by Tyler *et al.* (1991). The dominant geological unit is the Tertiary Colluvium (Tc) comprised of partially cemented valley-fill deposits with boulders of limonite. Interspersed within this unit are areas of limestone and calcareous gravels with opaline silica, which are part of the Oakover Formation (To). The Tertiary Robe Pisolite (Tp) formation is also present and is comprised of pisolitic limonite with fossil wood fragments. This unit contains iron ore deposits and is the main source of iron ore mined at Yandi. The Weeli Wolli Formation (Phj) consists of banded jaspilite with interbedded shale intruded by medium grained dolerite, and is also found in the area.

## 1.9 Flora and Vegetation

The study area is located within the Hamersley Botanical District, within the Pilbara IBRA region of the Eremaean Province (Beard 1990). Beard (1975) mapped vegetation of the Pilbara at a scale of 1:1,000,000. The most common vegetation associations within the study area were *Eucalyptus leucophloia* (snappy gum) and *Triodia wiseana* (hard spinifex) tree steppe occurring on hills, and tall woodlands of *Eucalyptus camaldulensis*, *Eucalyptus victrix* and *Melaleuca argentea* along major drainage lines such as Marillana Creek.

The original vegetation mapping undertaken by Beard (1975) was refined by Shepherd *et al*. (2002), who confirmed the same three vegetation associations were present within the study area (Figure 3). While the Pre-European extent for each vegetation association is greater than 99.9 percent, less than ten percent of each association occurs within formal or informal reserves (Table 1).

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

| Vegetation Sub-Association | Description | Pre-Euro. Extent Remaining | % remaining IUCN Class I-IV Reserves | % remaining Other Reserves | % remaining DPaW Managed PL |
|---|---|---|---|---|---|
| 82 | Hummock grasslands, low tree steppe; snappy gum over *Triodia wiseana* | 100.0 | 8.9 | 0.2 | 1.0 |
| 111 | Hummock grasslands, shrub steppe; Eucalyptus gamophylla over hard spinifex | 100.0 | 5.8 | 0.5 | 0.0 |
| 29 | Sparse low woodland; mulga, discontinuous in scattered groups | 100.0 | 0.3 | 0.0 | 2.4 |

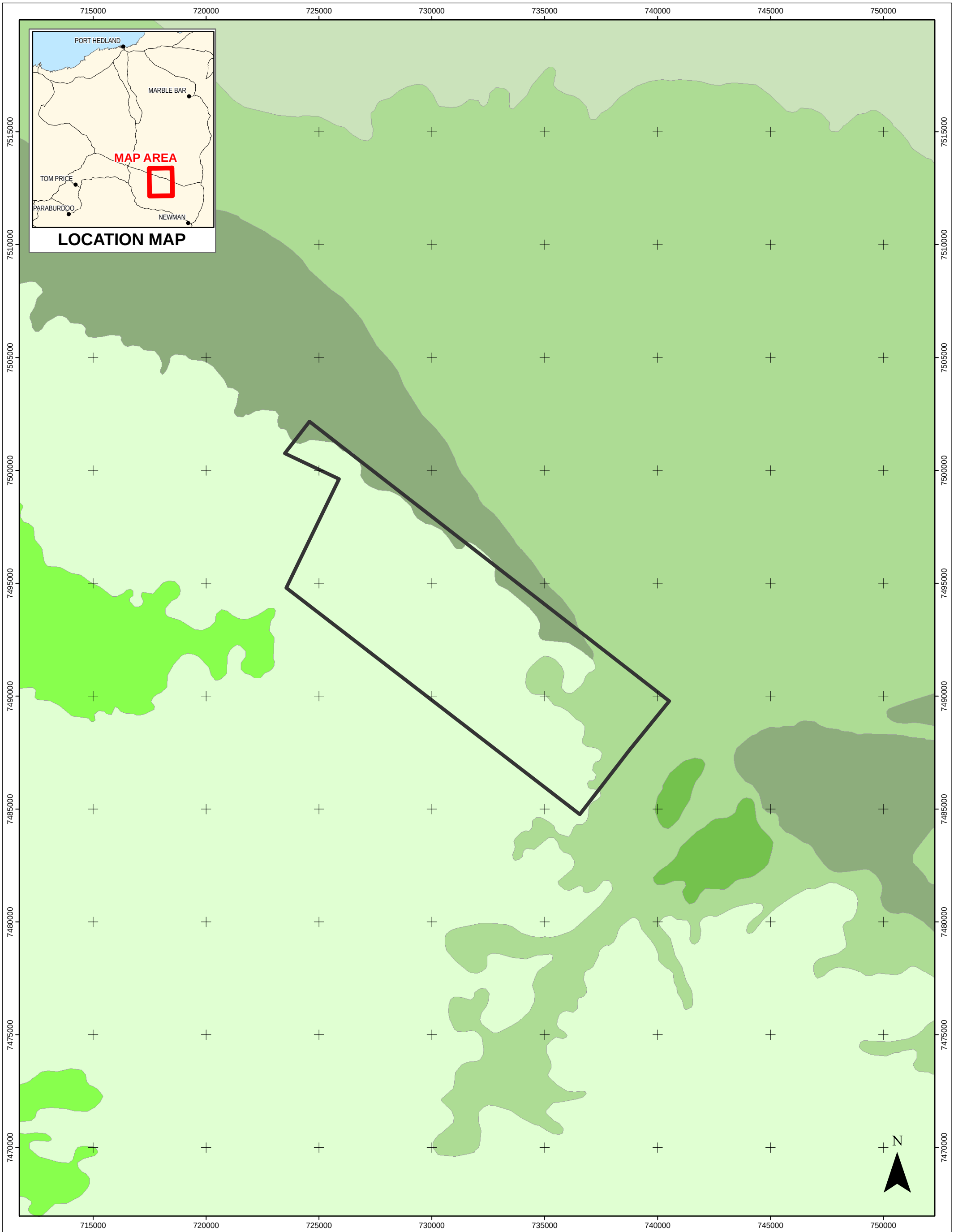
## 1.10 Land Systems

The Department of Agriculture (now the Department of Agriculture and Food) has conducted inventory and condition surveys of the Pilbara (van Vreeswyk *et al.* 2004) using an integrated survey method involving the land system approach to rangeland description evaluation.

A total of 102 land systems were defined in the Pilbara at a scale of 1: 250,000 (van Vreeswyk *et al.* 2004). Four land systems occurring within the study area (Table 2, Figure 4). The dominant land system is the Newman Land System, which forms the main ridge at Marillana. The Boolgeeda Land System is present along the north-eastern border of the study area extending to the south-east corner. It forms the lowers slopes of the range leading down into the plains of the Fortescue Valley. These are generally depositional surfaces of very gently inclined stony slopes leading to flat plains. The River and Urandy Land Systems occupy the eastern corner of the study area, consisting of alluvial plains and floodplains around Weeli Wolli Creek as it enters the Fortescue Valley. These areas are periodically flooded and the vegetation is highly attractive to grazing animals.

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

| Land System | Representation in the Pilbara | Description |
|---|---|---|
| River | 4,088 km$^2$ or 2.3% | Active flood plains and major rivers supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grassland. |
| Newman | 14,580 km$^2$ or 8.0% | Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. |
| Boolgeeda | 7,748 km$^2$ or 4.3% | Stony plains with hard spinifex grasslands or mulga shrublands. The geology is quaternary colluvium. |
| Urandy | 1,311 km$^2$ or 0.7% | Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands. |

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# FIGURE 3

Vegetation of thestudy area,
as mapped by Beard (1975)

0 2 4 6 8 10
Kilometers

1:150,000

Datum: GDA94
Projection: MGA Zone50

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## Legend

Study Area - Marillana

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

- FORTESCUE VALLEY, 111
- FORTESCUE VALLEY, 29
- FORTESCUE VALLEY, 676
- FORTESCUE VALLEY, 82
- HAMMERSLEY, 18
- HAMMERSLEY, 82

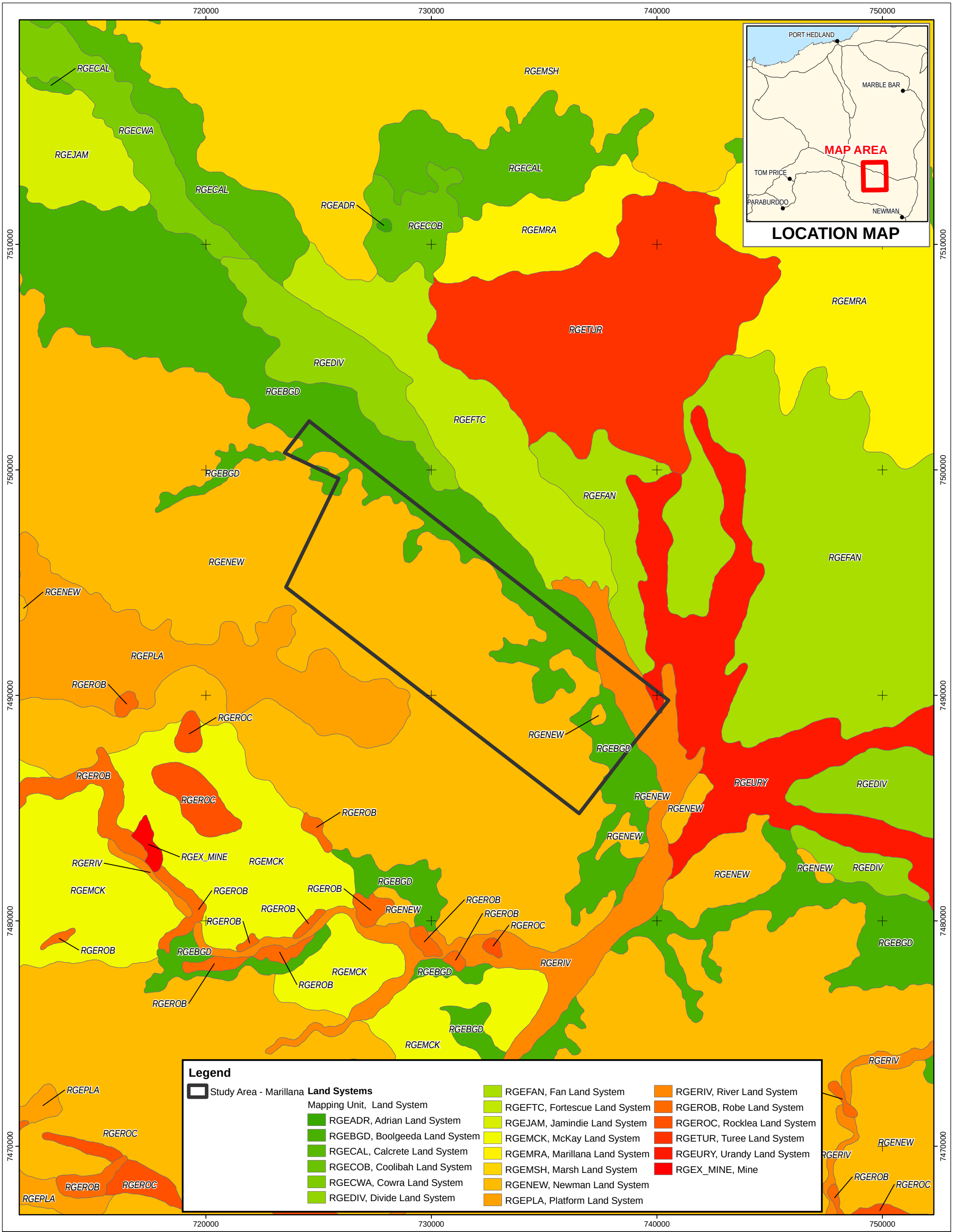


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**FIGURE 4**

Land systems occurring within the study area (descriptions from Van Vreeswyk *et al.* 2004)

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N

0 2 4 6 8 10
Kilometers

1:150,000

Datum: GDA94
Projection: MGA Zone50

# 2.0 METHODOLOGY

## 2.1 Legislation and Guidance Statements

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

- Terrestrial Biological Surveys as an Element of Environmental Protection. Position Statement No. 3 (EPA 2002);
- EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51 (EPA 2004); and
- Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPaW 2015).

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

## 2.2 Desktop Searches

Desktop searches of three databases were completed for information relating to rare flora (DPaW 2015a), TECs and PECs (DPaW 2015b) previously collected or described within, or in close proximity to, the study area. For this report a database search covering the entire study area was completed. The search was extended beyond the immediate survey limits to place flora values into a local and regional context. The search was undertaken for a 50 km radius around the study area using the point coordinate 723000 mE 7494500 mN (Zone 50 GDA94). The State database search investigated three DPaW databases:

- The DPaW Threatened Flora Database (DPaW 2015a);
- The DPaW Threatened and Priority Flora List (DPaW 2015b); and
- The Western Australian Herbarium Specimen Database for priority species opportunistically collected in the area of interest.

A search of the EPBC Act Protected Matters database was undertaken (DOE 2015), as well as a search of the International Union for Conservation of Nature (IUCN) database (IUCN 2015). A comprehensive literature review of surveys previously completed within or in close proximity to the study area was also completed.

## 2.3 Field Survey Methodology

### 2.3.1 Timing and Personnel

The targeted flora survey was completed by Principal Botanist Dr Jerome Bull and Field Botanist Ms Jessica Waters working over a four day period on the 4th, 6th, 11th and 16th November 2015.

### 2.3.2 Targeted Surveys for Conservation Significant Species

Targeted searches for species of conservation significance were completed across the study area. Previous locations for priority flora within the study area were revisited in the field to confirm their existence. Targeted searches were then conducted in similar habitats in the surrounding area. Aerial maps were also used

to identify the locations of habitat potentially supporting species of conservation significance.

### 2.3.3 Vouchering

Voucher specimens were taken for all conservation significant plant taxa as well as taxa that could not be identified to species level in the field. Taxonomy was completed by Dr Jerome Bull at the Western Australian Herbarium (WAH), with selected voucher specimens provided to the BHP Billiton Iron Ore sponsored botanist, Mr Steve Dillon. Use was made of the WAH for confirmation of species identification.

### 2.3.4 Field Survey Constraints

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

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

| Constraint | Relevance |
|---|---|
| Scope | The scope was established by BHP Billiton Iron Ore in compliance with relevant EPA Guidance Statements. |
| Proportion of flora collected and identified | The seasonal conditions at the time of survey were rated as fair. However, ephemeral taxa may not have been present at the time of the field survey, noting there were five Priority flora taxa recorded from the database search as possibly or likely to occur within the study area. That said, the conservation significant flora previously recorded within the study area were easily identified under the *in situ* conditions. |
| Sources of information | Three previous flora and vegetation surveys have been completed from within the study area, with a further 42 completed surrounding areas. This is confirmed by the intensity of rare flora records locally. |
| The proportion of the task achieved and further work which might be needed | All allocated tasks detailed in the scope of works were achieved during the 2015 survey and no further work is required at this site. |
| Timing / weather / season / cycle | The survey was completed in November 2015 under *fair* seasonal conditions and following significant monthly rainfall from January to May. |
| Disturbances, e.g. fire, flood | Disturbances within the study area include introduced species, grazing of vegetation by domestic stock (cattle), flooding and fire (mosaic of burn ages recorded). |
| Intensity | A total of four days was spent surveying for conservation significant flora and weed species across the study area in November 2015. |
| Completeness | Given the intensity of the current survey and the additional previous surveys completed it is considered the area has been adequately surveyed. However due to time constrains and the steep nature of the terrain only a portion of the suitable habitat for *Synostemon hamersleyensis* could be surveyed. It is likely this species occurs more extensively within the study area. |

| Constraint | Relevance |
|---|---|
| Resources | Appropriate resources were applied to surveying the study area. |
| Access problems | The study area was accessed by vehicle and on foot. The terrain of the study area is very steep with deep gorges and cliffs making access difficult. |
| Availability of contextual information | At least 45 previous flora and vegetation surveys have been undertaken within or in close proximity to the study area, providing an extensive local database. |
| Experience levels | The Principal Botanist working on the survey has over 15 years Pilbara experience, and the accompanying Field Botanist has in excess of four years Pilbara experience. Together the group has completed numerous surveys in close proximity to the study area over recent years. |

### 2.3.5 Assessment of Conservation Significance

The conservation significance of flora, fauna and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

Commonwealth Level:

- EPBC Act: The Department of Environment (DoE) lists Threatened Flora, Fauna and Ecological Communities, which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 4).

State Level:

- WC Act: At a State level native flora and fauna species are protected under the WC Act – Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations.
- DPaW Priority list: DPaW produces a list of Priority species and ecological communities (PEC's) that have not been assigned statutory protection under the WC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 5). The list of PEC's identifies those that need further investigation before nomination for TEC status at a State level.

Local Level:

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

# 3.0 RESULTS

## 3.1 Desktop Review

### 3.1.1 Previous Baseline Flora Surveys

A total of 45 previous flora and vegetation surveys have been completed within, or in close proximity to, the study area. Appendix 1 summarises findings from the literature review including survey timing, survey type, flora statistics, vegetation associations, significant flora and weed species recorded during each survey.

There are three previous baseline flora and vegetation surveys that have been completed within the study area (Ecologia 2007, ENV Australia 2008, and Onshore Environmental 2013a). The latest survey recorded *Sauropus* sp. Koodaideri detritals (J. Naaykens & J. Hurter JH 11213) which is now known as the Priority 1 flora taxon *Synostemon hamersleyensis.* No other conservation significant flora had been recorded during previous surveys.

A total of seven introduced weed species were recorded from the study area during previous baseline surveys including **Acetosa vesicaria* (Ruby Dock), **Aerva javanica* (Kapok Bush), **Argemone ochroleuca* (Mexican Poppy), **Bidens bipinnata* (Beggar's Bipinnate), **Cenchrus ciliaris* (Buffel Grass), **Cenchrus setiger* (Birdwood Grass) and **Sisymbrium orientale* (Indian Hedge Mustard).

### 3.1.2 Threatened Flora listed under the EPBC Act

A search of the EPBC Act Protected Matters database was undertaken within a 40 km buffer of the study area (DoE 2015). One Threatened Flora or their habitat was listed as likely to occur within the study area; *Lepidium catapycnon*. This species is no longer listed as Threatened Flora by DPaW and has recently had the State conservation code downgraded to Priority 4. No Federal listed TECs were recorded during the database search.

### 3.1.3 Threatened Flora listed under the IUCN Red List

A search of the International Union for Conservation of Nature (IUCN) database was conducted (IUCN 2015). No Threatened Flora were listed as likely to occur within the study area from this search.

### 3.1.4 Threatened Flora listed under the WA Wildlife Conservation (Rare Flora) Notice

A search of the DPaW databases did not identify any Threatened Flora taxon as occurring within a 50 km radius of the study area.

### 3.1.5 Priority Flora recognised by the DPaW

The DPaW rare flora database search (DPaW 2015a) identified 29 Priority flora taxa as potentially occurring within a 50 km radius of the study area (Table 4). It was determined that five of these taxa were likely to occur within the study area based on occurrence of habitat and proximity to previous records (Table 4).

**Table 4 Significant flora previously recorded from a 50 km search radius of the study area (DPaW 2015a).**

| Taxon | Cons. Code | Life Form | Habitat Preference | Suitable Habitat | Likelihood in Study Area |
|---|---|---|---|---|---|
| *Acacia bromilowiana* | 4 | Perennial | Red skeletal stony loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds. | Yes | Possible |
| *Acacia subtiliformis* | 3 | Perennial | Rocky calcrete plateau. | No | Unlikely |
| *Aristida lazaridis* | 2 | Perennial | Hard pan plains. | Yes | Possible |
| *Atriplex flabelliformis* | 3 | Perennial | Clay loam, loam. Saline flats or marshes. | No | Unlikely |
| *Calotis squamigera* | 1 | Perennial | Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds. | Yes | Possible |
| *Eremophila spongiocarpa* | 1 | Perennial | Weakly saline alluvial plain on margins of marsh. | No | Unlikely |
| *Eremophila youngii* subsp. *lepidota* | 4 | Perennial | Flats plains, floodplains, sometimes semi-saline, clay flats. | No | Unlikely |
| *Euphorbia australis* var. *glabra* | 2 | Annual or Perennial | Variety of soils. | Yes | Possible |
| *Fimbristylis sieberiana* | 3 | Perennial | Mud, skeletal soil pockets. Pool edges, sandstone cliffs. | No | Unlikely |
| *Goodenia nuda* | 4 | Annual | Plains and floodplains. | Yes | Likely |
| *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) | 3 | Biennial | Low undulating plain, swampy plains. | No | Unlikely |
| *Grevillea saxicola* | 3 | Perennial | Ironstone hills and ridges. Skeletal ironstone soils. Steep slopes and cliffs. | Yes | Possible |
| *Gymnanthera cunninghamii* | 3 | Perennial | Sandy soils. Major drainage lines. | Yes | Possible |
| *Hibiscus* sp. Gurinbiddy Range (M.E. Trudgen MET 15708) | 2 | Perennial | Skeletal soils over ironstone. | Yes | Possible |
| *Indigofera gilesii* | 3 | Perennial | Pebbly loam amongst boulders and outcrops. Hills. | Yes | Possible |

| Taxon | Cons. Code | Life Form | Habitat Preference | Suitable Habitat | Likelihood in Study Area |
|---|---|---|---|---|---|
| *Isotropis parviflora* | 2 | Perennial | Ironstone hills. Short lived post-disturbance coloniser. | Yes | Likely |
| *Lepidium catapycnon* | 4 | Perennial | Skeletal soils. Hillsides. | Yes | Likely |
| *Myriocephalus scalpellus* | 1 | Annual | Clay. Depression on flood plain. | Yes | Possible |
| *Nicotiana heterantha* | 1 | Annual or Perennial | Black clay. Seasonally wet flats. | No | Unlikely |
| *Polymeria distigma* | 3 | Annual | Sandy soils. | Yes | Possible |
| *Rhagodia* sp. Hamersley (M. Trudgen 17794) | 3 | Perennial | Clay plains. Mulga woodlands. | Yes | Possible |
| *Rostellularia adscendens* var. *latifolia* | 3 | Annual or Perennial | Ironstone soils. Near creeks, rocky hills. | Yes | Likely |
| *Sida* sp. Barlee Range (S. van Leeuwen 1642) | 3 | Perennial | Cliffs and gorges, rocky ledges, overhangs. | Yes | Possible |
| *Stylidium weeliwolli* | 2 | Annual | Gritty sand soil, sandy clay. Edge of watercourses. | No | Unlikely |
| *Synostemon hamersleyensis* | 1 | Perennial | Ironstone upper hill slopes. | Yes | Likely |
| *Tecticornia globulifera* | 1 | Perennial | Saline flats. Marsh. | No | Unlikely |
| *Tecticornia medusa* | 3 | Perennial | Saline flats. Marsh. | No | Unlikely |
| *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) | 3 | Perennial | Clay pan, grass plain. | No | Unlikely |
| *Triodia* sp. Mt Ella (M.E. Trudgen 12739) | 3 | Perennial | Upper hill slopes, ironstone ranges. | Yes | Possible |

## 3.2 Significant Flora

### 3.2.1 Threatened Flora listed under the WC Act and EPBC Act

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

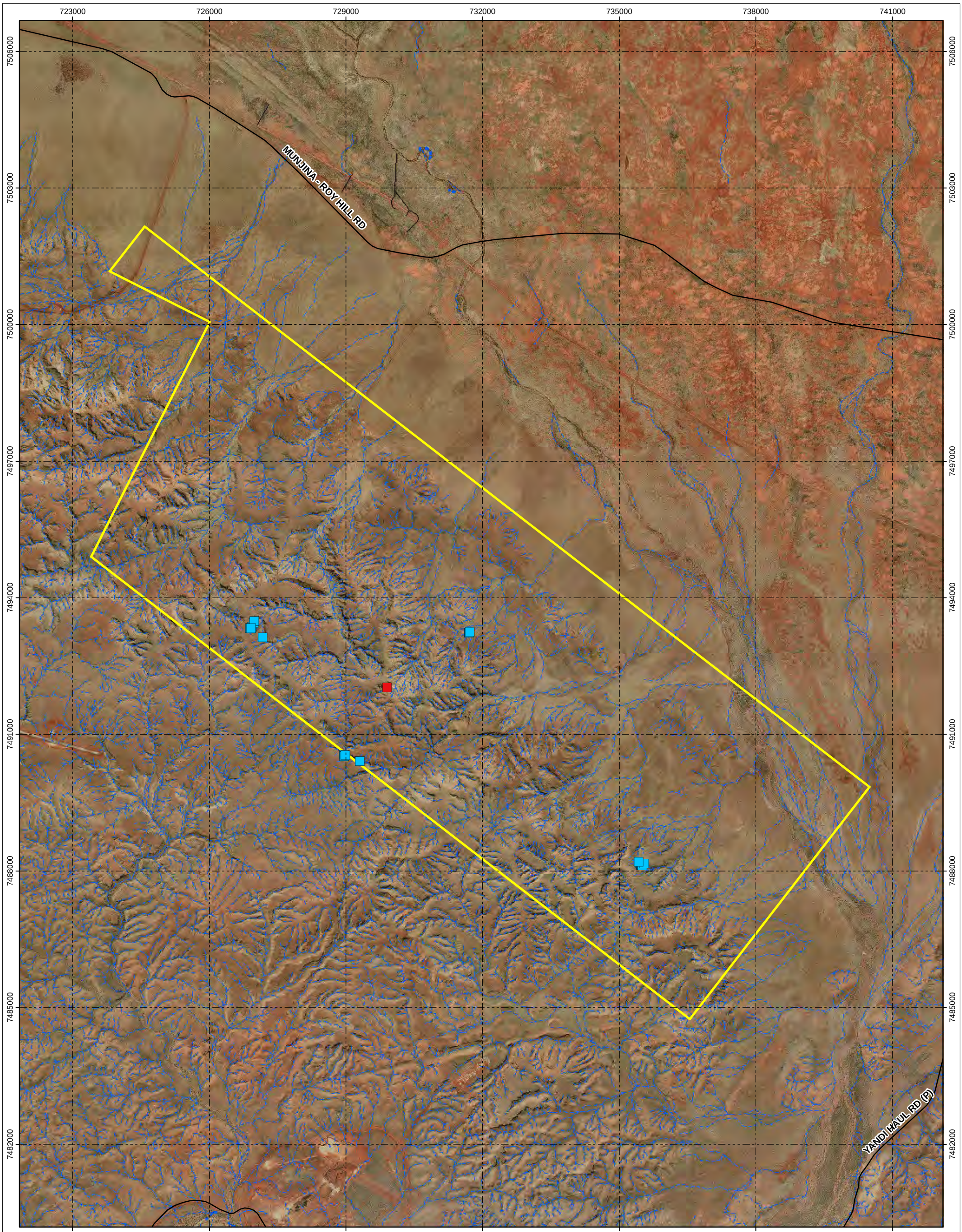
### 3.2.2 Significant Flora

Two Priority flora taxa as defined by DPaW were recorded from the study area; *Synostemon hamersleyensis* (Priority 1) and *Eremophila magnifica* subsp. *magnifica* (Priority 4) (Table 5, Figure 5, and Appendix 4).

**Table 5 Description of Priority flora species recorded within the study area.**

| Taxon | Photograph | Description | Occurrence in study area |
|---|---|---|---|
| *Synostemon hamersleyensis* (Priority 1) |  | This species is recently described and grows to a height of 0.5 m. It has been observed flowering from August through to November. It is restricted to the Hamersley subregion from a 30km x 5km area at the northern edge of the Hamersley Range. It grows on breakaway formations and rocky outcrops in gullies and on upper slopes (Telford and Naaykens 2015). This species had previously been recorded from three locations within BHP Billion Iron Ore's Marillana tenement (Onshore Environmental 2013a) and at one location within the Area C West to Yandi infrastructure corridor (Onshore Environmental 2014a). It has also been recorded from Rio Tinto's Koodaideri tenement (Biota 2012a). | Recorded from a total of 27 locations within the study area including three previous locations recorded by Onshore Environmental (2013a). An additional 4 records were also made from marginally outside the boundary of the study area. It was recorded from steep rocky gullies, hillslopes and cliff lines throughout elevated sectors of the study area. Numbers of individuals at each location ranged from a single plant up to 10 plants. It is likely that it occurs elsewhere within the study area where suitable habitat exists. Vegetation was non-specific and characterised by up to four vegetation strata:<br>1. Low Woodland (to Low Open Woodland) of *Corymbia ferriticola*, *Eucalyptus leucophloia* subsp. *leucophloia, Corymbia hamerselyana, Acacia pruinocarpa* and/or *Brachychiton acuminatus;*<br>2. High Open Shrubland of *Acacia tumida* var. *pilbarensis, Grevillea wickhamii* subsp. *hispidula, Petalostylis labicheoides, Acacia hamersleyensis, Flueggea virosa, Acacia monticola, Santalum lanceolatum* and/or *Acacia bivenosa;*<br>3. Hummock Grassland (to Open Hummock Grassland) of *Triodia* sp. Shovelanna Hill (S. van Leeuwen 3835), *Triodia wiseana, Triodia pungens* and/or *Triodia brizoides;* and<br>4. Open Tussock Grassland of *Aristida burbidgeae, Cymbopogon ambiguus, Eriachne mucronata* and/or *Themeda triandra.* |

| Taxon | Photograph | Description | Occurrence in study area |
|---|---|---|---|
| *Eremophila magnifica* subsp. *magnifica* (Priority 4) |  | Shrub growing to a height of 1.5 m, producing blue or magenta flowers between August and November. It typically occurs on skeletal soils over ironstone and on rocky screes.<br>Known from 548 locations across the southern Pilbara bioregion and recorded from majority of BHP Billiton Iron Ore tenements in south-east Pilbara including Mining Area C, Marillana, Tandanya, Mudlark and South Flank, and with scattered records from Mt Whaleback extending east along Ophthalmia Range towards Jimblebar. | Recorded as an estimated 50 - 100 plants from the summit of a rocky gorge and cliff line at one location within the study area. The vegetation was described as 'Hummock Grassland of *Triodia wiseana* with High Shrubland of *Acacia arida* and *Acacia inaequilatera* and Very Open Mallee of *Eucalyptus gamophylla'.* |

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# FIGURE 5

Location of Priority flora taxa within the study area

0 1 2 3 4 5
Kilometers
1:75,000
Datum: GDA94
Projection: MGA Zone 50

ONSHORE ENVIRONMENTAL

| | | | |
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| Figure: | 5 | Date: | 13/02/2016 |
| Sheet Size: | A3 | Status: | Draft |
| Drawn by GSM | Requested by DB | Internal Reference Marillana Project Sig | |

## Legend

- Study Area

**Significant Flora**

- *Eremophila magnifica* subsp. *magnifica*
- *Synostemon hamersleyensis*

N

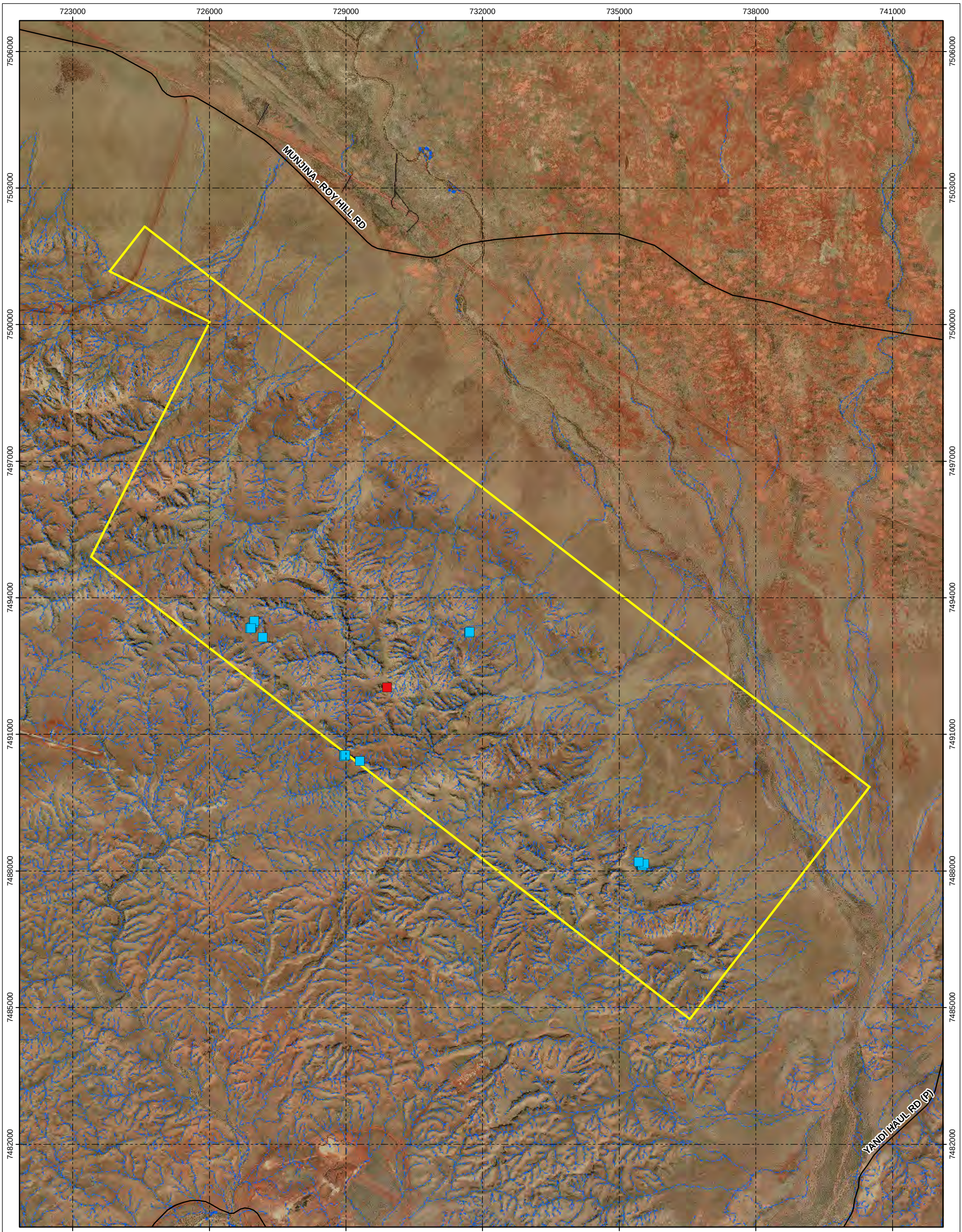
## 3.3 Introduced Flora

There were three introduced weed species recorded from the study area in November 2015; **Bidens bipinnata, *Cenchrus ciliaris* and **Setaria verticillata.* Seven weed species have previously been recorded from within the study area (Ecologia 2007, ENV Australia 2008, Onshore Environmental 2013a); **Acetosa vesicaria, *Aerva javanica*, **Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger* and **Sisymbrium orientale.*

The total number of weed taxa recorded from the study area to-date is eight taxa; these taxa are described in more detail below (see Table 6, Figure 6, Appendix 5). None of these taxa are listed as a Declared Pest under the BAM Act.

**Table 6 Introduced weed species recorded from the study area.**

| Weed Taxon | Common Name | Occurrence in Study Area |
|---|---|---|
| **Acetosa vesicaria* | Ruby Dock | Recorded from a single location during a previous survey (Ecologia 2007). There was no GPS coordinate provided for this location. |
| **Aerva javanica* | Kapok Bush | Recorded as scattered plants from four locations in the eastern, central and north-western sectors of the study area, associated with sandy levee banks and riverbeds on major drainage lines. |
| **Argemone ochroleuca* | Mexican Poppy | Restricted to three locations within the gravelly stream channel of a major drainage line in the eastern sector of the study area. It was a minor component of the vegetation. |
| **Bidens bipinnata* | Bipinnate Beggars Tick | Recorded as scattered plants from four locations in the western sector of the study area. Found in small groves of Mulga frequented by cattle, as well as under overhanging rock ledges along disturbed cliff lines. |
| **Cenchrus ciliaris* | Buffel Grass | Common across the entire study area with highest ground coverage (approximating 70 percent) provided along drainage lines, floodplains, sand dunes and other sites where soil disturbance was apparent. It was especially dominant on floodplains in the northern and eastern sectors of the study area. |
| **Cenchrus setiger* | Birdwood Grass | Recorded from the far northern and eastern sectors of the study area where it was confined to floodplains associated with the major drainage line (occurring with the more dominant **Cenchrus ciliaris).* |
| **Setaria verticillata* | Whorled Pigeon Grass | Scattered plants were recorded from one location within the central eastern sector of the study area, occurring on steep gorge slopes. |
| **Sisymbrium orientale* | Indian Hedge Mustard | Recorded from a single location within the riverbed of the major drainage line on the eastern fringe of the study area. |

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# FIGURE 5

Location of Priority flora taxa within the study area

0 1 2 3 4 5
Kilometers
1:75,000
Datum: GDA94
Projection: MGA Zone 50

ONSHORE ENVIRONMENTAL

| | | | |
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| Figure: | 5 | Date: | 13/02/2016 |
| Sheet Size: | A3 | Status: | Draft |
| Drawn by GSM | Requested by DB | Internal Reference Marillana Project Sig | |

## Legend

- Study Area

**Significant Flora**

- *Eremophila magnifica* subsp. *magnifica*
- *Synostemon hamersleyensis*

N

# 4.0 SUMMARY

The targeted flora survey completed by Onshore Environmental in November 2015 recorded two Priority flora taxa from the Marillana Tenement; *Synostemon hamersleyensis* (Priority 1) and *Eremophila magnifica* subsp. *magnifica* (Priority 4).

*Synostemon hamersleyensis* was recorded from 28 locations distributed across elevated areas of the Marillana tenement. Plants were typically present at low density (1-10 individuals) and associated with steep and very steep upper hillslopes, breakaway slopes, gorges and cliff lines. Vegetation in which it occurred was non-specific but characterised by a Low Woodland (to Low Open Woodland) strata of low trees, High Open Shrubland of tall shrubs, with Hummock Grassland (to Open Hummock Grassland) of variable spinifex species, occasionally with Open Tussock Grassland.

*Eremophila magnifica* subsp. *magnifica* was recorded as an estimated 50 to 100 plants from the summit of a rocky gorge and cliff line at one location within the Marillana Tenement. The associated vegetation was described as Hummock Grassland of *Triodia wiseana* with High Shrubland of *Acacia arida* and *Acacia inaequilatera* and Very Open Mallee of *Eucalyptus gamophylla.*

A total of eight introduced weed species have been recorded from the study area; **Acetosa vesicaria, *Aerva javanica*, **Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Setaria verticillata* and **Sisymbrium orientale*. None of these taxa are listed as a Declared Pest under the BAM Act, and all are common weeds in the Pilbara.

# 5.0 STUDY TEAM

The targeted vegetation survey was planned, co-ordinated and executed by the following personnel:

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Project Staff

| | | |
|---|---|---|
| Dr Darren Brearley | PhD | Project Manager and Principal Botanist |
| Dr Jerome Bull | PhD | Principal Botanist |
| Ms Jessica Waters | BSc | Botanist |
| Mrs Kerry Keenan | | Data Analyst |
| Mr Todd Griffin | | GIS Specialist |

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# APPENDIX 1

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

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Surveys within or partially within the study area | | | | | |
| Onshore Environmental 2013) Flora and Vegetation Survey Marillana ML70/270 | Within the study area | 27th-30th April, 28th September - 6th October 2011 | 18 vegetation associations | 268 taxa, 44 families, 117 genera, 7 weed species **Aerva javanica, *Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Sisymbrium orientale* | No Threatened or Priority Flora |
| ENV Australia (2008) RGP5 M270SA Flora and Vegetation Assessment | Within the study area | 22nd April 2008 7 quadrats | 5 vegetation associations | 114 taxa, 30 families, 58 genera, 2 weed species **Aerva javanica*, **Cenchrus ciliaris* | No Threatened or Priority Flora |
| Ecologia (2007) Marillana ML70/270 SA Sec 2 Flora and Vegetation Survey | Within the study area | 5th-14th October 2005, March 2006 78 quadrats | 16 vegetation associations | 243 taxa, 43 families, 92 genera, 2 weed species **Acetosa vesicaria, *Cenchrus ciliaris* | No Threatened or Priority Flora |
| Barimunya Airport | | | | | |
| ENV Australia (2009d) RGP5 Yandi Flora Survey and Assessment of Barimunya Airport and a Potential Borrow Area | ~ 3.5km south of the study area | 24th - 27th September 2008 8 quadrats | 4 vegetation associations | Barimunya Airport: 79 taxa, 24 families, 44 genera<br>Potential borrow areas: 84 taxa, 28 families, 52 genera, 1 weed species **Cucumis melo* subsp. *agrestis* | No Threatened or Priority Flora |
| Ecologia Environment (2001) Yandi Proposed Air Strip Environmental Clearance Survey | ~ 3.5km south of the study area | 26th-27th September 2001 | Not Recorded | 66 taxa, 25 families, no weed species | No Threatened or Priority Flora |
| Ecologia Environment (2002) Yandi Airstrip and Access Road Rare and Priority Flora Survey | ~ 3.5km south of the study area | 14th- 17th March 2002 | 3 vegetation associations | 154 taxa, 38 families, no weed species | No Threatened Flora<br>*Isotropis parviflora* (P2)[1] |

[1] Originally recorded as *Isotropis winneckei*

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Biota (2002) Proposed Yandi Airstrip Flora Survey | ~ 3.5km south of the study area | 19th August 2002 | Not Recorded | Not Recorded | No Threatened Flora<br>*Isotropis parviflora* (P2)[2]<br>Species of interest: *Senna curvistyla* and *Tephrosia arenicola* |
| Other surveys in close proximity to the study area | | | | | |
| Onshore Environmental (2012) Flora and Vegetation Survey Jinidi to Mainline Study Area | Adjoins the eastern part of the study area | February, March, April and September 2011<br>395 quadrats | 28 vegetation associations | 471 taxa, 178 genera, 59 families, 20 weeds species | No Threatened Flora<br>*Lepidium catapycnon* (P4)[3], *Goodenia nuda* (P4), *Rostellularia adscendens* var. *latifolia* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Fimbristylis sieberiana* (P3), *Stylidium weeliwolli* (P2) |
| Biota (2012a) A Vegetation and Flora Survey of the Koodaideri Study Area | Adjoins the western part of the study area | July 2010, March, May 2011<br>69 quadrats | 29 vegetation associations | 385 taxa, 192 genera, 44 families | No Threatened Flora<br>*Lepidium catapycnon* (P4)[3], *Vigna* sp. Central[4], *Nicotiana umbratica* (P3), *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3), *Eremophila magnifica* subsp. *magnifica* (Priority 4), *Rhynchosia bungarensis* (P4) |
| Ecologia Environment (2007a) Rapid Growth Project 5 Cowra to Kurrajurra Sidings and Cowra Camp Site Flora and Vegetation Survey | Adjoins the study area to the west and continues to Cowra siding | 5th-9th October 2007<br>Level 1 Survey | 13 vegetation associations | 206 taxa, 92 genera, 38 families<br>5 weed species; **Acetosa vesicaria, *Aerva javanica, *Cenchrus ciliaris, *Malvastrum americanum, *Setaria verticillata* | No Threatened or Priority Flora |

[2] Originally recorded as *Isotropis winneckei*

[3] Listed as a Threatened Flora at the time of survey

[4] No longer listed as a Priority flora taxon

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Onshore Environmental (2014a) Area C West to Yandi Level 2 Flora and Vegetation Survey | ~8.5 km west of the study area | 21st May – 3rd June 2011, 19th July – 1st August 2012, 20th -29th August 2013 | 23 vegetation associations | 428 taxa, 58 families, 174 genera, 12 weed species; **Acetosa vesicaria, *Bidens bipinnata, *Cenchrus ciliaris, *Cenchrus setiger, *Citrullus colocynthis, *Flaveria trinervia, *Malvastrum americanum, *Setaria verticillata, *Sigesbeckia orientalis, *Sonchus oleraceus, *Tribulus terrestris, *Vachellia farnesiana* | No Threatened Flora<br>*Acacia bromilowiana* (P4), *Acacia effusa* (P3), *Acacia subtiliformis* (P3), *Aristida jerichoensis* var. *subspinulifera* (P3), *Gymnanthera cunninghamii* (P3), *Goodenia nuda* (P4), *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3), *Rostellularia adscendens* var. *latifolia* (P3), *Rhynchosia bungarensis* (P4), *Sauropus* sp. Koodaideri detritals (J. Naaykens & J. Hurter JH 11213) (P1)[5], *Sida* sp. Barlee Range (S. van Leeuwen 1642) (P3), *Spartothamnella puberula* (P2)[6], *Vittadinia* sp. Coondewanna Flats (s. van Leeuwen 4684) (P1) |
| ENV Australia (2007a) Mindy North Exploration Lease Flora and Vegetation Assessment | ~10km south-east of the study area | 18th-25th April 2007<br>53 quadrats | 21 vegetation associations | 200 taxa, 93 genera, 38 families, 4 introduced flora; **Cenchrus ciliaris, *Malvastrum americanum, *Setaria verticillata, *Bidens bipinnata* | No Threatened or Priority Flora |
| Ecologia Environment (2005) Mindy-Coondiner Exploration Project Biological Survey | ~10km south-east of the study area | 7th-11th November 2005<br>14 quadrats | 7 vegetation associations | 137 taxa, 66 genera, 32 families, 3 weed species; **Cenchrus ciliaris, *Acetosa vesicaria, *Aerva javanica* | No Threatened or Priority Flora |
| Biota (2012b) Jinidi to Mindy Level 1 Flora and Vegetation Survey | ~10km south-south east | 11th-13th March 2011<br>9 quadrats | 16 vegetation associations | 260 taxa, 117 genera, 41 families, 6 weed species **Bidens bipinnata, *Cenchrus ciliaris, *Datura leichhardtii, Portulaca oleracea*[7], *Setaria *verticillata, *Tribulus terrestris* | No Threatened or Priority Flora |

[5] Now known as *Synostemon hamersleyensis* (P1)

[6] Now known as *Spartothamnella canescens* and no longer considered threatened

[7] No longer listed as a weed in the Pilbara

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| BHPBIO (2008) Rapid Growth Project 5 Paroo, Ethel and Sandhill Proposed Sidings Flora and Vegetation Report | ~25km east-south east (Sandhill Siding) | 20th October 2007 | 3 vegetation associations | Sandhill siding: 59 taxa, 36 genera, 22 families, 2 weed species **Cenchrus ciliaris, *Malvastrum americanum* | No Threatened or Priority Flora |
| ENV Australia (2007b) Coondiner and Mindy East Exploration Leases Flora and Vegetation Assessment | ~35 km south-east | 13th-18th April 2007<br>36 quadrats | Coondiner: 11 vegetation associations<br>Mindy East: 3 vegetation associations | Coondiner: 217 taxa, 97 genera, 43 families<br>Mindy East: 95 taxa, 60 genera, 24 families<br>5 weeds species from both tenements**Aerva javanica, *Cenchrus ciliaris, *Malvastrum americanum, *Setaria verticillata, *Solanum nigrum* | No Threatened Flora<br>Coondiner: *Olearia fluvialis*[8], *Cynanchum* sp. Hamersley (M. Trudgen 2302)[9], Sida sp. Barlee Range (S. van Leeuwen 1642) (P3) *Triumfetta leptacantha*[8]<br>Mindy East: No Priority Flora |
| Onshore Environmental (2014b) Mainline Rail Expansion Level 2 Flora and Vegetation Survey | Starts approximately 3km to the north of the north-western corner of the study area and continues along the mainline rail to Port Hedland | 25th October -7th November 2011, 21st November – 4th December 2011, 12th March – 25th March 2012, 18th April – 1st May 2012 | 73 vegetation associations.<br>Vegetation within the study area was affiliated with the following PECs:<br>i) The western fringe of the Fortescue Marsh PEC (Priority 1);<br>ii) Freshwater claypans of the Fortescue Valley;<br>iii) Four plant assemblages of the Wona Land System' described as 'Mitchell Grass *(Astrebla* spp.) on gilgai (Priority 3iii) | 706 taxa, 229 genera and 67 families, 16 weed species, Those recorded in close proximity included; **Cenchrus ciliaris, *Cenchrus setiger, *Vachellia farnesiana, *Bidens bipinnata, *Aerva javanica, *Malvastrum americanum, *Setaria verticillata, *Flaveria trinervia* | No Threatened flora<br>16 priority flora<br>Those recorded in close proximity included *Eremophila spongiocarpa* (P1), *Tecticornia* sp. Christmas Creek (K.A Shepherd and T. Colmer et al KS 1063) (P1), *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P1), *Eremophila youngii* subsp. *lepidota* (P4), *Bulbostylis burbidgeae* (P4) |

[8] No longer listed as a Priority flora taxon

[9] Now known as *Tylophora flexuosa* and no longer listed as Priority flora

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Fortescue Marsh | | | | | |
| Onshore Environmental (2015a) Fortescue Marsh Tenements E47/1585&E47/1586 Level 1 Flora and Vegetation Survey | ~30 km east | 26th- 7th October 2014 | 59 vegetation associations | No flora inventory, 6 weed species; **Aerva javanica, *Bidens bipinnata, *Cenchrus ciliaris, *Malvastrum americanum, *Setaria verticillata, *Vachellia farnesiana* | No Threatened Flora<br>*Eremophila spongiocarpa* (P1), *Helichrysum oligochaetum* (P1), *Nicotiana heterantha* (P1), *Tecticornia globulifera* (Priority 1), *Tecticornia* sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063) (P1), *Eremophila youngii* subsp. *lepidota* (P4), *Goodenia nuda* (P4) |
| Onshore Environmental (2015b) Targeted Flora Survey Fortescue Marsh Tenements | ~10km north-east | 4th – 14th May 2015 | Not recorded | Not recorded | *Eremophila spongiocarpa* (P1), *Teucrium pilbaranum* (P1), *Stackhousia clementii* (P3), *Eremophila youngii* subsp. *lepidota* (P4), *Goodenia nuda* (P4) |
| Marillana (Yandi) Mine | | | | | |
| Dames & Moore (1991) Yandi Baseline Vegetation Survey Marillana Creek – Part 1, Precommissioning of Yandicoogina Iron Ore Mine | Within the Yandi study area and downstream on Marillana Creek | 1st- 7th March 1991<br>9 transects along drainage lines | 3 vegetation associations | 23 taxa, 1 weed species; **Vachellia farnesiana* | No Threatened or Priority Flora |
| AGC Woodward Clyde (1995) Marillana and Weeli Wolli Creeks and Paleochannel Vegetation and Flora Survey | Within the Yandi study area and surrounds | 9th -15th May 1995<br>41 vegetation sites (including four of the 9 established above by Dames & Moore) | 6 vegetation associations | 270 taxa, 7 weed species; **Cenchrus ciliaris, *Argemone ochroleuca, *Malvastrum americanum, *Bidens bipinnata, *Sonchus oleraceus, *Vachellia farnesiana, *Citrullus lanatus* | No Threatened Flora<br>*Rostellularia adscendens* var. *latifolia* (P3)<br>*Goodenia stellata*[10], *Olearia fluvialis*[10], *Eriachne tenuiculmis*[10] |

[10] No longer listed as a Priority flora taxon

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Ecologia Environment (1995) Yandi Stage 2 Iron Ore Project Biological Assessment Survey | Within the Yandi study area and surrounds | May- June 1995<br>83 flora sites | 22 vegetation associations | 345 taxa, 55 families, 156 genera, 5 weed species; **Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Malvastrum americanum, *Sonchus oleraceus* | No Threatened or Priority Flora<br>*Goodenia stellata*[11] |
| Halpern Glick Maunsell (1996) Yandi Stage 2 Iron Ore Project Survey of Flora of Interest | Within the Yandi study area and surrounds | 24th-27th October 1996 | Not Recorded | Not Recorded | No Threatened or Priority Flora<br>*Wedelia* sp. Hamersley (A.S. Weston 8444)[11]<br>Previously located species of species of conservation significance were not recorded due to poor seasonal conditions |
| Halpern Glick Maunsell (1997) Marillana Creek Iron Ore Project Survey for *Goodenia stellata* and Flora of Interest | Within the Yandi study area and surrounds | 28th May- 1st June 1997 | Not Recorded | Not Recorded | No Threatened or Priority Flora<br>*Goodenia stellata*[11] |
| BSD (1997) A survey of Mexican Poppy (*Argemone ochroleuca) at Marillana Creek | Within the Yandi study area and extending to surrounding tributaries | 30th November- 6th December 1996 | Not Recorded | **Argemone ochroleuca* was recorded at 27 locations | Not Recorded |
| Ecologia Environment (1998) Yandi Vegetation and Soil Survey | Within the Yandi study area and surrounds | 27th May – 1st June 1998<br>32 quadrats | 14 vegetation associations | 200 taxa, 45 families, 104 genera, 7 weed species; **Argemone ochroleuca, *Cenchrus ciliaris, *Rostraria cristata*[12]*, *Malvastrum americanum, *Centaurea melitensis*[13]*, *Sonchus oleraceus, *Vachellia farnesiana* | No Threatened Flora<br>*Goodenia nuda* (P4) |

[11] No longer listed as a Priority flora taxon

[12] It is noted that **Rostraria cristata* has not previously been recorded north from a line between Shark Bay and Wiluna

[13] It is noted that **Centaurea melitensis* has not previously been recorded north from a line between Carnarvon and Laverton

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Halpern Glick Maunsell (1999a) Marillana Creek Iron Ore Project Review of Biological Reporting | Within the Yandi study area and surrounds | Desktop review | 28 vegetation associations from previous surveys | 493 taxa, 55 families, 7 weed species; **Argemone ochroleuca* subsp. *ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Centaurea melitensis, *Malvastrum americanum, *Rostraria cristata* and **Sonchus oleraceus* | No Threatened Flora<br>*Goodenia nuda* (P4)<br>*Goodenia stellata*[14], *Olearia fluvialis*[14], *Eriachne tenuiculmis*[14] |
| Halpern Glick Maunsell (1999b) Marillana Creek Western Access Corridor Biological Assessment | Western Access Corridor runs from Mining Area C through the Juna Downs pastoral lease to the Yandi mine site | 23rd -30th April 1999<br>16 vegetation sites | 25 vegetation associations | 195 taxa, 40 families, 98 genera, 2 weed species; **Bidens bipinnata*, **Malvastrum americanum* | No Threatened or Priority Flora<br>*Goodenia stellata*[14] |
| BHPBIO (2000) Yandi Priority Flora Species Survey | Within the Yandi study area and surrounds | July 2000<br>Targeted survey for flora of conservation significance | Not Recorded | Not Recorded | No Threatened or Priority Flora<br>*Goodenia nuda* (P4) could not be relocated |

[14] No longer listed as a Priority flora taxon

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Biota (2001) Mining Area C Rail Rare Flora Survey | 40km rail corridor between MAC and Yandi | 12th-18thNovember 2001 Targeted survey for flora of conservation significance | Not Recorded | Not Recorded | No Threatened or Priority Flora *Triodia biflora*[15], *Triumfetta leptacantha*[15], *Themeda* sp. Mt Barricade[15], *Dicrastylis* sp.[15] |
| Biota (2003) Mining Area C Rail Corridor – Seasonal Rare Flora Survey Phase II | 40km rail corridor between MAC and Yandi | 21st - 31st March 2002 Targeted survey for flora of conservation significance | Not Recorded | Not Recorded | No Threatened or Priority Flora *Triodia biflora*[15], *Eriachne tenuiculmis*[15], *Triumfetta leptacantha*[15], *Themeda* sp. Mt Barricade[15], *Goodenia stellata*[15] |
| Ecologia Environment (2003a) Yandi IOWA Conveyor: Rare and Priority Flora Survey | Within the Yandi study area and surrounds | 27th March and 19th - 21st May 2003 Targeted survey for flora of conservation significance | Not Recorded | 174 taxa[16] | No Threatened or Priority Flora *Olearia fluvialis*[15], *Themeda* sp. Mt Barricade[15] |
| Ecologia Environment (2003b) Yandi IOWA Conveyor - Amendment to Rare and Priority Flora Survey | Within the Yandi study area and surrounds | 8th August 2003 Targeted survey for *Olearia fluvialis* | Not Recorded | Not Recorded | No Threatened or Priority Flora *Olearia fluvialis*[15] |
| Maunsell (2003) Yandi Life of Mine Flora and Fauna | Within and surrounding the Yandi the study area | 23rd – 28th September 2003 Targeted survey for flora of conservation significance | Not Recorded | 5 weed species; **Acetosa vesicaria, *Argemone ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Sisymbrium orientale* | No Threatened or Priority Flora *Olearia fluvialis*[15], *Goodenia stellata*[15] |

[15] No longer listed as a Priority flora taxon

[16] As the survey was targeting DRF and Priority flora some common species may not have been recorded

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Ecologia Environment (2004) Yandi Stockyard and Overland Conveyor Fauna and Flora Assessment | Within and surrounding the Yandi the study area | 18th -19th October 2004 | 2 vegetation associations | Not Recorded | No Threatened Flora<br>*Isotropis parvifolia* (P2)[17] |
| Maunsell (2004) Yandi Flora and Vegetation Survey Lease M47 292 and E4 Drill Lines | To the north of the Yandi study area | 15th-16th December 2003<br>Targeted searches for flora of conservation significance | 7 vegetation associations | Not Recorded | No Threatened or Priority Flora<br>*Olearia fluvialis*[18] |
| Ecologia Environment (2006) Yandi Rail Corridor DRF and Priority Flora Assessment | To the north of the study area | 19th -20th May 2006<br>Targeted searches for flora of conservation significance | 6 vegetation associations | 131 taxa, 37 families, 84 genera, 7 weeds; **Bidens bipinnata, *Cenchrus ciliaris, *Sonchus oleraceus, *Malvastrum americanum, *Acetosa vesicaria, *Solanum nigrum* and **Citrullus lanatus* | No Threatened or Priority Flora |
| Ecologia Environment (2007b) Yandi Mine Extension RGP5 EIA Flora Survey Interim Report Post Phase 1 Survey | Within the Yandi study area and surrounds | 13th - 20th November 2007 | Not recorded | 212 taxa, 38 families, 93 genera, 4 weed species; **Argemone ochroleuca* subsp. *ochroleuca, *Sonchus oleraceus, *Malvastrum americanum* and **Cenchrus ciliaris* | No Threatened or Priority Flora<br>One species of interest: *Sida* sp. |

[17] Originally recorded as *Isotropis winneckei*

[18] No longer listed as a Priority flora taxon

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| Ecologia Environment (2008) Two Phase Assessment of the Flora and Vegetation of the Proposed Marillana Creek (Yandi) Mine Extension Areas RGP5-KBR | Within the Yandi study area and surrounds | 13th - 19th November 2007 and 10th - 17th March 2008 119 quadrats | 10 vegetation associations | 333 taxa, 52 families, 138 genera, 9 weed species: *A*rgemone ochroleuca, *Malvastrum americanum*, *Cenchrus ciliaris*, *Sonchus oleraceus*, *Aerva javanica*, *Bidens bipinnata*, *Cucumis melo* subsp. *agrestis, *Cynodon dactylon*, *Vachellia farnesiana* | No Threatened or Priority Flora *Tephrosia* sp. Cathedral Gorge (F.H. Mollemans 2420)[19] |
| ENV Australia (2009a) Western 2 & Western 1 Waste Dump Flora and Assessment | Within the Yandi study area and surrounds | 22nd-23rd September 2007 16 quadrats | 7 vegetation associations | 163 taxa, 36 families, 76 genera, 3 weed species; *Argemone ochroleuca*, *Bidens bipinnata* and *Chloris virgata* | No Threatened Flora *Rostellularia adscendens* var. *latifolia* (P3) |
| ENV Australia (2009b) Central 3 Flora and Vegetation Assessment | ~3km to the north of the Yandi study area | 19th - 24th September 2007 9 quadrats | Six vegetation/landform types | 128 taxa, 38 families, 74 genera, 4 weed species; *Acetosa vesicaria, *Solanum nigrum*, *Sonchus asper*[20], *Vachellia farnesiana* | No Threatened or Priority Flora |
| ENV Australia (2009c) Western 6, 7, and 8 Flora and Vegetation Assessment | Within the Yandi study area and surrounds | 22nd - 23rd September 2007 17 quadrats | Eight vegetation associations | 133 taxa, 35 families, 76 genera, 6 weed species: *Bidens bipinnata*, *Cenchrus ciliaris*, *Malvastrum americanum*, *Setaria verticillata*, *Sonchus oleraceus, *Vachellia farnesiana* | No Threatened or Priority Flora One species of interest; *Hibiscus* aff. *gardneri* |
| GHD (2010) Report for Yandi W1 and W4 OSA Targeted Rare and Priority Flora Survey | Within the Yandi study area and surrounds | 16th -19th February 2010 Targeted survey for flora of conservation significance | Five vegetation associations | No species inventory, 2 weed species; *Malvastrum americanum, *Vachellia farnesiana* | No Threatened or Priority Flora |

[19] No longer listed as a Priority flora taxon
[20] No previous collections from the Pilbara and determined to be a misidentification

| Report | Proximity to Study Area | Survey Timing & Intensity | Vegetation Associations & Landform | Taxon Summary | Significant Flora |
|---|---|---|---|---|---|
| BHPBIO (2010a) Declared Rare Flora (DRF) and Priority flora search at Yandi - Proposed haul road crossing at Marillana Creek | Within the Yandi study area and surrounds | 28th September 2010 | Not recorded | 41 taxa, 20 families, 2 weed species: **Malvastrum americanum, *Argemone ochroleuca* | No Threatened or Priority Flora |
| Onshore Environmental (2011) Yandi Flora and Vegetation Review | Within the Yandi study area and surrounds | 9th - 16th December 2010 Targeted survey and desktop review | 24 vegetation associations | 452 taxa, 56 families, 178 genera, 20 weed species; **Acetosa vesicaria, *Aerva javanica, *Argemone ochroleuca* subsp. *ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *Centaurea melitensis, *Chloris virgarta, *Citrullus lanatus, *Conyza bonariensis, *Cucumis melo* subsp. *agrestis, *Cynodon dactylon, *Latuca serriola* forma *serriola, *Malvastrum americanum, *Polypogon monspeliensis, *Rostaria cistata, Setaria verticillata, *Sisymbrium orientale, *Solanum nigrum, *Sonchus oleraceus, *Vachellia farnesiana* | *Lepidium catapycnon* (P4)[21], *Acacia subtiliformis* (P3), *Rostellularia adscendens* var. *latifolia* (P3) and *Goodenia nuda* (P4). |
| Onshore Environmental (2015c) Marillana Creek Riparian Flora and Vegetation Survey | ~13 km southwest | 8th - 19th June 2015. | 22 vegetation associations | 399 taxa, 186 genera, 58 families, 22 weed species | No Threatened Flora *Amaranthus centralis* (P3), *Aristida lazaridis* (P2), *Goodenia nuda* (P4), *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3), *Ipomoea racemigera* (P2), *Rostellularia adscendens* var. *latifolia* (P3) |

[21] Listed as DRF at the time of survey

# APPENDIX 2

## Conservation categories for flora described under the EPBC Act.

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

# APPENDIX 3

Conservation Codes for Western Australian Flora.

**T: Threatened (Declared Rare) Flora - Extant Taxa**

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

**1: Priority One - Poorly Known Taxa**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

**2: Priority Two - Poorly Known Taxa**

Species that are known from one or a few collections (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

**3: Priority Three - Poorly Known Taxa**

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

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

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

# APPENDIX 4

## Records for conservation significant species recorded from the study area

| Genus | Species | Infra Rank | Infra Name | Easting m | Northing m | MGA Zone |
|---|---|---|---|---|---|---|
| *Eremophila* | *magnifica* | subsp. | *magnifica* | 729900 | 7492030 | 50 |
| *Synostemon* | *hamersleyensis* | | | 731702 | 7493232 | 50 |
| *Synostemon* | *hamersleyensis* | | | 731702 | 7493232 | 50 |
| *Synostemon* | *hamersleyensis* | | | 731702 | 7493232 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726926 | 7493360 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726902 | 7493337 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726887 | 7493331 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726923 | 7493343 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726971 | 7493452 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726987 | 7493485 | 50 |
| *Synostemon* | *hamersleyensis* | | | 727168 | 7493131 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735465 | 7488166 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735466 | 7488160 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735457 | 7488157 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735476 | 7488155 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735483 | 7488155 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735493 | 7488138 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735488 | 7488129 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735486 | 7488125 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735485 | 7488136 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735485 | 7488142 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735493 | 7488135 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735502 | 7488127 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735508 | 7488121 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735547 | 7488163 | 50 |
| *Synostemon* | *hamersleyensis* | | | 728953 | 7490555 | 50 |
| *Synostemon* | *hamersleyensis* | | | 728968 | 7490530 | 50 |
| *Synostemon* | *hamersleyensis* | | | 728963 | 7490529 | 50 |
| *Synostemon* | *hamersleyensis* | | | 728983 | 7490539 | 50 |
| *Synostemon* | *hamersleyensis* | | | 729303 | 7490411 | 50 |
| *Synostemon* | *hamersleyensis* | | | 726916 | 7493337 | 50 |
| *Synostemon* | *hamersleyensis* | | | 731717 | 7493254 | 50 |
| *Synostemon* | *hamersleyensis* | | | 735427 | 7488195 | 50 |

# APPENDIX 5

## Records for introduced weed species recorded from the study area

| Genus | Species | Easting m | Northing m | MGA Zone |
|---|---|---|---|---|
| *Aerva* | *javanica* | 724072 | 7500791 | 50 |
| *Aerva* | *javanica* | 728329.8866 | 7495313.347 | 50 |
| *Aerva* | *javanica* | 728515.9997 | 7494567.001 | 50 |
| *Aerva* | *javanica* | 737883.9997 | 7490825.999 | 50 |
| *Argemone* | *ochroleuca* | 738195.9914 | 7490513.543 | 50 |
| *Argemone* | *ochroleuca* | 738346.3331 | 7490265.619 | 50 |
| *Argemone* | *ochroleuca* | 739022.9998 | 7488299 | 50 |
| *Bidens* | *bipinnata* | 726915.9998 | 7493337.001 | 50 |
| *Bidens* | *bipinnata* | 727054.3345 | 7493551.746 | 50 |
| *Bidens* | *bipinnata* | 727115 | 7493571 | 50 |
| *Bidens* | *bipinnata* | 727167 | 7493290 | 50 |
| *Cenchrus* | *ciliaris* | 724273 | 7501345 | 50 |
| *Cenchrus* | *ciliaris* | 724404.0008 | 7500888.001 | 50 |
| *Cenchrus* | *ciliaris* | 724469.0001 | 7500620 | 50 |
| *Cenchrus* | *ciliaris* | 724521 | 7501809 | 50 |
| *Cenchrus* | *ciliaris* | 724543.5041 | 7501041.993 | 50 |
| *Cenchrus* | *ciliaris* | 724558 | 7501498 | 50 |
| *Cenchrus* | *ciliaris* | 724575 | 7501033 | 50 |
| *Cenchrus* | *ciliaris* | 725317.9993 | 7500096.001 | 50 |
| *Cenchrus* | *ciliaris* | 725468.9991 | 7495238 | 50 |
| *Cenchrus* | *ciliaris* | 726121.9996 | 7499780.001 | 50 |
| *Cenchrus* | *ciliaris* | 726533.0001 | 7497345 | 50 |
| *Cenchrus* | *ciliaris* | 726999.9991 | 7498336 | 50 |
| *Cenchrus* | *ciliaris* | 727815.9995 | 7499390.999 | 50 |
| *Cenchrus* | *ciliaris* | 728026.9993 | 7496468.001 | 50 |
| *Cenchrus* | *ciliaris* | 728183.0003 | 7497310.001 | 50 |
| *Cenchrus* | *ciliaris* | 728515.9997 | 7494567.001 | 50 |
| *Cenchrus* | *ciliaris* | 728974.793 | 7496032.999 | 50 |
| *Cenchrus* | *ciliaris* | 730189.0006 | 7495124 | 50 |
| *Cenchrus* | *ciliaris* | 730574 | 7490333 | 50 |
| *Cenchrus* | *ciliaris* | 731255.9997 | 7496625 | 50 |
| *Cenchrus* | *ciliaris* | 733079.0007 | 7494818.999 | 50 |
| *Cenchrus* | *ciliaris* | 733115.999 | 7492633.001 | 50 |
| *Cenchrus* | *ciliaris* | 733255.56 | 7492786.952 | 50 |
| *Cenchrus* | *ciliaris* | 733300.0005 | 7491506.999 | 50 |
| *Cenchrus* | *ciliaris* | 734484.999 | 7492939.001 | 50 |
| *Cenchrus* | *ciliaris* | 734857.9991 | 7486776.001 | 50 |
| *Cenchrus* | *ciliaris* | 735337.0005 | 7487388.999 | 50 |
| *Cenchrus* | *ciliaris* | 735426.9997 | 7488195.001 | 50 |
| *Cenchrus* | *ciliaris* | 735603.0005 | 7492113.001 | 50 |
| *Cenchrus* | *ciliaris* | 735647.0513 | 7493001.444 | 50 |
| *Cenchrus* | *ciliaris* | 735686.9997 | 7492939 | 50 |
| *Cenchrus* | *ciliaris* | 735750 | 7490954.001 | 50 |
| *Cenchrus* | *ciliaris* | 736222.0004 | 7488215.001 | 50 |
| *Cenchrus* | *ciliaris* | 736242.9996 | 7490560 | 50 |
| *Cenchrus* | *ciliaris* | 736276.0009 | 7492359.001 | 50 |
| *Cenchrus* | *ciliaris* | 736326.999 | 7487302 | 50 |
| *Cenchrus* | *ciliaris* | 737152.999 | 7486061 | 50 |
| *Cenchrus* | *ciliaris* | 737487.0008 | 7487958.001 | 50 |
| *Cenchrus* | *ciliaris* | 737676.9992 | 7491712 | 50 |
| *Cenchrus* | *ciliaris* | 737704.9999 | 7489525 | 50 |

| Genus | Species | Easting m | Northing m | MGA Zone |
|---|---|---|---|---|
| *Cenchrus* | *ciliaris* | 737883.9997 | 7490825.999 | 50 |
| *Cenchrus* | *ciliaris* | 738815.0002 | 7490413 | 50 |
| *Cenchrus* | *ciliaris* | 738910.222 | 7490166.325 | 50 |
| *Cenchrus* | *ciliaris* | 739022.9998 | 7488299 | 50 |
| *Cenchrus* | *ciliaris* | 739380 | 7489421 | 50 |
| *Cenchrus* | *ciliaris* | 739846.0001 | 7490112.001 | 50 |
| *Cenchrus* | *setiger* | 724469.0001 | 7500620 | 50 |
| *Cenchrus* | *setiger* | 735686.9997 | 7492939 | 50 |
| *Cenchrus* | *setiger* | 737676.9992 | 7491712 | 50 |
| *Cenchrus* | *setiger* | 737883.9997 | 7490825.999 | 50 |
| *Cenchrus* | *setiger* | 738815.0002 | 7490413 | 50 |
| *Cenchrus* | *setiger* | 739380 | 7489421 | 50 |
| *Cenchrus* | *setiger* | 739846.0001 | 7490112.001 | 50 |
| *Setaria* | *verticillata* | 729920 | 7490171 | 50 |
| *Sisymbrium* | *orientale* | 739022.9998 | 7488299 | 50 |