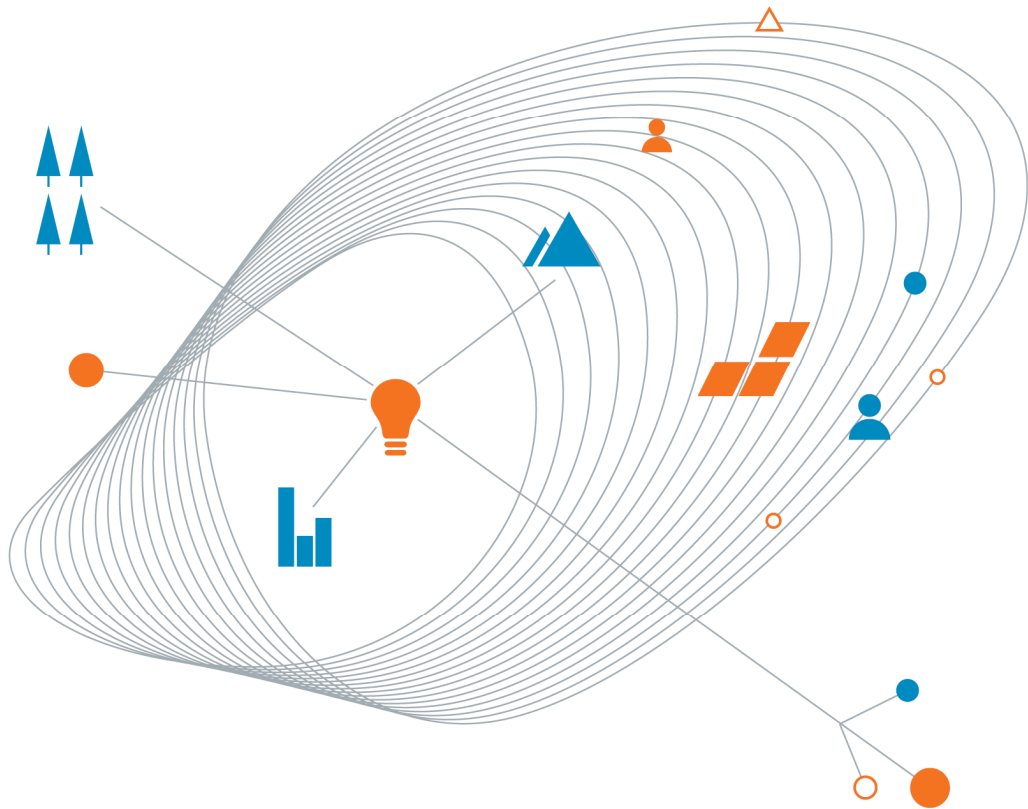


**Fortescue Metals Group Ltd**

**North Star Alternate Access Road**

Flora and Vegetation Assessment

August 2014



Innovation is  
finding answers  
to questions  
no one has  
asked

# North Star Alternate Access Road

Prepared for  
Fortescue Metals Group Ltd

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# Executive summary

IB Operations Pty Ltd ('IBO') is developing the North Star Hematite Project, and is completing the approval phase for the North Star Magnetite Project. IBO is a Joint Venture company owned by FMG Iron Bridge (Aust) Pty Ltd and Formosa Steel IB Pty Ltd.

IBO is proposing the development of an alternate access road to the North Star Hematite and Magnetite Project areas. To assist in defining the most appropriate route for the alternate access road within the project area, Fortescue commissioned Coffey to complete a flora and fauna assessment of the project area.

## Methods

A single phase Level 2 flora and vegetation survey and a targeted conservation significant flora survey was undertaken across the 4,419 ha project area. The survey method and approach is consistent with the EPA's Guidance Statement No. 51 (EPA, 2004a) and Fortescue's Flora and Vegetation Assessment Guidelines (Fortescue, 2014). The survey was undertaken between 3 and 11 June 2014.

A total of 30, 2,500 m<sup>2</sup> flora quadrats were sampled across the project area. In addition, large portions of the project area were traversed on foot to further delineate the vegetation associations, identify additional flora taxa and to search for conservation significant flora and ecological communities.

## Flora

A total of 166 flora taxa, including two introduced taxa, were recorded from the project area. Of the 164 native taxa recorded from the project area, two are considered to be flora of conservation significance, *Heliotropium muticum* (P1) and *Goodenia nuda* (P4).

The two Priority flora taxa recorded from the project area are not considered to be regionally significant. Two individuals, one from each location, of *Heliotropium muticum* (P1) were recorded from within the project area, while one individual, from one location, of *Goodenia nuda* (P4) was recorded from within the project area. Populations of *Heliotropium muticum* and *Goodenia nuda* are known to occur in the immediate vicinity to the project area and regionally (within 100 km of the project area).

The two introduced taxa, *\*Cenchrus ciliaris* and *\*Aerva javanica*, are not considered to be Declared Pests under the *Biosecurity and Agricultural Management Act 2007*. The two introduced taxa are considered to be weeds with a High environmental rating (CALM, 1999) and generally occurred in association with the Gillam Creek and areas of high cattle grazing.

## Vegetation

A total of ten vegetation associations delineated from four broad floristic formations were recorded for the project area. The ten vegetation associations are not considered to be regionally significant. The vegetation associations are not considered to represent a TEC or a PEC and are located throughout the North Star mine area (Ecologia, 2012a).

The vegetation was considered to be in very good condition, with isolated occurrences of good, poor and very poor vegetation. The vegetation in poor and very poor condition was generally associated with previously disturbed areas and vegetation adjacent to major infrastructure (i.e. the BHP Billiton Iron Ore rail corridor).

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# 1 Introduction

IB Operations Pty Ltd ('IBO') is developing the North Star Hematite Project, and is completing the approval phase for the North Star Magnetite Project. IBO is a Joint Venture company owned by FMG Iron Bridge (Aust) Pty Ltd and Formosa Steel IB Pty Ltd.

IBO is proposing the development of an alternate access road to the North Star Hematite and Magnetite Project areas (Figure 1). To date, access has been via pastoral tracks and various exploration tracks.

To assist in defining the most appropriate route for the alternate access road within the project area, Fortescue commissioned Coffey to complete a flora and fauna assessment of the project area. This report details the results of the flora and vegetation component of the assessment, while a separate report has been prepared by Coffey for the fauna component of the assessment (Coffey, 2014).

## 1.1 Location

The North Star Hematite and Magnetite Project areas are located approximately 110 kilometres (km) south of Port Hedland in the Pilbara region of Western Australia (refer to Figure 1). The alternate access road is located on the western boundary of the hematite and magnetite project areas and travels in a north-west direction towards Fortescue's railway to the Herb Elliot facility in Port Hedland.

The alternate access road is approximately 35 km in length and approximately 1 km wide across most of the corridor; excluding the western end, which expanded to a maximum width of approximately 3.3 km (refer to Figure 2).

The North Star alternate access road corridor project area is approximately 4,419 hectares (ha) in size and is located on Wallareenya Station and Unallocated Crown Land (UCL).

## 1.2 Report terms

For the purposes of this document the following terms have been used:

- Project – refers to the proposed North Star Alternate Access Road project.
- Project area – refers to the 4,419 ha survey area that was sampled during the site visit (refer to Figure 2).

## 1.3 Objective

The objective of the Level 2 flora and vegetation assessment was to:

- Identify, describe and map the vegetation associations present within the project area.
- Describe and map the condition of the vegetation associations present within the project area.
- Identify and map conservation significant flora and vegetation within the project area.
- Identify and map the presence of introduced flora within the project area.
- Determine the regional and local significance of the flora and vegetation within the project area.
- Determine the impact of the Project on the flora and vegetation within the project area from a regional and local context.

## 1.4 Scope of work

In accordance with Fortescue's requirements, a single phase, Level 2 flora and vegetation assessment was undertaken across the project area. The assessment involved:

- A desktop literature review of:
  - The Commonwealth Department of the Environment (DotE) protected matters search tool for Matters of National Environmental Significance (MNES).
  - The Department of Parks and Wildlife (DPaW) threatened and Priority flora database.
  - DPaW's threatened and priority ecological communities' database.
  - DPaW's combined biological database NatureMap.
  - Fortescue's significant flora records database.
  - Environmentally Sensitive Area's (ESA's) listed under the *Environment Protection Act 1986* (EP Act).
  - Previous flora and vegetation surveys undertaken in close proximity to the project area, including the flora and vegetation survey undertaken for the North Star mine area.
  - Groundwater dependent and sheet flow dependent ecosystems based on the Groundwater Dependent Ecosystem Atlas (BOM, 2014c) and existing flora and vegetation surveys undertaken in close proximity to the project area.
- A site reconnaissance trip to further delineate the vegetation types identified from the desktop literature review and to further refine the sampling plan.
- A Level 2 field survey that included:
  - Sampling of flora sampling quadrats.
  - A targeted conservation significant flora survey.
  - The identification and mapping of introduced species.
  - The delineation and description of the broad floristic formations and the vegetation associations identified within the project area.
  - Delineation and description of the condition of the vegetation using the condition rating scale developed by Trudgen (1991).
- Multivariate statistical analysis of the floristic data collected from the flora sampling quadrats, and regional quadrats, where applicable.
- The preparation of a detailed technical report in accordance with Fortescue's guidelines.

## 2 Environmental Legislation and Policy

The assessment and clearing of native vegetation within the project area was undertaken in accordance with the requirements of the following key environmental legislation and regulations:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cwlth).
- *Environmental Protection Act 1986* (EP Act) (WA).
- *Wildlife Conservation Act 1950* (WC Act) (WA).
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (WA).
- *Biosecurity and Agriculture Management Act 2007* (BAM Act) (WA).

### 2.1 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key Commonwealth environmental legislation that protects and manages matters of national and international environmental significance. The administering agency for this act is the Department of the Environment (DOTE).

The eight matters of national environmental significance addressed under the Act are:

- World heritage sites.
- National heritage places.
- Wetlands of international importance (i.e. Ramsar listed wetlands).
- Nationally threatened species and ecological communities.
- Migratory species (protected under international agreements).
- Commonwealth marine areas.
- The Great Barrier Reef marine park.
- Nuclear actions.

### 2.2 State legislation

#### 2.2.1 *Environment Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislation that governs environmental impact assessment (EIA) and protection in Western Australia. The aim of the Act is:

*“to provide for an Environmental Protection Authority, for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with foregoing”.*

In Section 4A of this Act there are five principles, which are necessary for the objectives of the Act to be realised. Three of these principles are applicable to native flora and vegetation:

- The precautionary principle.
- The principle of intergenerational equity.
- The principle of the conservation of biological diversity and ecological integrity.

Authorities under this Act include the Department of Environment Regulation (DER), Department of Parks and Wildlife (DPAW) (formerly the Department of Environment and Conservation (DEC)) and the Environmental Protection Authority (EPA).

Part IV of the EP Act relates to the assessment of environmental impacts, and Part V of the EP Act deals with licensing and control of pollution from prescribed premises and permits for land clearing.

### **2.2.2 Wildlife Conservation Act 1950**

The Western Australia *Wildlife Conservation Act 1950* (WC Act) is:

*“An Act to provide for Conservation and Protection of Wildlife”.*

Under the Act, all native flora is protected throughout the whole state at all times. In addition the Minister for the Environment can publish a notice in the Government Gazette, declaring a list of flora species that are rare, likely to become extinct or otherwise in need of special protection.

Flora that is declared as threatened is protected, and may not be impacted on, unless authorised and carried out in accordance with the terms and conditions of the licences issued under Section 23C. The WC Act also protects fauna species that are rare, likely to become extinct or otherwise in need of special protection.

### **2.2.3 Environmental Protection (Clearing of Native Vegetation) Regulations 2004**

In 2004, amendments to the EP Act introduced provisions for regulating the clearing of native vegetation. If native vegetation is intended to be cleared, a permit from the DER or the Department of Mining and Petroleum (DMP) (for mining related activities under a Memorandum of Understanding between the EPA and the DMP) is required, unless an exemption applies. It is an offence to clear native vegetation without the authority of a permit or an exemption.

There are two types of exemptions: Schedule 6 of the EP Act; and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. The exemptions under Regulations do not apply in Environmentally Sensitive Areas (ESAs) declared under Section 51B of the EP Act.

### **2.2.4 Biosecurity and Agriculture Management Act 2007**

The Western Australian Biosecurity and Agriculture Management Act 2007 (BAM Act) is:

*“An Act to provide for; the control of certain organisms; the use of agricultural and veterinary chemicals; the identification and attainment of standards of quality and safety for agricultural products, animal feeds, fertilisers and other substances and things; the establishment of a Declared Pest Account, a Modified Penalties Revenue Account and accounts for industry funding schemes; and related matters”.*

The Act is managed by the Department of Agriculture and Food Western Australia (DAFWA).

In regards to the proposed alternate access road project area, the Act specifically relates to the prohibition and regulation of the introduction and spread of plants (introduced species) declared under the Act for the protection of agricultural management.

## 2.3 Environmental guidance and policy

The EPA has produced a number of policy statements, guidelines and technical guides, which provide guidelines and advice regarding the EPA's position. Position statements, guidelines and technical guides relevant to flora and vegetation include:

- Guidance for the Assessment of Environmental Factors No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a).
- Guidance for the Assessment of Environmental Factors No. 6 Rehabilitation of Terrestrial Ecosystems (EPA, 2006).
- Position Statement No. 2 Environmental Protection of Native Vegetation in Western Australia (EPA, 2000).
- Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002).
- Position Statement No. 7 Principles of Environmental Protection (EPA, 2004b).

In addition to the position statements and guidelines developed by the EPA, Fortescue provide a set of guidelines to assist in the preparation of flora and vegetation assessments on Fortescue projects. The list of documents considered relevant for the Project, include:

- Flora and Vegetation Assessment Guidelines (100-GU-EN-0005).
- Proposal and Project Management Guidelines (100-GU-EN-0010).
- Geographic Information Systems and Raw Data Guidelines (100-GU-EN-0009).

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### 3 Background information

#### 3.1 Current and historical land-use

A portion of the project area is currently utilised by Wallareenya Station for cattle grazing. In addition, mining companies, including Fortescue and Atlas Iron Limited, utilise pastoral tracks and informal tracks to access exploration projects, mine sites and associated infrastructure. Historically, prior to iron-ore exploration and operation, the project area was used for cattle grazing.

#### 3.2 Climate

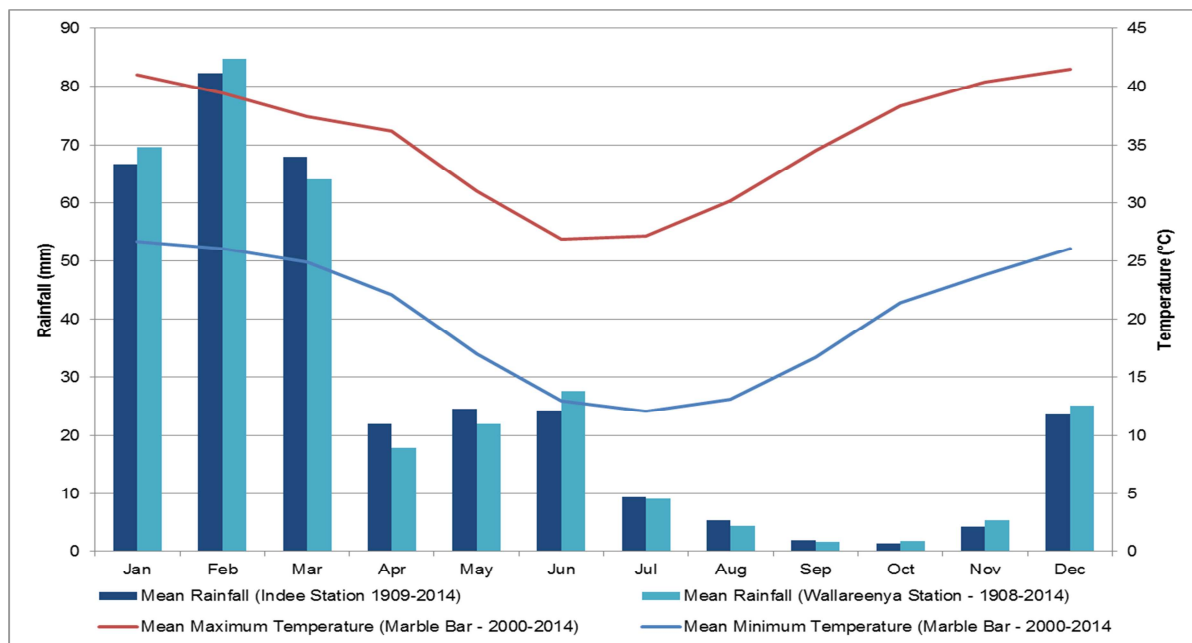
The project area is located in the Pilbara region of Western Australia. The Pilbara experiences an arid-tropical climate with two distinct seasons; a hot summer from October to April and a mild winter from May to September. Temperatures are generally high, with summer temperatures frequently exceeding 40°C. Light frosts occasionally occur in and during July and August.

The Pilbara is subject to tropical cyclones during the wet season (November to April), with the coastal area between Port Hedland and Exmouth Gulf the most cyclone prone area in Australia.

The nearest Bureau of Meteorology (BOM) station to the project area that collects weather observations is Marble Bar (Site No. 004106). While the nearest BOM weather station to the project that collects rainfall information is Indee and Wallareenya stations (Site No. 004016 and Site No. 004038 respectively).

Temperatures are generally high, with average maximum monthly temperatures at Marble Bar ranging between 24.7°C in July to 40.1°C in December. Average minimum monthly temperatures at Marble Bar range from 11.7°C in July to 26.1°C in January (adapted from Fortescue, 2014) (Chart 1).

The annual rainfall recorded from Indee and Wallareenya stations is 331 mm and 320 mm, respectively (BOM, 2014). The majority of the rainfall is received between the months of December and March (Chart 1).



**Chart 1 Weather observations for the project area**

Note: Temperatures from Marble Bar (Site No. 004106) and rainfall from Indee Station (Site No. 004016) and Wallareenya Station (Site No. 004038)

The monthly rainfall at Indee (station number 004016) and Wallareenya (station number 004038) Stations suggest the project area has received either average or above average rainfall from December 2013 (start of the cyclone or wet season) to the end of May 2014. Indee Station received approximately 300 mm of rain, which is considered to be average rainfall for the period of December to May. Wallareenya Station received approximately 410 mm of rain, which is significantly higher (approximately 130 mm) than the average between December and May (BOM, 2014).

### 3.3 Geological and physiographic context

#### 3.3.1 Soils and geology

Soils in the project area and surrounds are predominantly red and shallow with stony mantles (Van Vreeswyk *et al.*, 2004). Topsoils range in depth from 0 to 15 cm, dependant on topography (valley flats and plains having the deepest topsoils). Soils are likely to be moderately to highly permeable due to the relatively high amount of rock in the profile (GHD, 2011). Lower flood plains have cracking and non-cracking clays. Duplex (texture-contrast) soils occur in localised areas.

The project area is situated within the North Pilbara terrane of the Pilbara Craton which is Archaean in age (2.5-3.5 billion years), and contains volcanic and volcanoclastic rocks of the Pilbara Super Group (greenstone belts) intruded by Archaean age felsic granitoids, to form dome and keel type structures. The area has generally been regionally metamorphosed to greenschist faces, and folded into sub vertical tight to isoclinal folds that have wrapped around granitoid contacts during regional transpressional deformation and now are parallel to the granite contacts (adapted from Fortescue, 2013).

#### 3.3.2 Land systems

Van Vreeswyk *et al.* (2004) undertook a regional inventory of the Pilbara rangelands to delineate land systems across the Pilbara region into a system of mapping units. These land units occur in association with characteristic physiographic types. The project area traverses four separate land units, which are detailed below in Table 1, and is dominated by the stony plains of the Macroy land system.

**Table 1 Land systems present within the project area**

Land unit	Description	Area within the Pilbara (ha)	Area within the project area (ha)	Area within the project area (%)
Macroy	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands.	1,309,500	3447	78
Platform	Dissected slopes and raised plains supporting hard spinifex grasslands.	157,000	177	4
Rocklea	Basalt hills, plateau, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands.	2,299,300	618	14
Talga	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	212,400	177	4

### 3.3.3 Surface and groundwater hydrology

Drainage lines in the region are ephemeral and generally only flow for short durations following rainfall events (WorleyParsons, 2012). Intermittent flows normally occur during the wet season with long periods of no flow during the dry season (WorleyParsons, 2012).

The project area lies within the catchment boundary of the Turner River (Fortescue, 2013). The Turner River has a catchment of 4,802 km<sup>2</sup> and is a major river of the Port Hedland Coast Catchment (WorleyParsons, 2012).

Groundwater in the Pilbara region occurs in various hydrogeological environments, the most important being; alluvial aquifers (unconsolidated sediments), consolidated sediments (sedimentary rock) and fractured aquifers (Department of Water, 2010). Although generally continuous throughout the region, the water table is sometimes absent in high areas where the weathered and fractured zone is unsaturated or where the fractures are poorly developed (Fortescue, 2013).

## 3.4 Biological context

### 3.4.1 Bioregional data

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 89 bioregions based on major biological and geographical or geological attributes (Thackway & Cresswell, 1995). The study area is situated within the Pilbara bioregion. The Pilbara bioregion is considered to be a region of significant biodiversity due to the geological, altitudinal and climatic diversity.

The Pilbara bioregion has been divided into four subregions: Chichester (PIL01), Fortescue Plains (PIL02), Hamersley (PIL03) and Roebourne (PIL04). The project area lies within the Chichester subregion, which is 9,044,560 ha in area (Kendrick & McKenzie, 2001).

The Chichester (PIL01) subregion comprises the northern section of the Pilbara Craton, which is characterised by undulating Archaean granite and basalt plains including significant areas of basaltic ranges. The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on the ranges (Kendrick and McKenzie, 2001).

The climate is described as semi-desert-tropical and receives on average 300 mm of rainfall annually, with the majority falling in the summer and early months as a result of cyclonic events. Drainage occurs to the north via numerous rivers, including the De Grey, Oakover, Nullagine, Shaw, Yule and Sherlock rivers (Kendrick and McKenzie, 2001).

### 3.4.2 Vegetation system associations

A systematic survey of native vegetation in Western Australia in the 1970s described vegetation systems throughout Western Australia at either a 1:250,000 or 1:1,000,000 scale. The Pilbara region was mapped by Beard in 1975 at a 1:1,000,000 scale. The vegetation systems have since been reinterpreted and updated by Shepherd *et al.* (2002) to reflect the National Vegetation Information System (NVIS) standards originally developed by the National Land and Water Resources Audit (NLWRA, 2000) and updated by the Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003).

Shepherd *et al.* (2002) identified Vegetation System Associations, which are finer scale vegetation mapping. Some of Beard's vegetation associations have been separated to remove mosaic vegetation associations; however, some mosaics still occur.

The vegetation system associations, based on Beard's (1975) and Shepherd *et al.* (2002), which occur within the project area, are:

- George Ranges 82.1: Hummock grasslands, low tree steppe; snappy gum (*Eucalyptus leucophloia*) over *Triodia wiseana*.
- Abydos Plain-Chichester 93.4: Hummock grasslands, shrub steppe; kanji (*Acacia inaequilatera*) over soft spinifex.

The extent of the vegetation system associations prior to European settlement and the current extent of the system association within the State, the Pilbara bioregion, the Chichester subregion and the Shire of East Pilbara for project area are presented in Table 2.

Table 2 details the current extent protected within reserves that meet the International Union for Conservation of Nature (IUCN) Class I to Class IV reserves (i.e. National Parks, Nature Reserves that are managed by the DPAW). The extent protected within each context (State, bioregion, subregion and local government area) is provided; however, the extent protected within the bioregion and subregion are reporting units for assessing the status of ecosystems and their level of protection in the National Reserve System (NRMCC, 2009).

**Table 2 Vegetation system associations located within the project area**

Vegetation system association	Scale	Pre-European extent (ha)	Current extent (ha)	Current extent remaining (%)	Current extent within IUCN Class I-IV Reserves (ha)	Current extent remaining within IUCN Class I-IV Reserves (%)
Abydos Plain-Chichester 93.4	State	2,481,889	2,478,504	99.86	13,424	0.54
	Bioregion	2,480,782	2,477,408	99.86	13,424	0.54
	Subregion	2,476,378	2,473,007	99.86	13,424	0.54
	LGA	1,274,648	1,272,152	99.80	0	0.00
George Ranges 82.1	State	317,182	316,855	99.90	0	0.00
	Bioregion	317,182	316,855	99.90	0	0.00
	Subregion	317,182	316,855	99.90	0	0.00
	LGA	308,601	308,274	99.89	0	0.00

Note: The extent in hectares has been rounded to the nearest whole number.

Source: Government of Western Australia (2013).

### 3.4.3 Environmentally Sensitive Areas

An Environmentally Sensitive Area (ESA) is an area declared in Regulation 6 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Areas within the Pilbara bioregion that are declared to be ESAs for the purposes of Part V Division 2 of the EP Act include:

- A declared World Heritage property as defined in section 13 of the *Environment Protection and Biodiversity Conservation Act 1999* of the Commonwealth.
- An area that is registered on the Register of the National Estate, because of its natural values, under the *Australian Heritage Commission Act 1975* of the Commonwealth.
- A defined wetland and the area within 50 m of the wetland.

- The area covered by vegetation within 50 m of rare flora, to the extent to which the vegetation is continuous with the vegetation in which the rare flora is located.
- The area covered by a Threatened Ecological Community.

These areas are protected under the EP Act and are selected for their environmental values at a State or National level. There are no known ESAs located within or in close proximity to the project area.

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## 4 Methods

### 4.1 Desktop assessment

A request for searches of the DPAW threatened flora and ecological communities databases for a polygon (north-west corner 21°17'S, 118°41'14"E; south-east corner 21°12'9"S, 119°0'13"E) with a 25 km buffer was submitted to DPAW on 12 March 2014 (Appendix A).

The results of the database searches were supplemented with additional information obtained from previous flora and vegetation assessments undertaken in the proximity of the project area, a search of the publicly available NatureMap database and a search of the DOTE online database.

The DPAW database search included a search of the following databases:

- The Department's Threatened (Declared Rare) and Priority Flora Database.
- The Western Australian Herbarium Specimen Database for threatened and priority species opportunistically collected in the search area.
- The Department's Threatened and Priority Flora List which contains species that are declared rare (Conservation Code T or X for those presumed extinct), poorly known (Conservation Codes 1, 2 or 3), require monitoring (Conservation Code 4), or are not threatened but subject to a specific conservation program (Conservation Code 5). See Appendix B for a definition of each conservation category.
- The Department's Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs) Database.

An ecological community is described as a naturally occurring biological assemblage that occurs in a particular type of habitat. A Threatened Ecological Community (TEC) is categorised as; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable". Possible TECs that do not meet the survey criteria are added to DEC's Priority Ecological Community (PEC) lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation dependant ecological communities are placed in Priority 5.

The additional databases and reports reviewed prior to and concluding the field survey to supplement the information received from the DPAW included:

- The DOTE publicly available online EPBC Act database search tool (a 20 km around a point source, -21.12556S, 118.85778E was used to define the search area).
- The DPAW's publicly available database NatureMap.
- The Bureau of Meteorology's (BOM's) Groundwater Dependent Ecosystem Atlas.
- North Star Project Level 2 Flora and Vegetation Assessment. Ecologia 2012a. Unpublished report for Fortescue Metals Group.
- *Pityrodia* sp. Marble Bar Targeted Flora Survey. Ecologia 2012c. Unpublished report for Fortescue Metals Group.
- Canning Basin Borefield and Pipeline Single Phase Flora and Vegetation Assessment. Ecologia 2012b. Unpublished report for Fortescue Metals Group.
- North Star Access Corridor. Flora, Vegetation, Vertebrate Fauna and Fauna Habitat Assessment. Ecologia 2012d. Unpublished report for Fortescue Metals Group.

- Flora and Vegetation of the Proposed FMG Stage A Rail Corridor. Biota Environmental Sciences 2004. Unpublished report for Fortescue Metals Group.
- Abydos Direct Shipping Ore Project: Flora Assessment, Floristic Community Type Mapping and Impact Assessment. Woodman Environmental Consulting (Woodman) 2009. Unpublished report prepared for Atlas Iron Ltd.
- Abydos Direct Shipping Ore Project Stage 2: Flora and Vegetation Impact Assessment. Woodman, 2013a. Unpublished report prepared for Atlas Iron Ltd.
- Mt Dove Direct Shipping Ore Project: Flora and Vegetation Studies. Woodman 2011. Unpublished report prepared for Atlas Iron Ltd.
- Wodgina DSO Project: Flora and Vegetation Assessment. Outback Ecology Services (Outback) 2009. Unpublished report prepared for Atlas Iron Ltd.
- Flora and Vegetation Studies for the Hercules Project. Woodman 2012a. Unpublished report prepared for Atlas Iron Ltd.
- Hercules DSO Project: Flora and Vegetation Impact Assessment. Woodman, 2013b. Unpublished report prepared for Atlas Iron Ltd.
- Mt Webber DSO Project: Flora and Vegetation Impact Assessment. Woodman 2012b. Unpublished report prepared for Atlas Iron Ltd.

The results of the desktop assessment, including the database searches is presented in Section 5.1.

## 4.2 Field survey

A single phase Level 2 flora and vegetation survey and a targeted conservation significant flora search, consistent with the EPA's Guidance for the Assessment of Environmental Factors No. 51; Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a), was conducted for the proposed access road between the 3 and 11 June 2014.

The Level 2 flora and vegetation survey was undertaken by a qualified and experienced botanist from Coffey, Mr Clinton van den Bergh. Clinton has over 8 years' experience undertaking flora and vegetation surveys across Western Australia, including several Level 2 surveys in the Pilbara region.

The survey botanist currently holds a Licence to take flora for scientific or other prescribed purposes (licence number SL010743) and a Permit to take Declared Rare Flora (permit number 73–1314) from DPAW. All flora specimens collected during the survey were collected under these licences and permits, in accordance with the conditions required under each licence/ permit.

The monthly rainfall values recorded at Indee and Wallareenya Stations in the three months (March, April and May) preceding the survey was significantly lower than the average (BOM, 2014). Indee Station received approximately 22% (or 26 mm) of the average rainfall (115 mm) during March, April and May, while Wallareenya Station recorded approximately 65% (or 68 mm) of the expected average rainfall (104 mm) for the same period (BOM, 2014).

The weather at the time of the survey was considered to be dry, with temperatures in the high 20's to low 30's with high winds<sup>1</sup> (BOM, 2014).

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<sup>1</sup> The information on daily weather (temperature, rainfall and wind) during the field survey was obtained from the Marble Bar weather station (number 004106) (BOM, 2014b).

## 4.3 Methods

A field survey was undertaken to confirm the results of the desktop assessment and to further delineate the broad floristic formations, the vegetation associations and conditions identified from the project area, as well as providing a list of taxa present at the time of the survey. The field survey methodology is considered to be a single phase Level 2 flora and vegetation survey consistent with the EPA's Guidance for the Assessment of Environmental Factors No. 51 (EPA, 2004a). The field survey methodology is also consistent with the EPA's Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002), the EPA's Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia and Fortescue's Flora and Vegetation Assessment Guidelines (see Section 2.3).

In addition to the delineation of the vegetation associations and conditions, the field survey determined whether any significant flora species, including the species identified on the DPaW Threatened and Priority Flora list for the area and Fortescue's internal conservation significant flora database, actually occur or are likely to occur within the project area. This was determined by completed site traverses over the proposed disturbance footprint provided by Fortescue.

The field survey methodology consisted of quadrat (quadrats equalling 2,500 m<sup>2</sup> in area) sampling and site traverses to record the broad floristic formations, the vegetation associations and conditions. Thirty quadrats were established and sampled within the project area. While traversing the site, the flora species present at the time of the survey were collected, including introduced flora. The broad floristic formations and vegetation associations were described based on the floristic data recorded from the quadrats and from visual observations while traversing the project area, utilising the standardised terminology for vegetation structural classes detailed in the Australian Vegetation Attribute Manual (ESCAVI, 2003) and within Fortescue's Flora and Vegetation Assessment Guideline (Fortescue, 2014). The vegetation structural terminology of the National Vegetation Information System (NVIS) was adapted from Specht (1970), Specht *et al.* (1974), and Walker and Hopkins (1990) (ESCAVI, 2003).

The vegetation recorded from the project area has been described to a NVIS hierarchical level III (Broad Floristic Formation) and V (Vegetation Association). Hierarchical level III requires the dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum. Hierarchical level V requires the dominant growth form, cover, height and dominant species (three for each stratum) for each of the three traditional strata (i.e. upper, mid and ground). The hierarchical structure and the vegetation structural terminology are described in Table 3 and Table 4, while the NVIS height class definition is provided in Table 5.

**Table 3 NVIS hierarchical structure**

Hierarchical level	Description	NVIS structural/floristic components required
I	Class	Dominant growth form for the ecologically or structurally dominant stratum
II	Structural Formation	Dominant growth form, cover and height for the ecologically or structurally dominant stratum
III	Broad Floristic Formation	Dominant growth form, cover, height and dominant land cover genus for the upper most or the ecologically or structurally dominant stratum
IV	Sub-formation	Dominant growth form, cover, height and dominant genus for each of the three traditional strata (i.e. Upper, Mid and Ground)
V	Association	Dominant growth form, height, cover and species (3 species) for each of the three traditional strata (i.e. Upper, Mid, Ground)

**Table 3 NVIS hierarchical structure (cont'd)**

Hierarchical level	Description	NVIS structural/floristic components required
VI	Sub-association	Dominant growth form, height, cover and species (5 species) for all layers/sub-strata

Source: Table 1 from ESCAVI (2003).

**Table 4 NVIS structural terminology**

Stratum	Growth form	Height ranges (m) <sup>1</sup>	Structural formation classes (% cover)					
			80-100	50-80	20-50	0.25-20	0-0.25	Unknown
<b>U</b>	Tree, palm	<10 = low 10-30 = mid >30 = tall	Closed forest	Open forest	Woodland	Sparse woodland	Isolated trees	Isolated clumps of trees
	Tree mallee	<3 = low <10 = mid 10-30 = tall	Closed mallee forest	Open mallee forest	Mallee woodland	Sparse mallee woodland	Isolated mallee trees	Isolated clumps of tree mallees
<b>M</b>	Shrub, cycad, tree-fern	<1 = low 1-2 = mid >2 = tall	Closed shrubland	Shrubland	Open shrubland	Sparse shrubland	Isolated shrubs	Isolated clumps of shrubs
	Mallee shrub	<3 = low <10 = mid 10-30 = tall	Closed mallee shrubland	Mallee shrubland	Open mallee shrubland	Sparse mallee shrubland	Isolated mallee shrubs	Isolated clumps of mallee shrubs
	Heath shrub	<1 = low 1-2 = mid >2 = tall	Closed heath shrubland	Heath shrubland	Open heath shrubland	Sparse heath shrubland	Isolated heath shrubs	Isolated clumps of heath shrubs
	Chenopod shrub	<1 = low 1-2 = mid >2 = tall	Closed chenopod shrubland	Chenopod shrubland	Open chenopod shrubland	Sparse chenopod shrubland	Isolated chenopod shrubs	Isolated clumps of chenopod shrubs
	Samphire shrub	<0.5 = low >0.5 = mid	Closed samphire shrubland	Samphire shrubland	Open samphire shrubland	Sparse samphire shrubland	Isolated samphire shrubs	Isolated clumps of samphire shrubs
<b>G</b>	Hummock grass	<2 = low >2 = mid	Closed hummock grassland	Hummock grassland	Open hummock grassland	Sparse hummock grassland	Isolated hummock grasses	Isolated clumps of hummock grasses
	Tussock grass	<0.5 = low >0.5 = mid	Closed tussock grassland	Tussock grassland	Open tussock grassland	Sparse tussock grassland	Isolated tussock grasses	Isolated clumps of tussock grasses
	Other grass	<0.5 = low >0.5 = mid	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clumps of grasses
	Sedge	<0.5 = low >0.5 = mid	Closed sedgeland	Sedgeland	Open sedgeland	Sparse sedgeland	Isolated sedges	Isolated clumps of sedges

**Table 4 NVIS structural terminology (cont'd)**

Stratum	Growth form	Height ranges (m) <sup>1</sup>	Structural formation classes (% cover)					
			80-100	50-80	20-50	0.25-20	0-0.25	Unknown
G	Rush	<0.5 = low >0.5 = mid	Closed rushland	Rushland	Open rushland	Sparse rushland	Isolated rushes	Isolated clumps of rushes
	Vine	<10 = low 10-30 = mid >30 = tall	Closed vineland	Vineland	Open vineland	Sparse vineland	Isolated vines	Isolated clumps of vines
	Herbs	<0.5 = low >0.5 = mid	Closed herbland	Herbland	Open herbland	Sparse herbland	Isolated herbs	Isolated clumps of herbs

Source: Table 5 from Fortescue (2014)

Note: growth forms that do not occur dominantly in the Pilbara have been removed, while forbs have been referred to as herbs (Fortescue, 2014).

1: refer to Table 4 for height range information

**Table 5 NVIS height class definition**

Height class	Height range (m)	Growth form			
		Tree, vine, palm	Shrub, heath shrub, chenopod, samphire shrub, tree-fern	Tree mallee, mallee shrub	Hummock grass, tussock grass, other grass, sedge, rush, herb
8	>30	Tall			
7	10-30	Mid		Tall	
6	<10	Low		Mid	
5	<3			Low	
4	>2		Tall		Tall
3	1-2		Mid		Tall
2	0.5-1		Low		Mid
1	<0.5		Low		Low

Source: Table 4 from Fortescue (2014)

The condition of the vegetation recorded from within the project area was described using the condition rating scale developed by Trudgen (1991). The vegetation condition rating scale is described in Table 6.

**Table 6 Vegetation condition rating scale**

Condition code	Definition
Excellent (E)	Pristine or nearly so, no obvious signs of damage caused by the activities of European man.
Very Good (VG)	Some relatively slight signs of damage caused by the activities of European man, e.g. some signs of damage to tree trunks caused by repeated fires and the presence of some relatively non-aggressive weeds such as <i>Ursinia anthemoides</i> or <i>Briza</i> species, or occasional vehicle tracks.
Good (G)	More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as caused by low levels of grazing or by selective logging. Weeds as above, possible some more aggressive ones.

**Table 6** Vegetation condition rating scale (cont'd)

Condition code	Definition
Poor (P)	Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man such as grazing or partial clearing (chaining) or very frequent fires. Weeds as above, probably some more aggressive ones such as <i>Cenchrus ciliaris</i> .
Very Poor (VP)	Severely impacted by grazing, fire, 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 aggressive species.
Completely degraded (CD)	Areas that are completely or almost completely without native species in the structure of their vegetation, e.g. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

Source: Table 6 from Fortescue (2014)

The specimens collected during the field survey were assigned a unique number to facilitate tracking and pressed during that day, following recommendations provided by the Western Australia Herbarium (WAH). The specimens were then sufficiently dried prior to submitting to WAH for the mandatory four-day quarantine process prior to the specimens being identified.

The specimens were identified by qualified and experienced botanists/taxonomists with extensive experience in the Pilbara. The specimens were identified by Dr Julia Mattner, who has experience with the flora of the Pilbara region of Western Australia. Assistance was sought from WAH experts and Mr Malcolm Trudgen for difficult family, genera and species groups.

Conservation significant species, geographic range extensions and unique/unusual specimens were retained for future vouchering at the WAH. This is a condition of the flora collecting licences.

A total of 30 non-permanent 2,500 m<sup>2</sup> (i.e. 50 m x 50 m or 100 m x 25 m) quadrats were established and sampled during the site visit.

The following information was recorded from each quadrat:

- Location: GDA94 coordinates (equivalent of WGS84) were taken from the north-west corner of the quadrats using a handheld Garmin Global Positioning System (GPS) to an accuracy of  $\pm 5$  m.
- Vegetation description: The vegetation types were described and mapped using the NVIS vegetation structural classes (ESCAVI, 2003) (Table 4 and 5).
- Disturbance details: Vegetation condition was assessed using the condition rating scale developed by Trudgen (1991) (Table 6).
- Flora species: An inventory of the flora species located within the quadrat was taken.
- Foliage cover and height: The percentage cover and height was visually estimated for the flora species located within each quadrat. Estimates were made to the nearest percentage and tenth of a metre (i.e. 0.1 m) where possible.
- Habitat: Habitat was described based on aspect and slope within and around the surrounding area of the quadrat. Information was also collected if the quadrat was located within a riparian ecosystem or other prominent geological feature.
- Soil: Colour and soil texture within each quadrat was recorded. The percentage amount of litter covering the quadrat was also recorded.
- Rock type and cover: Estimates were made on the rock type, size and cover within each quadrat.

## 4.4 Statistical analysis

### 4.4.1 Multivariate analysis

Multivariate analysis of the floristic data collected from the quadrats during the June 2014 site visit was completed. The analysis was conducted on the species matrix with outputs consisting of a dendrogram and an MDS plot using the Bray Curtis similarity from the multivariate analysis program Primer 6™.

### 4.4.2 Species accumulation curves

Species accumulation curves provide a measure of species inventory efficacy and completeness, and can be used to compare surveys based upon standardized sampling protocols (Moreno and Halffter, 2000). Soberón and Llorente (1993) suggested that species accumulation curves lend rigour to species inventories, particularly in poorly collected areas. Species accumulation curves, or collectors' curves, plots the cumulative number of species discovered in a defined sampling area against increasing levels of survey effort (Thompson *et al.*, 2007).

Species accumulation curves were plotted with the ordinate axis as estimated species richness and the sampling effort on the abscissa. For the purposes of this assessment, data from the quadrats and were used, which equated to 30 sites. Opportunistically collected species were omitted from the analysis.

## 4.5 Survey limitations

The field survey of the project area was undertaken in early June 2014. The timing of the field survey is not considered to be the optimal time for surveying the flora and vegetation of the Pilbara region. According to Fortescue's guidelines for flora and vegetation assessments (Fortescue, 2014) and the EPA's Guidance Statement No. 51 (EPA, 2004a), the most appropriate time for completing single phase Level 2 surveys in the Pilbara is 6-8 weeks following sufficient rains.

The rainfall recorded at Indee and Wallareenya Stations (see Section 4.2) during the three months (March, April and May) prior to the survey was well below average. The low rainfall may not have been sufficient to ensure annuals and ephemerals persisted, or to ensure the onset of flowering and fruiting of perennials and annuals. As a result, it has been assumed that only 80–85% of the expected flora occurring within the project area has actually been recorded. This is consistent with the species accumulation curve output in Section 5.6.1. This is not considered to be a major limitation to the survey due to the homogenous nature of the flora and vegetation and the lack of geological landforms (i.e. steep gorges), which can support unique ecological communities and flora.

A portion (approximately 10–20%) of the project area had been burnt within 12 to 24 months prior to the field survey. The burnt vegetation was located on the sandplains in the central portion of the project area. The vegetation association description and mapping reliability has not been limited as a result of the fire because of the homogenous nature of the vegetation in the region and the ability to identify the dominant flora species from adjacent vegetation, regrowth and new germinants.

Access was limited across portions of the project area due to a lack of tracks and the distance required walking (5 km) to the project area from tracks. As a result, certain portions were not traversed on foot. This is not considered to be a major limiting factor due to the homogenous nature of the project area and the known limited knowledge of conservation significant flora occurring in the region.

Fungi and non-vascular flora (e.g. bryophytes, mosses etc.) were not specifically collected or recorded during the field survey. The collection of fungi and non-vascular flora was outside the scope of the study.

A statement of the botanical survey limitations for the project is provided in Table 7.

**Table 7 Botanical survey limitations**

Limitation	Constraint (Yes/No); Significance (Low, Moderate or High)	Comments
Competency/experience of the scientist conducting the survey	No	Experienced botanist undertook the field survey and the reporting, and an experienced botanist/ taxonomist completed the plant specimen identifications.
Level of survey	No	A single phase Level 2 flora and vegetation survey was considered appropriate to identify the flora and vegetation attributes and values. Nine days were spent on site sampling the flora and vegetation.
Sources of information	No	The Pilbara region has been extensively surveyed with several flora and vegetation surveys undertaken in within or adjacent to the project area.
Scope	No	The entire scope was met.
Proportion of: a) Flora collected and identified; and b) Task achieved and further work that may be required	a) Yes; low b) No	a) It is considered approximately 80–85% of the taxa occurring within the project area has been recorded, based on the weather conditions, sampling adequacy and the species accumulation curve output. The below average rainfall between February and May 2014 may not have ensured the germination or persistence of some annual, ephemeral or geophytic taxa (see above).  b) No further work is considered necessary to meet the current objectives and scope.
Completeness	No	The project area was adequately sampled and traversed.
Mapping reliability	No	The mapping reliability is considered to be high due to adjacent surveys, the homogenous nature of the project area and the quadrat sampling undertaken across the project area.
Timing/weather/season/cycle	Yes; low	The survey was undertaken in early June 2014 after below average rainfall from February 2014 (see Section 4.2). This may have caused some species to not germinate, persist or may have restricted the flowering and fruiting of taxa which is important to identify the taxa present.

**Table 7 Botanical survey limitations (cont'd)**

Limitation	Constraint (Yes/No); Significance (Low, Moderate or High)	Comments
Disturbances which affected the results of the survey	No	A portion of the project area in the central portion had been previously burnt approximately 12 to 24 months prior. This is not considered to be a limitation due to the extensive surveys undertaken in the immediate region and the homogenous nature of the vegetation within the project area.
Intensity of the survey	No	The intensity of the survey is sufficient to identify the vegetation associations within the project area and any potential conservation significant flora and vegetation.
Completeness	No	The project area was adequately traversed on foot or via vehicle.
Resources	No	Adequate resources were assigned to the field survey, plant specimen identifications and the reporting associated with the project.
Remoteness and/ or access problems	Yes; low	The project area was traversed on foot and by vehicle. Some portions of the project area were not traversed due to access constraints (>5 km from access tracks). This is not considered to be a major constraint to the survey due to the homogenous nature of the vegetation and the lack of conservation significant flora recorded during the survey. The majority of the areas not traversed were rolling spinifex hills or flat spinifex sandplains. In addition, the western extent of the project area that was not traversed has been extensively surveyed (Biota 2004a and Woodman 2009, 2012b and 2013).
Availability of contextual information	No	The Pilbara has been extensively surveyed, with all contextual information accessed prior, during and after the field survey (refer to Chapter 3 and Section 4.1).

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## 5 Results

### 5.1 Desktop assessment

The desktop review and database searches identified a total of 21 conservation significant flora occurring or potentially occurring within the proximity of the project area (Table 8). This included seven Priority 1 taxa, three Priority 2 taxa, eight Priority 3 taxa and three Priority 4 taxa. The desktop review did not identify any threatened or priority listed taxa occurring within the project area (Figure 3). The nearest known conservation significant flora taxa, *Euphorbia clementii* (P2) and *Goodenia nuda* (P4), to the survey area are located approximately 1.5 to 2 km to the north and south of the project area.

The desktop review did not identify any known TECs or PECs as occurring within close proximity to the project area. Two TECs are known to occur within the Pilbara bioregion:

- Themeda Grasslands: *Themeda* grasslands on cracking clays (Hamersley Station, Pilbara). Grassland plains dominated by the perennial *Themeda* (kangaroo grass) and many annual herbs and grasses.
- Ethel Gorge: Ethel Gorge aquifer stygobiont community.

Neither of these TECS is considered to occur within the project area based on the project location, the geological landforms present and the results of the field survey.

No Weeds of National Significance (WONS) are considered to occur within or in close proximity to the project area, according to the EPBC Act online database search. Buffel Grass (\**Cenchrus ciliaris*) is considered to be a weed of State significance and is known to occur within the project area and the immediate surrounds.

**Table 8 Conservation significant flora known to occur or potentially occur within the project area**

Species <sup>1</sup>	Conservation code <sup>2</sup>			Habit <sup>3</sup>	Habitat <sup>3</sup>	Flowering period <sup>3</sup>	Likelihood of occurrence
	EPBC Act	WC Act	DPAW				
<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)			1	Undescribed	Undescribed	Unknown	Potential Known to occur in the Turner River and the North Star mine area.
<i>Acacia leeuweniana</i>			1	Narrow, obconic tree, to 14 m high, bark minni ritchi; inflorescence in spikes	Gritty, skeletal red-grey sandy loam, light orange-brown gravelly sand, granite. In rock fissures in outcrops, among boulders.	Unknown	Unlikely Suitable habitat not present.
<i>Acacia</i> sp. Marble Bar (J.G. & M.H. Simmons 3499)			1	Shrub, inflorescence in spikes, to 30 mm long	Undescribed	Sep	Unlikely Only known to occur south of Marble Bar (>80 km east)
<i>Corchorus</i> sp. Yarrie (J. Bull & D. Roberts CAL 01.05) PN			1	Undescribed	Undescribed	Unknown	Unlikely Only known to occur at Shay Gap (>135 km north-east)
<i>Heliotropium muticum</i>			1	Ascending to spreading perennial, herb, to 0.3 m high	Varied habitats	Unknown	Likely Known to occur within the North Star mine area and Fortescue rail corridor.
<i>Pityrodia</i> sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)			1	Undescribed	Undescribed	Unknown	Potential Known to occur in the North Star mine area. Suitable habitat may be present.
<i>Rothia indica</i> subsp. <i>australis</i>			1	Prostrate annual, herb, to 0.3 m high, densely covered in spreading hairs	Sandy soils. Sandhills and sandy flats	Apr to Aug	Potential Habitat present, however nearest known location is greater than 60 km (south-east) away.

**Table 8 Conservation significant flora known to occur or potentially occur within the project area (cont'd)**

Species <sup>1</sup>	Conservation code <sup>2</sup>			Habit <sup>3</sup>	Habitat <sup>3</sup>	Flowering period <sup>3</sup>	Likelihood of occurrence
	EPBC Act	WC Act	DPAW				
<i>Indigofera ixocarpa</i>			2	Shrub, to 1 m high	Skeletal red soils over massive ironstone	May	Unlikely Suitable habitat not present.
<i>Stylidium weeliwolli</i>			2	Annual, herb, 0.1–0.25 m high, throat appendages 4, rod-shaped	Gritty sand soil, sandy clay. Edge of watercourses	Aug to Sep	Potential May potentially occur along the Gillam Creek.
<i>Euphorbia clementii</i>			2	Erect herb, to 0.6 m high	Gravelly hillsides, stony grounds	Unknown	Potential Suitable habitat is present with known locations within the North Star mine area.
<i>Acacia glaucocaesia</i>			3	Dense, glabrous shrub or tree, 1.8–6 m high	Red loam, sandy loam, clay. Floodplains	Jul to Sep	Potential Suitable habitat present with known locations within the North Star mine area.
<i>Acacia levata</i>			3	Spreading, multi-stemmed shrub, 1–3 m high, to 5 m wide	Sand or sandy loam over granite. Hillslopes	May	Unlikely Suitable habitat not present and known locations greater than 50 km (south-east) away.
<i>Eragrostis crateriformis</i>			3	Annual, grass-like or herb, 0.17–0.42 m high	Clayey loam or clay. Creek banks, depressions	Jan to May or Jul	Potential Suitable habitat present with known locations within 50 km of the project area.
<i>Gomphrena leptophylla</i>			3	Prostrate or erect to spreading annual, herb, to 0.15 m high	Sand, sandy to clayey loam, granite, quartzite. Open flats, sandy creek beds, edges salt pans & marshes, stony hillsides	Mar to Sep	Possible Suitable habitat present and known to occur in the Turner River.

**Table 8 Conservation significant flora known to occur or potentially occur within the project area (cont'd)**

Species <sup>1</sup>	Conservation code <sup>2</sup>			Habit <sup>3</sup>	Habitat <sup>3</sup>	Flowering period <sup>3</sup>	Likelihood of occurrence
	EPBC Act	WC Act	DPAW				
<i>Gymnanthera cunninghamii</i>			3	Erect shrub, 1–2 m high	Sandy soils	Jan to Dec	Potential Suitable habitat present and known to occur in the Turner River.
<i>Nicotiana umbratica</i>			3	Erect, short-lived annual or perennial, herb, 0.3–0.7 m high	Shallow soils. Rocky outcrops	Apr to Jun	Unlikely Suitable habitat not present.
<i>Phyllanthus hebecarpus</i>			3	Undescribed	Undescribed	Unknown	Potential Known location within 25 km (south-west) of the project area.
<i>Terminalia supranitifolia</i>			3	Spreading, tangled shrub or tree, 1.5–3 m high	Sand. Among basalt rocks	May or Jul or Dec	Unlikely Suitable habitat not present.
<i>Bulbostylis burbidgeae</i>			4	Tufted, erect to spreading annual, grass-like or herb (sedge), 0.03–0.25 m high, spikelets in a simple umbel or rarely solitary; stamens 3; involucre bracts long, hairy	Granitic soils. Granite outcrops, cliff bases	Mar or Jun to Aug	Unlikely Suitable habitat not present.
<i>Goodenia nuda</i>			4	Erect to ascending herb, to 0.5 m high	Varied habitats	Apr to Aug	Likely Suitable habitat present with known locations within the North Star mine area.
<i>Ptilotus mollis</i>			4	Compact, perennial shrub, to 0.5 m high, soft grey foliage	Stony hills and screes	May or Sep	Unlikely Suitable habitat not present.

1: See Section 4.1 for a comprehensive list of databases and reports reviewed to obtain the list of conservation significant flora

2: See Appendix B for the descriptions of the conservation codes.

3: Descriptions and flowering periods obtained from DPAW (2014). Descriptions by the Western Australian Herbarium, Department of Parks and Wildlife. Text used with permission (<http://florabase.dpaw.wa.gov.au/help/copyright>). Accessed on Friday, 27 June 2014.

## 5.2 Broad floristic formations

A total of four broad floristic formations were identified from the project area during the field survey. The broad floristic formations have been described based on the dominant growth form, cover, height and the ecologically or structurally dominant genus.

The descriptions of the four broad floristic formations are provided below.

- *Acacia* mid to tall open shrubland.

The *Acacia* mid to tall open shrubland broad floristic formation covered the majority of the project area, with the dominant *Acacia* species including *Acacia inaequilatera*, *Acacia acradenia*, *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis*. The broad floristic formation was recorded on stony soils, hills and sandplains.

- *Corymbia* sparse low woodland.

The *Corymbia* sparse low woodland was generally recorded from minor drainage lines and floodplains in the east of the project area, and the sandplains in the west. The dominant *Corymbia* included *Corymbia hamersleyana* in the minor drainage lines and floodplains; and *Corymbia zygophylla* on the sandplains.

- *Eucalyptus* mid open woodland.

The *Eucalyptus* mid open woodland was recorded in association with the major drainage line (Gillam Creek) that traverses the project area in several locations. The *Eucalyptus* mid open woodland is co-dominated by *Eucalyptus camaldulensis* var. *obtusa* and *Eucalyptus victrix*.

- *Triodia* mid hummock grassland.

The *Triodia* mid-hummock grassland was recorded in association with the rocky ridges and outcrops sporadically located throughout the eastern side of the project area. In general, the dominant *Triodia* species was *Triodia wiseana*.

Further information on the distribution of the broad floristic formations is provided in Table 9 in Section 5.3 below.



## 5.3 Vegetation associations

A total of ten vegetation associations were recorded from the project area during the field survey. The vegetation associations have been described based on the dominant growth form, height, cover and species for the three traditional strata (i.e. upper, middle and ground). The ten vegetation associations within the project area were identified based on multivariate analysis, interpretation of aerial imagery and the floristic data collected from the ground-truthing survey.



The ten vegetation associations are described in Table 9 and mapped on Figures 4A-4E, while the floristic data collected from the quadrats is provided in Appendix C. The similarity of the quadrats as determined by multivariate analysis is detailed in Figures 5.

Approximately 0.2% (7 ha) of the project area has been mapped as cleared. The cleared areas are associated with Fortescue's and BHP Billiton's rail corridors. An additional 9.3% (or 410 ha) has been mapped as a mosaic of two vegetation associations.



**Table 9** Vegetation associations recorded from the project area

Unit code	Quadrats	Vegetation description	Area of project area (%)	Photograph
<b>Minor Drain/ Floodplain</b>				
ChAtTe	NAAR05 NAAR23	<p><i>Corymbia</i> sparse low woodland.</p> <p><i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> tall shrubland over <i>Triodia epactia</i> and <i>Triodia wiseana</i> mid-open hummock grassland.</p> <p>Average species richness: 24.5 ± 2.12</p>	0.9 (42 ha)	
ChApTe	NAAR25 NAAR28	<p><i>Corymbia</i> sparse low woodland.</p> <p><i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia pyrifolia</i>, <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> and <i>Petalostylis labicheoides</i> tall sparse shrubland over <i>Triodia epactia</i> mid open hummock grassland.</p> <p>Average species richness: 26.0 ± 1.41</p>	3.8 (168 ha)	



**Table 9 Vegetation associations recorded from the project area (cont'd)**

Unit code	Quadrats	Vegetation description	Area of project area (%)	Photograph
<b>Major Drainage</b>				
EcAaBe	NAAR03 NAAR06	<p><i>Eucalyptus</i> mid open woodland.</p> <p><i>Eucalyptus camaldulensis</i> var. <i>obtusata</i> and <i>Eucalyptus victrix</i> mid woodland over <i>Acacia ampliceps</i>, <i>Acacia trachycarpa</i> and <i>Melaleuca linophylla</i> over <i>Bothriochloa ewartiana</i>, <i>Cenchrus ciliaris</i> and <i>Chrysopogon fallax</i> tall sparse tussock grassland.</p> <p>Average species richness: 31.0 ± 9.90</p>	4.3 (192 ha)	
<b>Ridges</b>				
EIAiTw	NAAR16 NAAR20	<p><i>Triodia</i> mid open hummock grassland.</p> <p><i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> isolated low trees over <i>Acacia inaequilatera</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> tall sparse shrubland over <i>Triodia wiseana</i> mid open hummock grassland.</p> <p>Average species richness: 20 ± 4.24</p>	0.5 (22 ha)	



**Table 9** Vegetation associations recorded from the project area (cont'd)

Unit code	Quadrats	Vegetation description	Area of project area (%)	Photograph
<b>Stony/sandy plain</b>				
AaTe	NAAR08 NAAR09 NAAR10 NAAR11 NAAR12 NAAR18	<p><i>Acacia</i> mid to tall open shrubland.</p> <p><i>Acacia acradenia</i>, <i>Acacia ancistrocarpa</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> tall open shrubland over <i>Triodia epactia</i>, <i>Triodia</i> aff. <i>lanigera</i> and <i>Triodia wiseana</i> mid open hummock grassland.</p> <p>Average species richness: 12.8 ± 3.54</p>	34.2 (1510 ha)	
<b>Stony plain</b>				
AiTS	NAAR04 NAAR19	<p><i>Acacia</i> mid to tall open shrubland.</p> <p><i>Acacia inaequilatera</i>, <i>Grevillea wickhamii</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> tall sparse shrubland over <i>Triodia</i> aff. sp. Shovelanna Hill (S. Van Leeuwen 3835) and <i>Triodia wiseana</i> mid hummock grassland.</p> <p>Average species richness: 18.0 ± 2.83</p>	2.5 (110 ha)	

**Table 9** Vegetation associations recorded from the project area (cont'd)

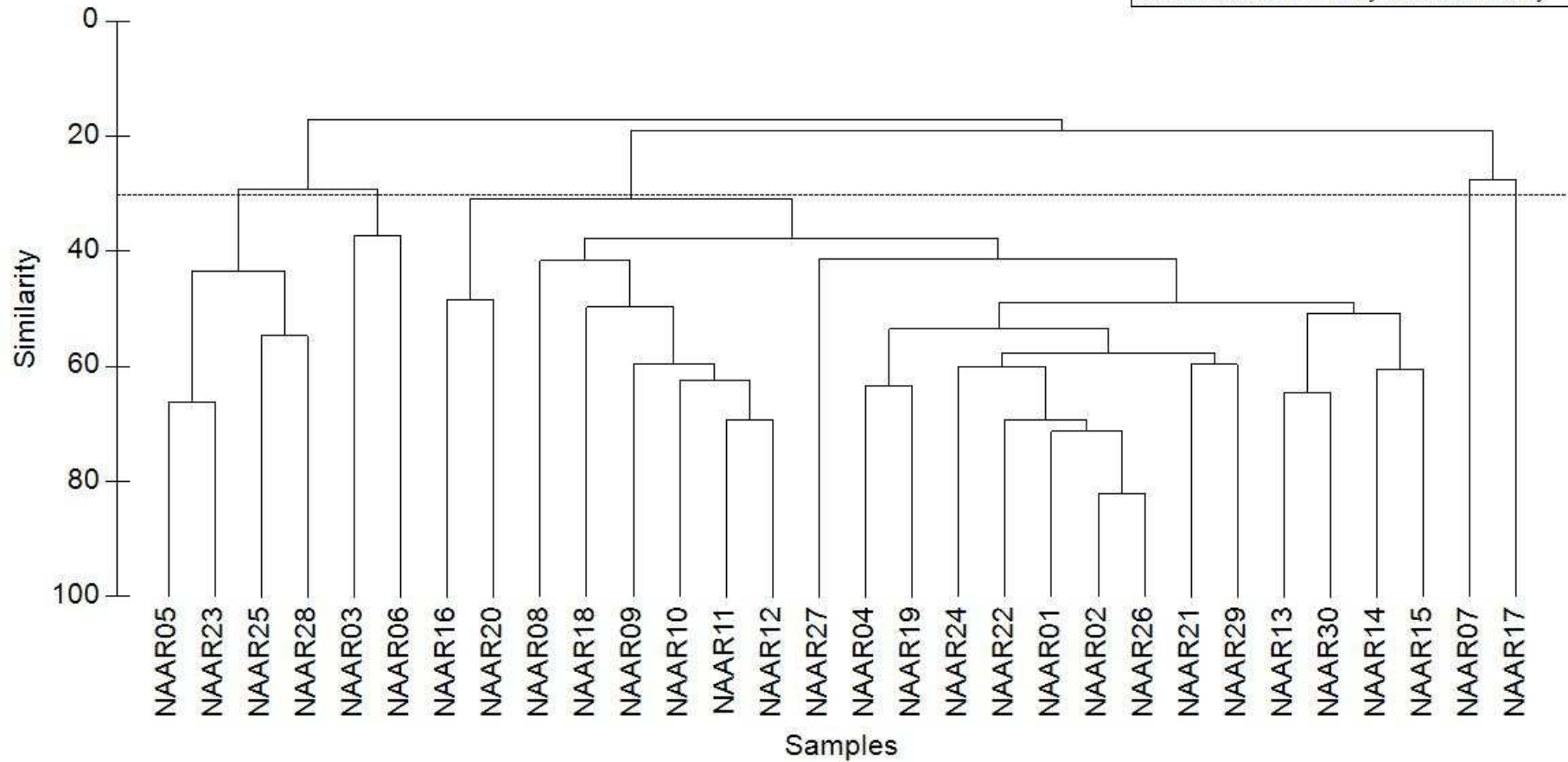
Unit code	Quadrats	Vegetation description	Area of project area (%)	Photograph
<b>Stony plain (cont'd)</b>				
AaTw <sup>1</sup>	NAAR13 NAAR14 NAAR15 NAAR30	<p><i>Acacia</i> mid to tall open shrubland.</p> <p><i>Acacia ancistrocarpa</i>, <i>Acacia inaequilatera</i> and <i>Acacia ptychophylla</i> tall to mid open shrubland over <i>Triodia wiseana</i> mid open hummock grassland.</p> <p>Average species richness: 22.5 ± 6.86</p>	10.1 (445 ha)	
AaTw <sup>2</sup>	NAAR01 NAAR02 NAAR21 NAAR22 NAAR24 NAAR26 NAAR27 NAAR29	<p><i>Acacia</i> mid to tall open shrubland.</p> <p>± <i>Corymbia hamersleyana</i>, ± <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low isolated trees over <i>Acacia acradenia</i> and <i>Acacia inaequilatera</i> tall sparse shrubland over <i>Triodia wiseana</i> mid hummock grassland.</p> <p>Average species richness: 14.3 ± 3.65</p>	5.6 (248 ha)	

**Table 9 Vegetation associations recorded from the project area (cont'd)**

Unit code	Quadrats	Vegetation description	Area of project area (%)	Photograph
<b>Sandplain</b>				
CzAaTI	NAAR07	<p><i>Corymbia</i> sparse low woodland.</p> <p><i>Corymbia zygophylla</i> sparse low woodland over <i>Acacia ancistrocarpa</i> mid sparse shrubland over <i>Triodia</i> aff. <i>lanigera</i> mid hummock grassland.</p> <p>Average species richness: 12.0 ± 0 (only one quadrat sampled)</p>	<p>23.5 (1,039 ha)</p>	
PfTe	NAAR17	<p><i>Triodia</i> mid open hummock grassland.</p> <p><i>Pluchea ferdinandi-muelleri</i> low sparse shrubland over <i>Triodia epactia</i> and <i>Triodia secunda</i> mid open hummock grassland.</p> <p>Average species richness: 20 ± 0 (only one quadrat sampled)</p>	<p>5.1 (227 ha)</p>	

## Dendrogram North Star Group average

Transform: Square root  
Resemblance: S17 Bray Curtis similarity



**Figure 5** Quadrate similarity based on multivariate analysis

## 5.4 Vegetation condition

The condition of the vegetation recorded within the project area was categorised based on the vegetation condition rating scale developed by Trudgen (1991) and detailed in Fortescue's flora and vegetation assessment guidelines (Fortescue, 2014).

The majority of the vegetation within the project area was considered to be in very good condition, with isolated occurrences of good, poor and very poor vegetation (Figure 6). The vegetation considered to represent poor and very poor were associated with anthropogenic disturbances and areas with a higher density of introduced taxa and cattle grazing.

The vegetation considered to be in very good condition coincided with the rocky hills where human disturbances were not as prevalent and evidence of cattle grazing was not evident.

A portion of the project area, approximately 10–20%, has been burnt within the last 12 to 24 months, which has altered the vegetation structure. Large intense fires with little interval for regeneration can have a detrimental impact on the vegetation structure and condition. The vegetation within this burnt section was considered to be in good condition despite the fire.

## 5.5 Vegetation significance

The significance of the vegetation recorded from the project area has been determined at a regional and local level based on:

- The presence of TECs or PECs.
- The level of protection within the bioregion and subregions.
- The pre-European extent remaining of the vegetation system associations.
- The extent of the vegetation associations within the project area
- The potential disruption or fragmentation of any ecological corridors.

### 5.5.1 Threatened and priority ecological communities

A search of the DPAW's threatened and priority ecological communities database was undertaken for the survey area prior to undertaking the site visit. The DPAW's database search did not identify any TECs or PECs known to occur in close proximity to the project area.

The vegetation associations recorded from the project area are not considered to represent a threatened or priority ecological community.

### 5.5.2 Bioregion and subregional protection

The bioregions and subregions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System. In this way, IBRA is used as a dynamic tool for monitoring progress towards building a comprehensive, adequate and representative 'CAR' reserve system (DOTE, 2014).

The Pilbara bioregion is considered to be an under-represented bioregion within the National Reserve System with less than 10% of the total area protected within an IUCN Class I-VI Reserve (i.e. National Park, management area).

The Chichester subregion is considered to be under-represented within the National Reserve System with only 5 to 10% of the total area protected within an IUCN Class I-VI reserve.

### 5.5.3 Vegetation system association extent and protection

The vegetation occurring within the project area is considered to represent two Vegetation System Associations as mapped by Beard (1975) and Shepherd *et al.* (2002), Abydos Plain-Chichester 93.4 and George Ranges 82.1. The National Objectives and targets for Biodiversity Conservation 2001-2005 recognises that a retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (ANZECC, 2000). In addition to the ANZECC 30% retention target, the EPA has adopted a 10% level of pre-clearing extent as representing 'endangered' (EPA, 2000).

The two vegetation system associations in the project area are under-represented within IUCN Class I-IV Reserves (i.e. less than 30% of the current extent) at both the bioregional (Pilbara) and subregional level (Chichester).

The George Ranges 82.1 vegetation system association is not represented in any IUCN Class I-IV Reserves in the Pilbara, while the Abydos Plain-Chichester 93.4 vegetation system association has less than 1% protected within an IUCN Class I-IV Reserve.

The vegetation system associations may not have sufficient reservation; however, over 99% of the pre-European extent still remains in the Pilbara bioregion and the Chichester subregion. The proposed clearing of native vegetation for the project will not reduce the current extent to levels nearing the 30% threshold or the 10% endangered level.

### 5.5.4 Ecological corridors

The project area is located within the Pilbara bioregion, which has not been historically cleared at a large scale for urban development or agricultural purposes; therefore the vegetation has remained relatively intact. Minor clearing has occurred as a result of the development of mining towns, mines and associated transport infrastructure. As a result, ecological corridors within the Pilbara are still intact with only minor disruptions.

The clearing associated with the project through the project area will not significantly impact on the ecological corridors in the region.

## 5.6 Recorded taxa

A total of 166 taxa from 40 families and 85 genera were recorded from the project area. The total included 164 native taxa and two introduced taxa. The full list of taxa recorded from the project area is presented in Appendix D.

Four taxa were only identified to genus level due to a lack of flowering or fruiting material to assist with the identification. Four taxa have been tentatively identified to species level due to a lack of appropriate flowering or fruiting material to assist with the identification. The seven taxa that have not been confidently identified to species level are not considered to be any of the priority listed taxa known to occur within vicinity of the project area.

The families, genera and species with the greatest representation in the project area are provided in Table 10 below.

**Table 10 Dominant families, genera and species within the project area**

Families	Genera	Species
Poaceae – 34	Acacia – 13	<i>Triodia wiseana</i> (22 quadrats – 71%)
Fabaceae – 33	Triodia – 7	<i>Acacia acradenia</i> (21 quadrats – 68%)
Malvaceae – 16	Ptilotus – 6	<i>Indigofera monophylla</i> (20 quadrats – 64%)
Myrtaceae – 8	Eragrostis – 6	<i>Corchorus parviflorus</i> (20 quadrats – 64%)
Amaranthaceae – 8	Senna – 5	<i>Ptilotus obovatus</i> (19 quadrats – 61%)

The species richness recorded from the quadrats ranged from 9 to 38 taxa, with a mean species richness of 18.4 ( $\pm$  6.9). Based on the quadrats sampled, the major, minor drainage lines and the floodplains were the most species rich (23 to 38 taxa within a quadrat), while the sandplains (CzAaTI) and stony rises (AaTw<sup>2</sup>) were the least species rich.

### 5.6.1 Survey adequacy

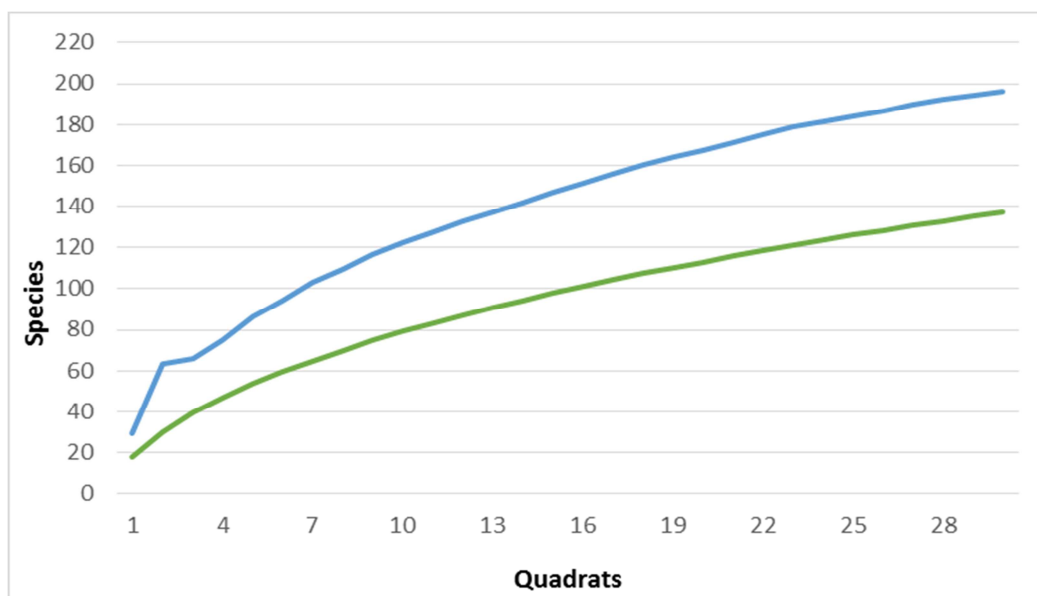
The taxa recorded from the project area were compared to the taxa recorded from several flora and vegetation surveys undertaken in close proximity to the project area (Table 11).

**Table 11 Comparison of taxa collected**

Reference	Size of survey (ha)	Quadrats surveyed	Total taxa recorded	Native taxa	Introduced taxa
Fortescue Stage B Rail Corridor & Mine Areas (Biota, 2004b)	88,505	206	599	586	13
Fortescue North Star mine area (Ecologia, 2012a)	34,857	272	453	444	9
Atlas Abydos DSO (Woodman, 2013a)	19,256	133	263	258	5
<b>This survey</b>	<b>4,419</b>	<b>30</b>	<b>166</b>	<b>164</b>	<b>2</b>
Atlas Wodgina DSO Project (Outback, 2009)	550	41	122	121	1
Atlas Mt Dove DSO (Woodman, 2011)	5,224	49	90	88	2

The results of this survey compared to surveys with similar levels of quadrat sampling and size area (Wodgina DSO and Mt Dove DSO), suggest that the sampling intensity was adequate. The remaining surveys (Abydos DSO, North Star Mine and the Stage B Rail) were significantly larger in extent than this project and included a diversity of habitats (steep gorges, granite outcropping etc.) that were not located within the project area.

The adequacy of the flora sampling within the project area was also determined using species accumulation curve output from Primer 6<sup>TM</sup>. Reviewing the outputs of the analysis and the average of the means (Chao1, Chao2, Jack1, Jack2, Bootstrap and MM), it can be assumed that approximately 80% of the taxa potentially occurring within the project area has been recorded (Chart 2). This includes the opportunistic collections made throughout the project area.



**Chart 2 Species accumulation curve for the project**

NB: Lines represent the actual observed (green) and the average of the means (blue)

## 5.7 Taxa of significance

While all native flora species are protected under the *Wildlife Conservation Act 1950*, a number of plant species are assigned an additional level of significance based on the limited number of known populations and the perceived threats to these populations (Appendix B).

Species of highest conservation significance are designated Threatened Flora (Declared Rare Flora – Extant) (T) or Presumed Extinct Flora (Declared Rare Flora – Extinct). Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories. Conservation Codes 1, 2 and 3 are considered to be poorly known and Conservation Code 4 is considered to be rare taxon that requires monitoring. For taxa that are not threatened but are subject to a specific conservation program are assigned Conservation Code 5.

The results of the desktop assessment did not identify any known threatened flora to occur within or in close proximity to the project area; however, several Priority flora are known to occur in close proximity (see Section 5.1, Table 8 and Figure 3).

The field survey of the project area recorded two Priority flora, *Heliotropium muticum* (P1) and *Goodenia nuda* (P4). *Heliotropium muticum* was recorded from two locations, and *Goodenia nuda* was recorded from one location (Table 12). The locations are provided in Figure 7. The Rare Flora Report Forms are provided in Appendix E.

**Table 12 Priority flora recorded within the project area**

Species	Conservation Code	Quadrat	GPS location (UTM, Zone 50)		Estimated number of plants
			Easting	Northing	
<i>Heliotropium muticum</i>	P1	NAAR07	683501	7670436	1
<i>Heliotropium muticum</i>	P1	NAAR17	683832	7668145	1
<i>Goodenia nuda</i>	P4	NAAR13	695514	7662205	1

*Heliotropium muticum* (P1) is an ascending to spreading herb that grows to a height of approximately 30 cm (Plate 1). *Heliotropium muticum* occurs in the north of the Pilbara bioregion between Karratha and Port Hedland and extending south towards the North Star mine site. *Heliotropium muticum* is quite often found in high numbers following disturbance (i.e. wildfire, raised-blade clearing) on spinifex sandplains, so it can be assumed that it is an opportunist or disturbance specialist with lower numbers recorded during periods of low to no disturbance activities. The record at quadrat NAAR07 was associated with a wildfire approximately 12-24 months prior to the survey, while the record at NAAR 17 was located in a relatively undisturbed site.

The specimens of *Heliotropium muticum* (P1) identified were considered to be desiccated, which may be a result of the lower than expected rainfall for the region or the species has an annual or biennial life form.

*Goodenia nuda* (P4) is an erect to ascending herb growing to a maximum height of 50 cm (Plate 2). Yellow flowers typical of the *Goodenia* genus, appear from April through to August, with flowering extent depending on rainfall. *Goodenia nuda* occurs on a variety of habitats from sandplains to stony plains and rocky rises across the entire Pilbara bioregion.



**Plate 1: *Heliotropium muticum* (P1)**

**Plate 2: *Goodenia nuda* (P4)**

Photography by K.C. Richardson. Image used with the permission of the Western Australian Herbarium, Department of Parks and Wildlife (<http://florabase.dpaw.wa.gov.au/help/copyright>). Accessed on Tuesday, 1 July 2014.

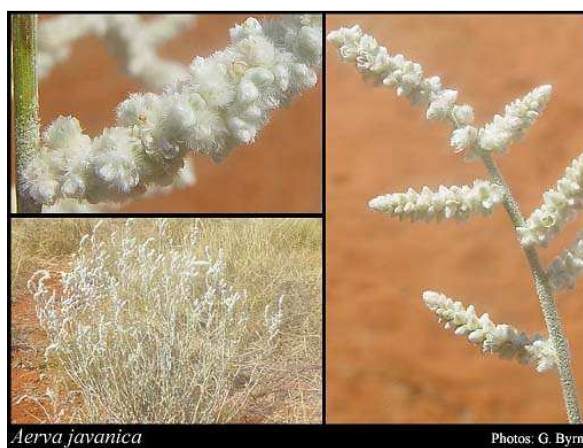
## 5.8 Introduced taxa

Two introduced taxa, *\*Cenchrus ciliaris* (Plate 3) and *\*Aerva javanica* (Plate 4), were recorded from the project area during the field survey. The two introduced taxa are not considered to be WONS based on their invasiveness, potential for spread and environmental, social and economic impacts.

Buffel Grass (*\*Cenchrus ciliaris*) and Kapok (*\*Aerva javanica*) are considered to be major weeds impacting on the landscapes and biodiversity values of the Pilbara bioregion (Carwardine *et al.*, 2014).



**Plate 3: *\*Cenchrus ciliaris* (Buffel Grass) in situ**



**Plate 4: *\*Aerva javanica* (Kapok).**

Photography by G. Byrne. Image used with the permission of the Western Australian Herbarium, Department of Parks and Wildlife (<http://florabase.dpaw.wa.gov.au/help/copyright>). Accessed on Tuesday, 1 July 2014.

### 5.8.1 Declared pests

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) and regulations were enacted on 1 May 2013. The BAM Act replaces the *Agriculture and Related Resources Protection Act 1976*. The main purposes of the BAM Act that relate to weeds are to:

- Prevent new animal and plant pests (vermin and weeds) and diseases from entering Western Australia.
- Manage the impact and spread of those pests already in Western Australia.

Organisms are grouped into four main classifications:

- Declared pests (under Section 22 of the Act).
- Permitted (under Section 11 of the Act).
- Prohibited (under Section 12 of the Act).
- Permitted requiring a permit (under Section 73 of the BAM Regulations 2013).

Under the BAM Act, all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management).

\**Cenchrus ciliaris* (Buffel Grass) and \**Aerva javanica* (Kapok) are not listed as Declared Pests under Section 22 of the BAM Act. Buffel Grass and Kapok are categorised as Permitted under Section 11 of the Act.

The environmental weed strategy for Western Australia (CALM, 1999) has detailed criteria for the assessment and rating of introduced flora species based on their impact on biodiversity. The criteria included:

- Invasiveness – ability to invade bushlands in good to excellent condition or ability to invade waterways (score of yes or no);
- Distribution – wide current or potential distribution including consideration of known history of widespread distribution elsewhere in the world (score as a yes or no); and
- Environmental impacts – ability to change the structure, composition and function of ecosystems in particular an ability to form a monoculture in a vegetation community (score as a yes or no).

The environmental weed strategy uses the following scoring system:

- High – an introduced flora species that scores yes to all three criteria. An introduced flora species with a high rating would indicate prioritising this weed for control and/or research.
- Moderate – an introduced flora species that scores yes to two of the three criteria. Rating an introduced flora species as moderate would indicate that control or research effort should be directed if funds are available, however it should be monitored.
- Mild – an introduced flora species that scores yes to one of the three criteria. A mild rating would indicate that monitoring and control of the introduced flora species is necessary where appropriate.
- Low – an introduced flora species that scores no to all three criteria. A low rating would mean that this species would require a low level of monitoring.

Buffel Grass and Kapok are listed as environmental weeds with a high rating based on their invasiveness, distribution and potential environmental impacts to Western Australia (CALM, 1999).

## 6 Discussion and impact assessment

The proposed disturbance footprint was not finalised by Fortescue at the time of preparing this report. Therefore, potential impacts can only be discussed in generalities on the basis of the entire project area that was surveyed.

### 6.1 Impact on vegetation

Ten vegetation associations were recorded from the project area. The impact and its significance on the vegetation associations is based on the representativeness across the project area, the Chichester subregion, the Pilbara bioregion, and the State.

The vegetation associations have been compared to the vegetation units recorded from the North Star mine area surveyed by Ecologia (2012a) and Fortescue's rail corridor surveyed by Biota (2004a).

#### 6.1.1 EPBC Act listed ecological communities

There are no ecological communities listed under the EPBC Act that are known to occur in the project area. As a result, there is no impact on ecological communities listed under the EPBC Act.

#### 6.1.2 State listed ecological communities

The desktop assessment did not identify any known threatened or priority ecological communities listed by DPAW. The field survey and subsequent analysis of the results did not record any TECs or PECs as occurring within the project area. As a result, there are no impacts on State listed ecological communities (i.e. TECs and PECs).

#### 6.1.3 Regional impact on vegetation associations

The vegetation associations recorded from the project area are located within the Abydos Plain-Chichester 93.4 and George Ranges 82.1 vegetation system associations (Beard, 1975 and Shepherd *et al.*, 2002). The Abydos-Plain Chichester 93.4 vegetation system associations covers approximately 84% (or 3,719 ha) of the project area, while the remaining 16% (or 700 ha) is covered by the George Ranges 82.1 vegetation system association.

The regional impact of the clearing within the project area has been determined based on the current extent of each vegetation system associations within the Pilbara bioregion and the Chichester subregion (Table 13).

**Table 13 Regional impact of the project**

Unit code	Scale	Current extent (ha)	Current extent remaining (%)	Extent within project area (ha)	Extent after clearing for the project (ha) <sup>1</sup>	Extent remaining (%)
82.1	Pilbara bioregion	316,855	99.90	700	316,155	99.68
	Chichester subregion	316,855	99.90	700	316,155	99.68
93.4	Pilbara bioregion	2,477,408	99.86	3,719	2,473,689	99.71
	Chichester subregion	2,473,007	99.86	3,719	2,469,288	99.71

1: Approximately 700 ha of the proposed disturbance area occur within the George Ranges 82.1 vegetation system association, while the remaining 3,719 ha occurs within the Abydos Plain-Chichester 93.4 vegetation system association.

The clearing within the proposed disturbance area for the project will not significantly reduce the regional extent of the mapped vegetation system associations within the Pilbara bioregion or the Chichester subregion. On the assumption stated above, that the entire project area is to be cleared, this would reduce the current extent by less than 0.5% compared to the pre-European extent.

Therefore, the impact on the regional extent of the vegetation within the project area is considered to be low.

#### **6.1.4 Local impact on vegetation associations**

The vegetation associations recorded from the project area were compared with the vegetation units recorded from the North Star mine area (Ecologia, 2012a) to determine local representation. Table 14 compares the vegetation associations recorded the project area with the vegetation units from Ecologia (2012a).

The comparison of the vegetation recorded from the project area and the North Star mine area was determined based on the vegetation descriptions, landforms, associated species and photography collected from both survey areas.

The vegetation associations recorded from the project area are considered to be similar to vegetation units recorded from the North Star mine area (Ecologia, 2012a), excluding AaTe and CzAaTI. However, these vegetation associations are consistent with vegetation units recorded from Fortescue's rail corridor (Biota, 2004a).

The vegetation associations recorded from the project area are not considered to be locally significant and although some (EIAiT<sub>w</sub>) of the vegetation associations are not widely represented within the project area (22 ha), additional landforms and associated vegetation occurs within the North Star mine area (221 ha) and adjacent areas to the project area.

The local impact on the mapped vegetation associations as a result of the project is considered to be low.

**Table 14 Comparison of vegetation associations with North Star Mine Area**

North Star Alternate Access Road			North Star mine area (Ecologia, 2012a)		
Unit code	Description	Area (ha)	Unit code	Description	Area (ha)
ChAtTe	<i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i> , <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> tall shrubland over <i>Triodia epactia</i> and <i>Triodia wiseana</i> mid-open hummock grassland.	42	At	<i>Acacia tumida</i> , <i>Grevillea wickhamii</i> and <i>Indigofera monophylla</i> shrubland.	444 (1.27%)
ChApTe	<i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia pyrifolia</i> , <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> and <i>Petalostylis labicheoides</i> tall sparse shrubland over <i>Triodia epactia</i> mid open hummock grassland.	168	ApTp	<i>Acacia pyrifolia</i> , <i>Acacia acradenia</i> and <i>Tephrosia rosea</i> mid shrubland, over <i>Triodia pungens</i> open hummock grassland	1,011 (2.90%)
			ChAbTp	<i>Corymbia hamersleyana</i> open low woodland, over <i>Acacia bivenosa</i> mid shrubland, over <i>Triodia pungens</i> open hummock grassland	42 (0.12%)
EcAaBe	<i>Eucalyptus camaldulensis</i> var. <i>obtusata</i> and <i>Eucalyptus victrix</i> mid woodland over <i>Acacia ampliceps</i> , <i>Acacia trachycarpa</i> and <i>Melaleuca linophylla</i> over <i>Bothriochloa ewartiana</i> , <i>Cenchrus ciliaris</i> and <i>Chrysopogon fallax</i> tall sparse tussock grassland.	192	EvCc	± <i>Eucalyptus victrix</i> ± <i>Eucalyptus camaldulensis</i> open mid woodland, over <i>Cenchrus ciliaris</i> tussock grassland	1,335 (3.89%)
EIAiTw	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> isolated low trees over <i>Acacia inaequilatera</i> and <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> tall sparse shrubland over <i>Triodia wiseana</i> mid open hummock grassland.	22	Tl	<i>Triodia lanigera</i> open hummock grassland	193 (0.55%)
			GaTw	<i>Gossypium australe</i> sparse mid shrubland, over <i>Triodia wiseana</i> open hummock grassland	28 (0.08%)
AaTe	<i>Acacia acradenia</i> , <i>Acacia ancistrocarpa</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> tall open shrubland over <i>Triodia epactia</i> , <i>Triodia</i> aff. <i>lanigera</i> and <i>Triodia wiseana</i> mid open hummock grassland.	1,540 (includes mosaics)		No equivalent Ecologia (2012a) unit	
				Equivalent to Biota (2004a) units	
			Apt13	<i>Acacia ancistrocarpa</i> open shrubland to open heath over <i>Triodia lanigera</i> hummock grassland	10,657
	Apt13/Ah1	Apt13 and <i>Acacia inaequilatera</i> scattered tall shrubs over <i>Triodia wiseana</i> hummock grassland to mid-dense hummock grassland	1,851		

**Table 14 Comparison of vegetation associations with North Star Mine Area (cont'd)**

North Star Alternate Access Road			North Star mine area (Ecologia, 2012a)		
Unit code	Description	Area (ha)	Unit code	Description	Area (ha)
AiTS	<i>Acacia inaequilatera</i> , <i>Grevillea wickhamii</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> tall sparse shrubland over <i>Triodia</i> aff. sp. Shovelanna Hill (S. Van Leeuwen 3835) and <i>Triodia wiseana</i> mid hummock grassland.	201 (includes mosaics)	Tw <sup>3</sup>	<i>Triodia wiseana</i> and <i>Triodia basedowii</i> hummock grassland	4,236 (12.15%)
AaTw <sup>1</sup>	<i>Acacia ancistrocarpa</i> , <i>Acacia inaequilatera</i> and <i>Acacia ptychophylla</i> tall to mid open shrubland over <i>Triodia wiseana</i> mid open hummock grassland.	568 (includes mosaics)	Tw <sup>2</sup>	<i>Triodia wiseana</i> open hummock grassland	1,964 (5.63%)
			AaTw <sup>3</sup>	<i>Acacia acradenia</i> , <i>Acacia tumida</i> and <i>Grevillea wickhamii</i> open shrubland, over <i>Triodia wiseana</i> hummock grassland	2,770 (7.95%)
			ElApTw	<i>Eucalyptus leucophloia</i> isolated trees, over <i>Acacia ptychophylla</i> sparse shrubland, over <i>Triodia wiseana</i> open hummock grassland	582 (1.67%)
AaTw <sup>2</sup>	± <i>Corymbia hamersleyana</i> , ± <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low isolated trees over <i>Acacia acradenia</i> and <i>Acacia inaequilatera</i> tall sparse shrubland over <i>Triodia wiseana</i> mid hummock grassland.	383 (Includes mosaics)	AaTw <sup>3</sup>	<i>Acacia acradenia</i> , <i>Acacia tumida</i> and <i>Grevillea wickhamii</i> open shrubland, over <i>Triodia wiseana</i> hummock grassland	2,770 (7.95%)
			AaTw <sup>4</sup>	<i>Acacia acradenia</i> and <i>Acacia inaequilatera</i> sparse mid shrubland over <i>Triodia wiseana</i> and <i>Triodia lanigera</i> hummock grassland	4,244 (12.17%)
CzAaTI	<i>Corymbia zygophylla</i> sparse low woodland over <i>Acacia ancistrocarpa</i> mid sparse shrubland over <i>Triodia</i> aff. <i>lanigera</i> mid hummock grassland.	1,039		Not equivalent Ecologia (2012a) unit Equivalent to Biota (2004a) units	
			Apt11	<i>Acacia</i> spp. scattered tall shrubs over <i>A. stellaticeps</i> low open shrubland over <i>Triodia lanigera</i> hummock grassland	1,945
			Apt13	<i>Acacia ancistrocarpa</i> open shrubland to open heath over <i>Triodia lanigera</i> hummock grassland	10,657
PfTe	<i>Pluchea ferdinandi-muelleri</i> low sparse shrubland over <i>Triodia epactia</i> and <i>Triodia secunda</i> mid open hummock grassland.	257 (includes mosaics)	PfTp	<i>Pluchea ferdinandi-muelleri</i> open low shrubland, over <i>Triodia pungens</i> sparse hummock grassland	163 (0.47%)

## 6.2 Impact on flora

A total of 166 taxa were recorded from the project area, including two priority listed taxa and two introduced taxa. The impact and the significance of the project on the flora have been discussed based on their representation across the project area, the Chichester subregion, the Pilbara bioregion and the State.

### 6.2.1 EPBC Act listed flora

There are no flora listed under the EPBC Act known to occur within or been recorded within the project area. As a result, there is no impact on flora listed under the EPBC Act.

### 6.2.2 WC Act listed flora

The three threatened (Declared Rare – Extant) flora known to occur in the Pilbara were not recorded from within the project area and are not expected to occur in the project area based on the known distribution and habitat requirements. As a result, there is no impact on flora listed under the WC Act.

### 6.2.3 Priority listed flora

Two priority taxa, *Heliotropium muticum* (P1) and *Goodenia nuda* (P4), were recorded from the project area during the site visit. Two individuals of *Heliotropium muticum* and one individual of *Goodenia nuda* were recorded at the time of the survey. The known locations of the two priority taxa are not located along the proposed alternate access road (Figure 7).

*Heliotropium muticum* (P1) has been recorded in high numbers in close proximity to the project area and in the greater Port Hedland region. The records of *Heliotropium muticum* known to occur in close proximity to the project area is provided in Table 15.

**Table 15** *Heliotropium muticum* (P1) records in close proximity to the project area

Study (Reference)	Populations (Individuals)	Distance from project area
North Star mine area (Ecologia 2012a)	12 (20)	Within 5 km
Canning Basin Borefield (Ecologia, 2012b)	12 (n/a)	Within 30 km
Abydos DSO Project (Woodman, 2013a)	36 (n/a)	Within 3 km
Port Hedland Regional Assessment (ENV, 2011)	142 (1,287)	Within 80 km
Mt Dove DSO (Woodman, 2011)	11 (40)	Within 30 km

*Goodenia nuda* (P4) has also been recorded in high numbers in close proximity and within 120 km to the project area. The records of *Goodenia nuda* known to occur in close proximity to the project area is provided in Table 16.

**Table 16** *Goodenia nuda* (P4) records in close proximity to the project area

Study (Reference)	Populations (Individuals)	Distance from project area
North Star mine area (Ecologia 2012a)	48 (785)	Within 10 km
Canning Basin Borefield (Ecologia, 2012b)	1 (1)	Within 80 km
Port Hedland Regional Assessment (ENV, 2011)	35 (238)	Within 80 km
Fortescue Rail Corridor Stage A (Biota, 2004a)	2 (2)	Within 120 km

Based on the known distribution of *Heliotropium muticum* (P1) and *Goodenia nuda* (P4), the local and regional impact of clearing in the project area on these priority listed flora, is considered low.

#### 6.2.4 Introduced flora

Two introduced taxa, *Cenchrus ciliaris* and *Aerva javanica*, were recorded from the project area. The introduced taxa were recorded in association with the Gillam Creek and the larger tributaries that flowed into the Gillam Creek from the surrounding hills.

Buffel Grass (*Cenchrus ciliaris*) was recorded within vegetation associations EcAaBe, ChApTe and ChAtTe. These areas were also impacted upon by cattle grazing and as a result were considered to be in good to poor condition.

Kapok (*Aerva javanica*) was recorded within vegetation association EcAaBe and has more than likely been introduced as a result of cattle grazing or episodic flooding of the Gillam Creek.

Densities of Kapok were considered to be low, while the density of Buffel Grass ranged from low to high depending on the level of cattle activity. Sections along the Gillam Creek in the western and eastern sections of the project area had higher densities, while the remaining areas and the tributaries had lower densities of Buffel Grass.

The project may spread or introduce Buffel Grass and Kapok within the project area, if not managed appropriately. However, Buffel Grass is considered to be widespread over the majority of the Pilbara, in particular with drainage lines and where water pools. The impact of the project with regards to the spread and introduction of introduced taxa is considered to be low. It has been assumed that the impact will be managed appropriately by Fortescue, via environmental management plans and clearing procedures.

## 7 Conclusion

A single phase Level 2 flora and vegetation survey and a targeted conservation significant flora survey was undertaken across the 4,419 ha survey area. The survey method and approach is consistent with the EPA's Guidance Statement No. 51 (EPA, 2004a) and Fortescue's Flora and Vegetation Assessment Guidelines (Fortescue, 2014).

A total of 30, 2,500 m<sup>2</sup> flora quadrats were sampled across the project area. In addition, large portions of the project area were traversed on foot to further delineate the vegetation associations, identify additional flora taxa and to search for conservation significant flora and ecological communities.

### 7.1 Flora

A total of 166 flora taxa, including two introduced taxa, were recorded from the project area. Of the 164 native taxa recorded from the project area, two are considered to be flora of conservation significance, *Heliotropium muticum* (P1) and *Goodenia nuda* (P4).

The two Priority flora taxa recorded from the project area are not considered to be regionally significant. Two individuals, one from each location, of *Heliotropium muticum* (P1) were recorded from within the project area, while one individual, from one location, of *Goodenia nuda* (P4) was recorded from within the project area. Populations of *Heliotropium muticum* and *Goodenia nuda* are known to occur in the immediate vicinity to the project area and regionally (within 200 km of the project area).

### 7.2 Vegetation

A total of ten vegetation associations delineated from four broad floristic formations were recorded for the project area. The ten vegetation associations are not considered to be regionally significant. The vegetation associations are not considered to represent a TEC or a PEC and are located throughout the North Star mine area (Ecologia, 2012a).

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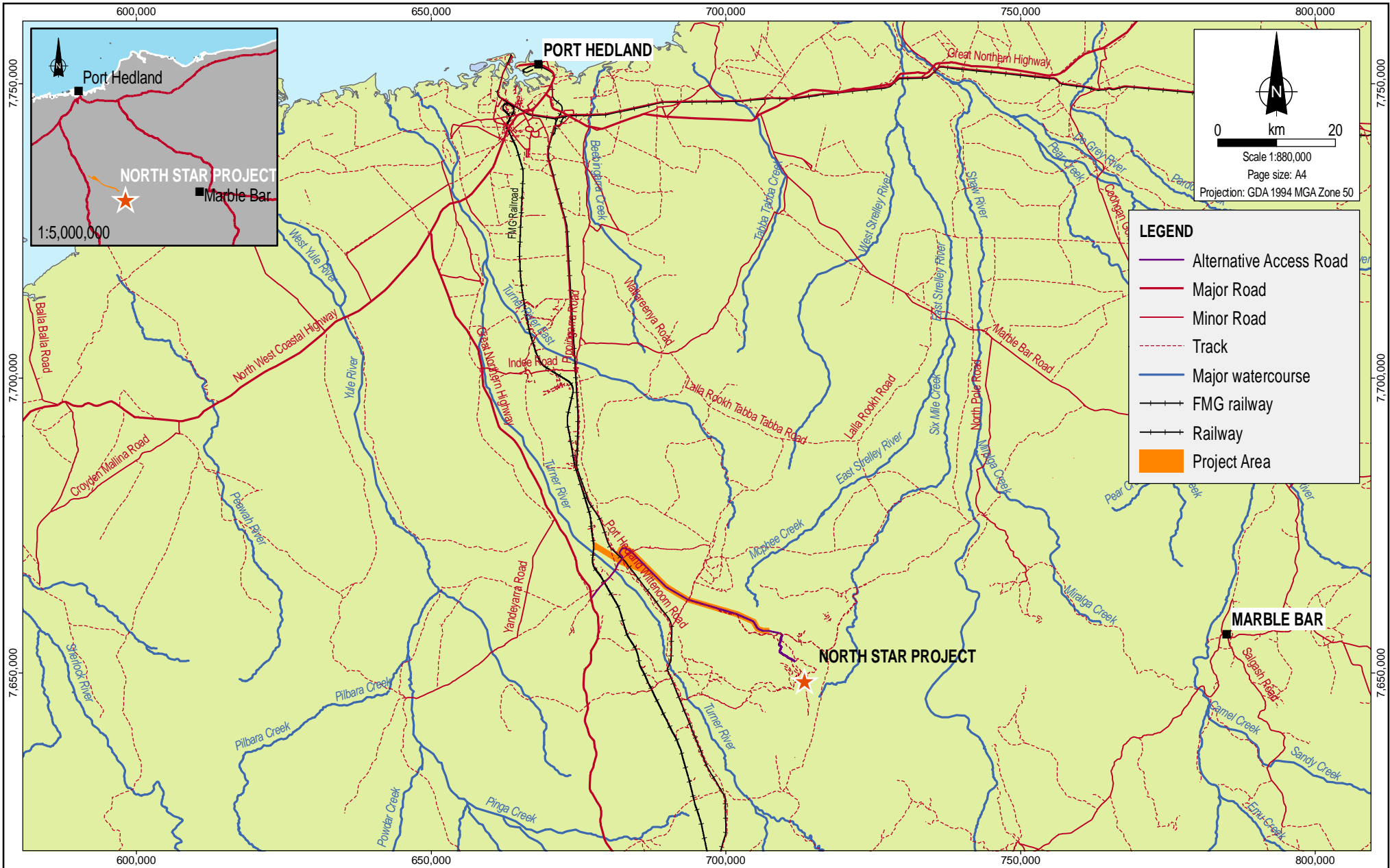
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## Figures

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Source & Notes  
 North Star Project from DMP (August 2014).  
 Tracks and Project area from FMG (March 2014)  
 Towns, roads and railways from GEODATA 250K (optimum scale 1:250,000).  
 Aerial imagery from ArcGIS Online.

**coffey**

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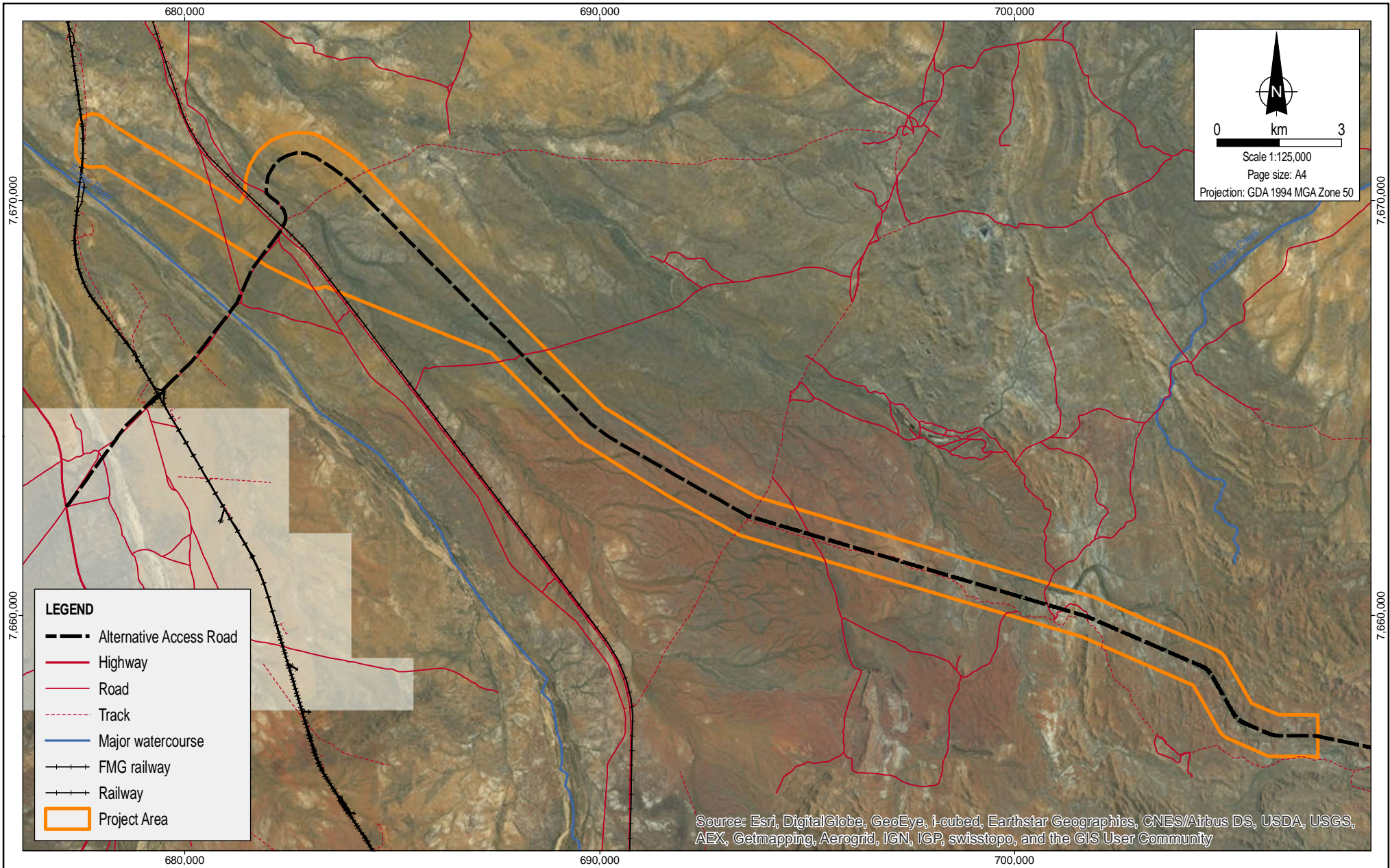
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**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**











**Regional Location**

Figure No:  
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**LEGEND**

-  Alternative Access Road
-  Highway
-  Road
-  Track
-  Major watercourse
-  FMG railway
-  Railway
-  Project Area

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Source & Notes  
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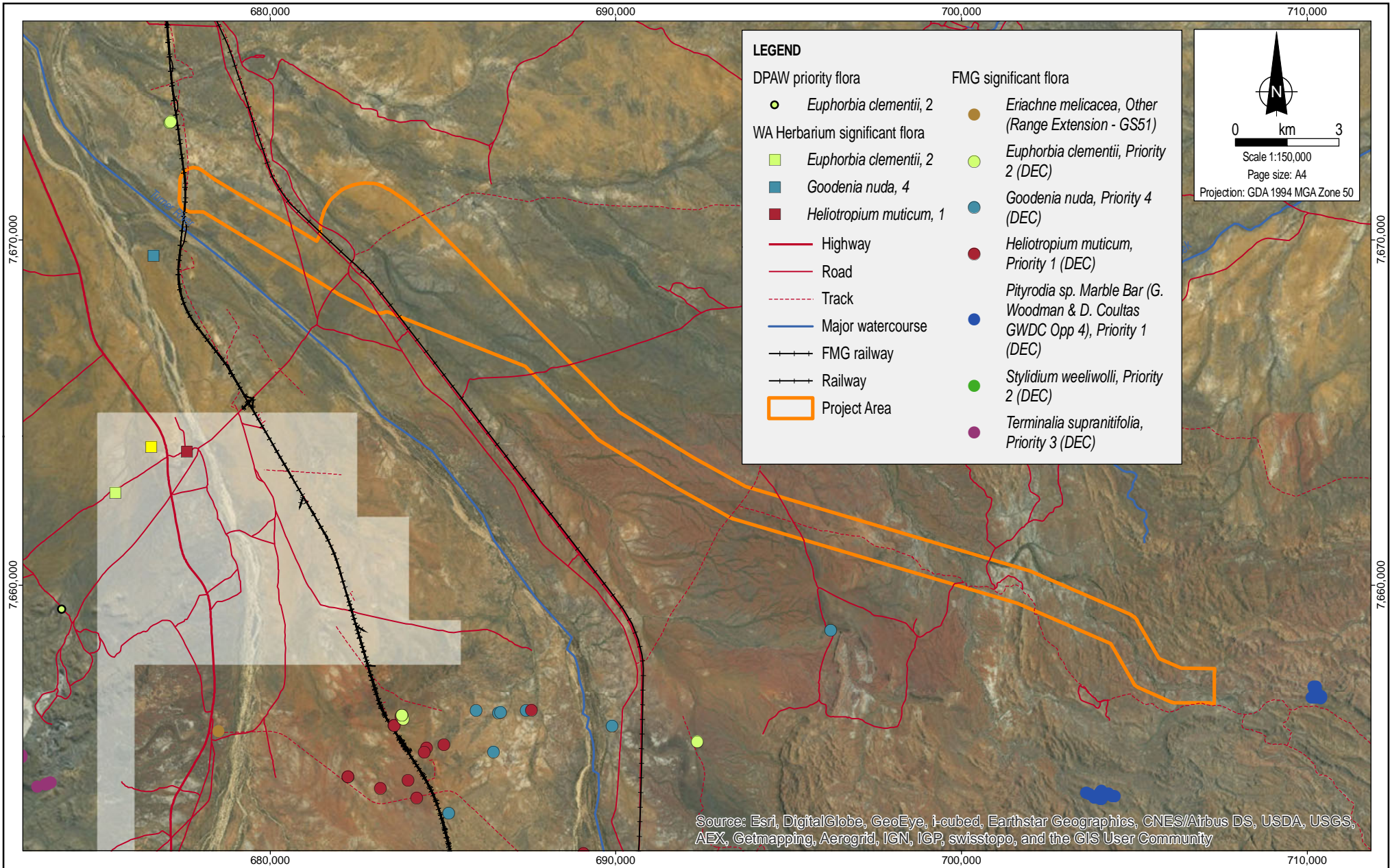
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**Fortescue Metals Group**  
**Flora and Fauna Assessment**  
**North Star Alternative Access Road**



**North Star Project Area**

Figure No: **2**



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Source & Notes  
 Project area from FMG (March 2014)  
 Roads and watercourses from GEODATA 250K (optimum scale 1:250,000).  
 FMG railway from FMG (2007).  
 Aerial imagery from Bing Online.

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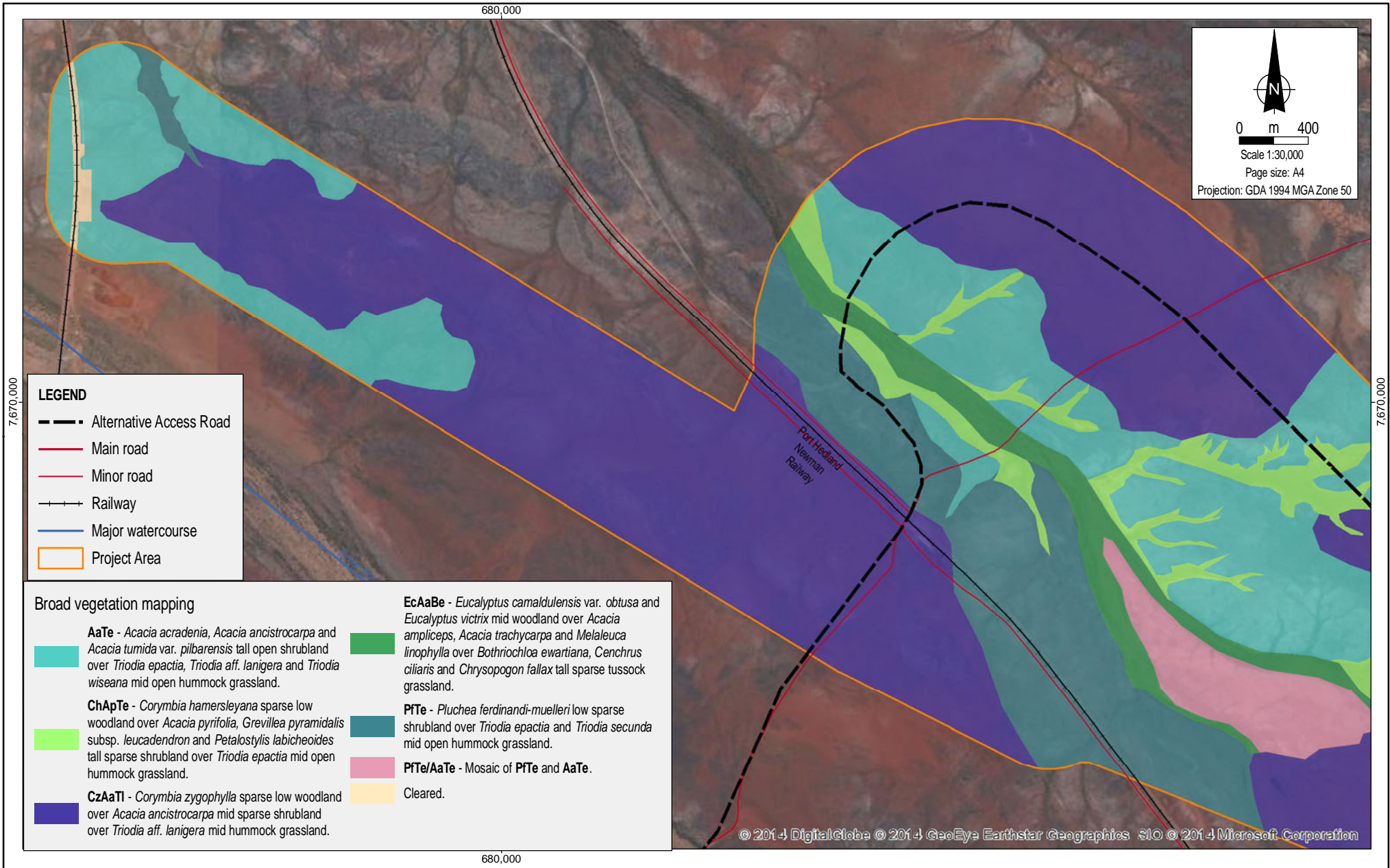
**Fortescue Metals Group**

**Flora and Fauna Assessment  
 North Star Alternative Access Road**



**Desktop Assessment Results**

Figure No: **3**



**LEGEND**

- Alternative Access Road
- Main road
- Minor road
- Railway
- Major watercourse
- Project Area

**Broad vegetation mapping**

<p> <b>AaTe</b> - <i>Acacia acradenia</i>, <i>Acacia ancistrocarpa</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> tall open shrubland over <i>Triodia epactia</i>, <i>Triodia aff. lanigera</i> and <i>Triodia wiseana</i> mid open hummock grassland.</p> <p> <b>ChApTe</b> - <i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia pyrifolia</i>, <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> and <i>Petalostylis labicheoides</i> tall sparse shrubland over <i>Triodia epactia</i> mid open hummock grassland.</p> <p> <b>CzAaTl</b> - <i>Corymbia zygophylla</i> sparse low woodland over <i>Acacia ancistrocarpa</i> mid sparse shrubland over <i>Triodia aff. lanigera</i> mid hummock grassland.</p>	<p> <b>EcAaBe</b> - <i>Eucalyptus camaldulensis</i> var. <i>obtusata</i> and <i>Eucalyptus victrix</i> mid woodland over <i>Acacia ampliceps</i>, <i>Acacia trachycarpa</i> and <i>Melaleuca linophylla</i> over <i>Bothriochloa ewartiana</i>, <i>Cenchrus ciliaris</i> and <i>Chrysopogon fallax</i> tall sparse tussock grassland.</p> <p> <b>PfTe</b> - <i>Pluchea ferdinandi-muelleri</i> low sparse shrubland over <i>Triodia epactia</i> and <i>Triodia secunda</i> mid open hummock grassland.</p> <p> <b>PfTe/AaTe</b> - Mosaic of <b>PfTe</b> and <b>AaTe</b>.</p> <p> Cleared.</p>
--	---

© 2014 DigitalGlobe © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation

Source & Notes  
 Vegetation association mapping from Coffey (July 2014)  
 Project area from FMG (March 2014)  
 Roads and watercourses from GEODATA 250K (optimum scale 1:250,000).  
 FMG railway from FMG (2007).  
 Aerial imagery from Bing Online and FMG (January 2014).



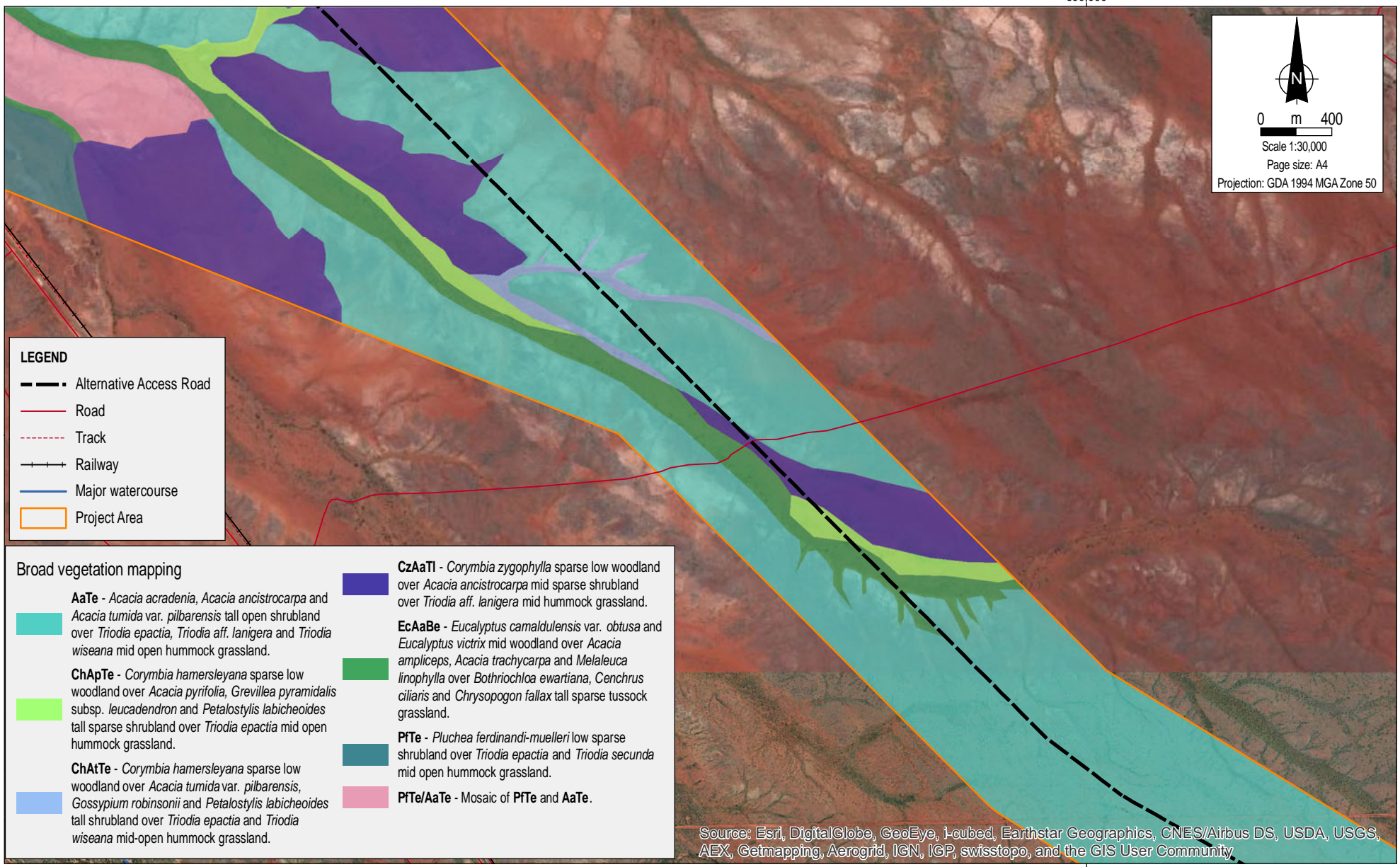
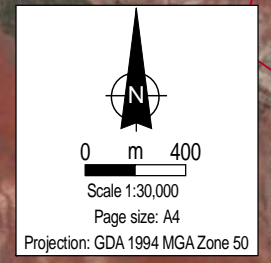
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**Fortescue Metals Group**  
**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**



**Vegetation Associations**

Figure No:  
**4A**



**LEGEND**

- Alternative Access Road
- Road
- Track
- Railway
- Major watercourse
- Project Area

**Broad vegetation mapping**

- AaTe** - *Acacia acradenia*, *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* tall open shrubland over *Triodia epactia*, *Triodia aff. lanigera* and *Triodia wiseana* mid open hummock grassland.
- ChApTe** - *Corymbia hamersleyana* sparse low woodland over *Acacia pyrifolia*, *Grevillea pyramidalis* subsp. *leucadendron* and *Petalostylis labicheoides* tall sparse shrubland over *Triodia epactia* mid open hummock grassland.
- ChAtTe** - *Corymbia hamersleyana* sparse low woodland over *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* tall shrubland over *Triodia epactia* and *Triodia wiseana* mid-open hummock grassland.
- CzAaTI** - *Corymbia zygophylla* sparse low woodland over *Acacia ancistrocarpa* mid sparse shrubland over *Triodia aff. lanigera* mid hummock grassland.
- EcAaBe** - *Eucalyptus camaldulensis* var. *obtusa* and *Eucalyptus victrix* mid woodland over *Acacia ampliceps*, *Acacia trachycarpa* and *Melaleuca linophylla* over *Bothriochloa ewartiana*, *Cenchrus ciliaris* and *Chrysopogon fallax* tall sparse tussock grassland.
- PfTe** - *Pluchea ferdinandi-muelleri* low sparse shrubland over *Triodia epactia* and *Triodia secunda* mid open hummock grassland.
- PfTe/AaTe** - Mosaic of **PfTe** and **AaTe**.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Source & Notes  
 Vegetation association mapping from Coffey (July 2014)  
 Project area, railway and roads from FMG (March 2014)  
 Railway and watercourses from GEODATA 250K (optimum scale 1:250,000).  
 Aerial imagery from ArcGIS Online and FMG (January 2014).



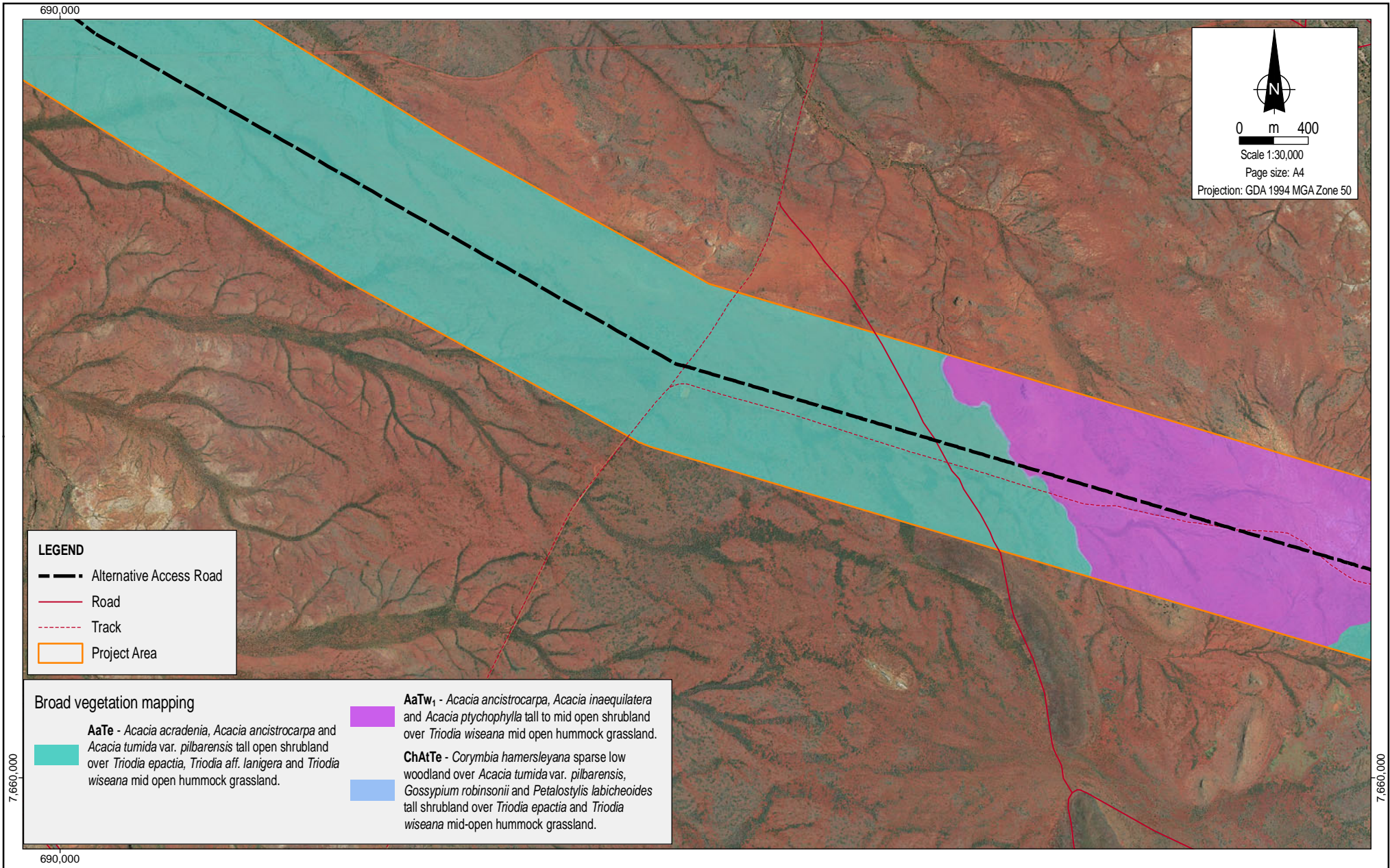
Date: 15.08.2014  
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 File Name: 4590\_01\_F004B\_GIS\_v0

**Fortescue Metals Group**  
**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**



**Vegetation Associations**

Figure No: **4B**



0 m 400  
 Scale 1:30,000  
 Page size: A4  
 Projection: GDA 1994 MGA Zone 50

**LEGEND**

- Alternative Access Road
- Road
- Track
- Project Area

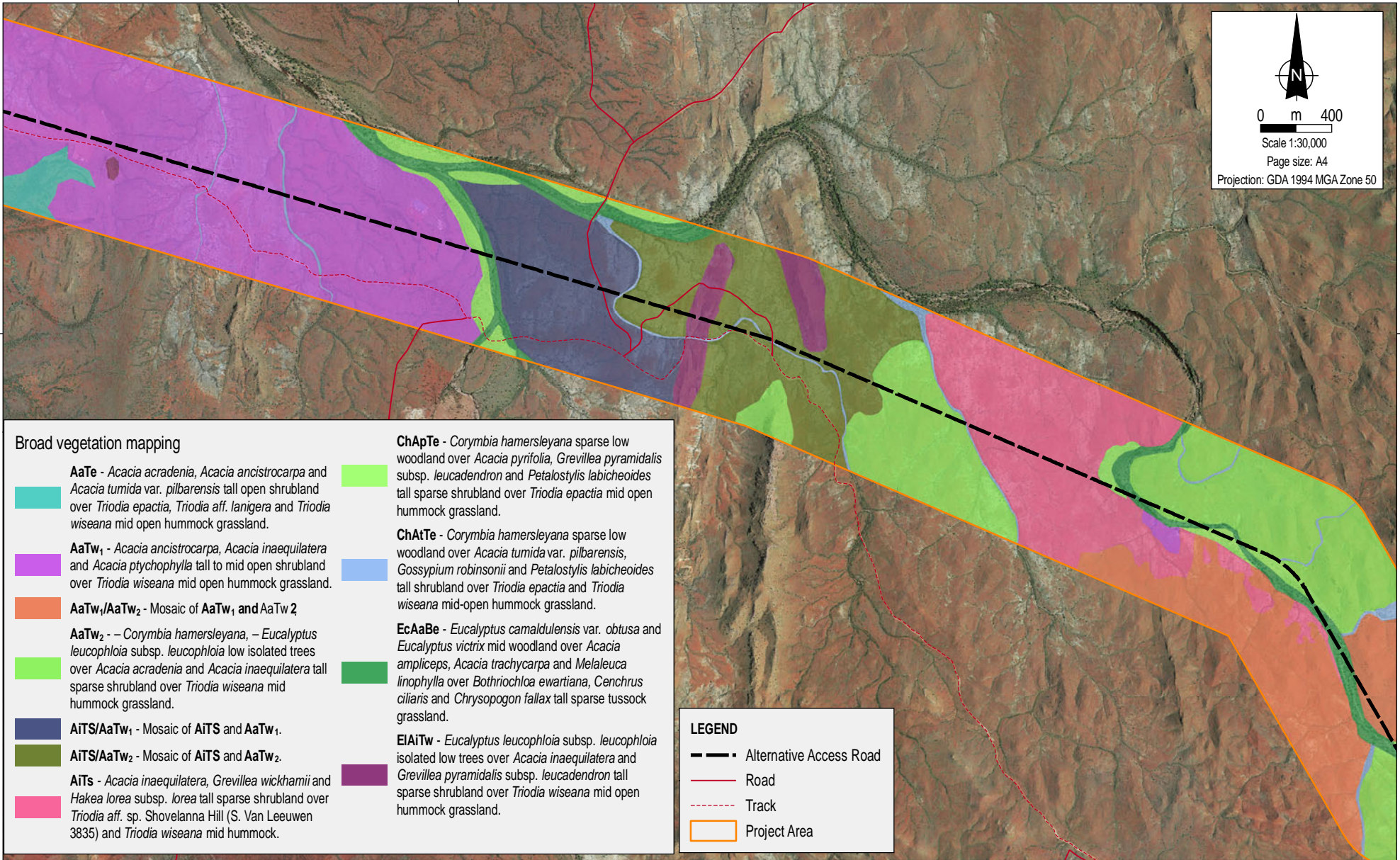
**Broad vegetation mapping**

<p> <b>AaTe</b> - <i>Acacia acradenia</i>, <i>Acacia ancistrocarpa</i> and <i>Acacia tumida</i> var. <i>pilbarensis</i> tall open shrubland over <i>Triodia epactia</i>, <i>Triodia aff. lanigera</i> and <i>Triodia wiseana</i> mid open hummock grassland.</p>	<p> <b>AaTw<sub>1</sub></b> - <i>Acacia ancistrocarpa</i>, <i>Acacia inaequilatera</i> and <i>Acacia ptychophylla</i> tall to mid open shrubland over <i>Triodia wiseana</i> mid open hummock grassland.</p>
<p> <b>ChAtTe</b> - <i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> tall shrubland over <i>Triodia epactia</i> and <i>Triodia wiseana</i> mid-open hummock grassland.</p>	

700,000

7,660,000

7,660,000



**Broad vegetation mapping**

**AaTe** - *Acacia acradenia*, *Acacia ancistrocarpa* and *Acacia tumida* var. *pilbarensis* tall open shrubland over *Triodia epactia*, *Triodia* aff. *lanigera* and *Triodia wiseana* mid open hummock grassland.

**AaTw<sub>1</sub>** - *Acacia ancistrocarpa*, *Acacia inaequilatera* and *Acacia ptychophylla* tall to mid open shrubland over *Triodia wiseana* mid open hummock grassland.

**AaTw<sub>1</sub>/AaTw<sub>2</sub>** - Mosaic of **AaTw<sub>1</sub>** and **AaTw<sub>2</sub>**

**AaTw<sub>2</sub>** - *Corymbia hamersleyana*, *Eucalyptus leucophloia* subsp. *leucophloia* low isolated trees over *Acacia acradenia* and *Acacia inaequilatera* tall sparse shrubland over *Triodia wiseana* mid hummock grassland.

**AITS/AaTw<sub>1</sub>** - Mosaic of **AITS** and **AaTw<sub>1</sub>**.

**AITS/AaTw<sub>2</sub>** - Mosaic of **AITS** and **AaTw<sub>2</sub>**.

**AITS** - *Acacia inaequilatera*, *Grevillea wickhamii* and *Hakea lorea* subsp. *lorea* tall sparse shrubland over *Triodia* aff. sp. Shovelanna Hill (S. Van Leeuwen 3835) and *Triodia wiseana* mid hummock.

**ChApTe** - *Corymbia hamersleyana* sparse low woodland over *Acacia pyrifolia*, *Grevillea pyramidalis* subsp. *leucadendron* and *Petalostylis labicheoides* tall sparse shrubland over *Triodia epactia* mid open hummock grassland.

**ChAtTe** - *Corymbia hamersleyana* sparse low woodland over *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* tall shrubland over *Triodia epactia* and *Triodia wiseana* mid-open hummock grassland.

**EcAaBe** - *Eucalyptus camaldulensis* var. *obtus* and *Eucalyptus victrix* mid woodland over *Acacia amplexiceps*, *Acacia trachycarpa* and *Melaleuca linophylla* over *Bothriochloa ewartiana*, *Cenchrus ciliaris* and *Chrysopogon fallax* tall sparse tussock grassland.

**EIAiT<sub>w</sub>** - *Eucalyptus leucophloia* subsp. *leucophloia* isolated low trees over *Acacia inaequilatera* and *Grevillea pyramidalis* subsp. *leucadendron* tall sparse shrubland over *Triodia wiseana* mid open hummock grassland.

**LEGEND**

- Alternative Access Road
- Road
- Track
- Project Area

700,000

Source & Notes  
 Vegetation association mapping from Coffey (July 2014)  
 Project area, railway and roads from FMG (March 2014)  
 Watercourses from GEODATA 250K (optimum scale 1:250,000).  
 Aerial imagery from FMG (January 2014).



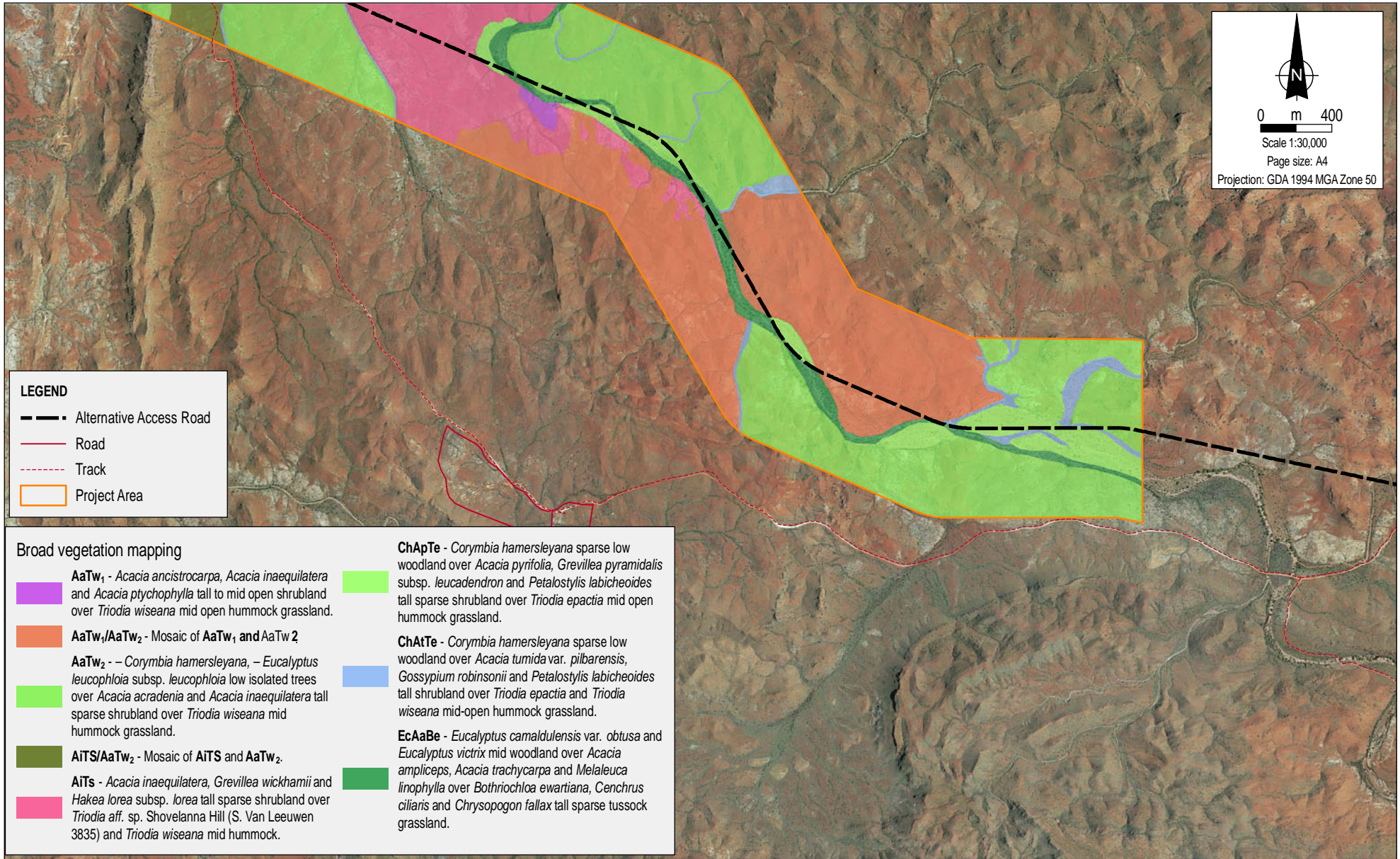
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4590\_01\_F004D\_GIS\_v0

**Fortescue Metals Group**  
**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**



**Vegetation Associations**

Figure No:  
**4D**



**LEGEND**

- Alternative Access Road
- Road
- Track
- Project Area

**Broad vegetation mapping**

<p> <b>AaTw<sub>1</sub></b> - <i>Acacia ancistrocarpa</i>, <i>Acacia inaequilatera</i> and <i>Acacia ptychophylla</i> tall to mid open shrubland over <i>Triodia wiseana</i> mid open hummock grassland.</p> <p> <b>AaTw<sub>1</sub>/AaTw<sub>2</sub></b> - Mosaic of <b>AaTw<sub>1</sub></b>, and <b>AaTw<sub>2</sub></b></p> <p> <b>AaTw<sub>2</sub></b> - <i>Corymbia hamersleyana</i>, - <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i> low isolated trees over <i>Acacia acradenia</i> and <i>Acacia inaequilatera</i> tall sparse shrubland over <i>Triodia wiseana</i> mid hummock grassland.</p> <p> <b>AITs/AaTw<sub>2</sub></b> - Mosaic of <b>AITs</b> and <b>AaTw<sub>2</sub></b>.</p> <p> <b>AITs</b> - <i>Acacia inaequilatera</i>, <i>Grevillea wickhamii</i> and <i>Hakea lorea</i> subsp. <i>lorea</i> tall sparse shrubland over <i>Triodia aff. sp.</i> Shovelanna Hill (S. Van Leeuwen 3835) and <i>Triodia wiseana</i> mid hummock.</p>	<p> <b>ChApTe</b> - <i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia pyrifolia</i>, <i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i> and <i>Petalostylis labicheoides</i> tall sparse shrubland over <i>Triodia epactia</i> mid open hummock grassland.</p> <p> <b>ChAtTe</b> - <i>Corymbia hamersleyana</i> sparse low woodland over <i>Acacia tumida</i> var. <i>pilbarensis</i>, <i>Gossypium robinsonii</i> and <i>Petalostylis labicheoides</i> tall shrubland over <i>Triodia epactia</i> and <i>Triodia wiseana</i> mid-open hummock grassland.</p> <p> <b>EcAaBe</b> - <i>Eucalyptus camaldulensis</i> var. <i>obtusa</i> and <i>Eucalyptus victrix</i> mid woodland over <i>Acacia amplexiceps</i>, <i>Acacia trachycarpa</i> and <i>Melaleuca linophylla</i> over <i>Bothriochloa ewartiana</i>, <i>Cenchrus ciliaris</i> and <i>Chrysopogon fallax</i> tall sparse tussock grassland.</p>
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Source & Notes  
 Vegetation association mapping from Coffey (July 2014)  
 Project area, railway and roads from FMG (March 2014)  
 Watercourses from GEODATA 250K (optimum scale 1:250,000).  
 Aerial imagery from FMG (January 2014).



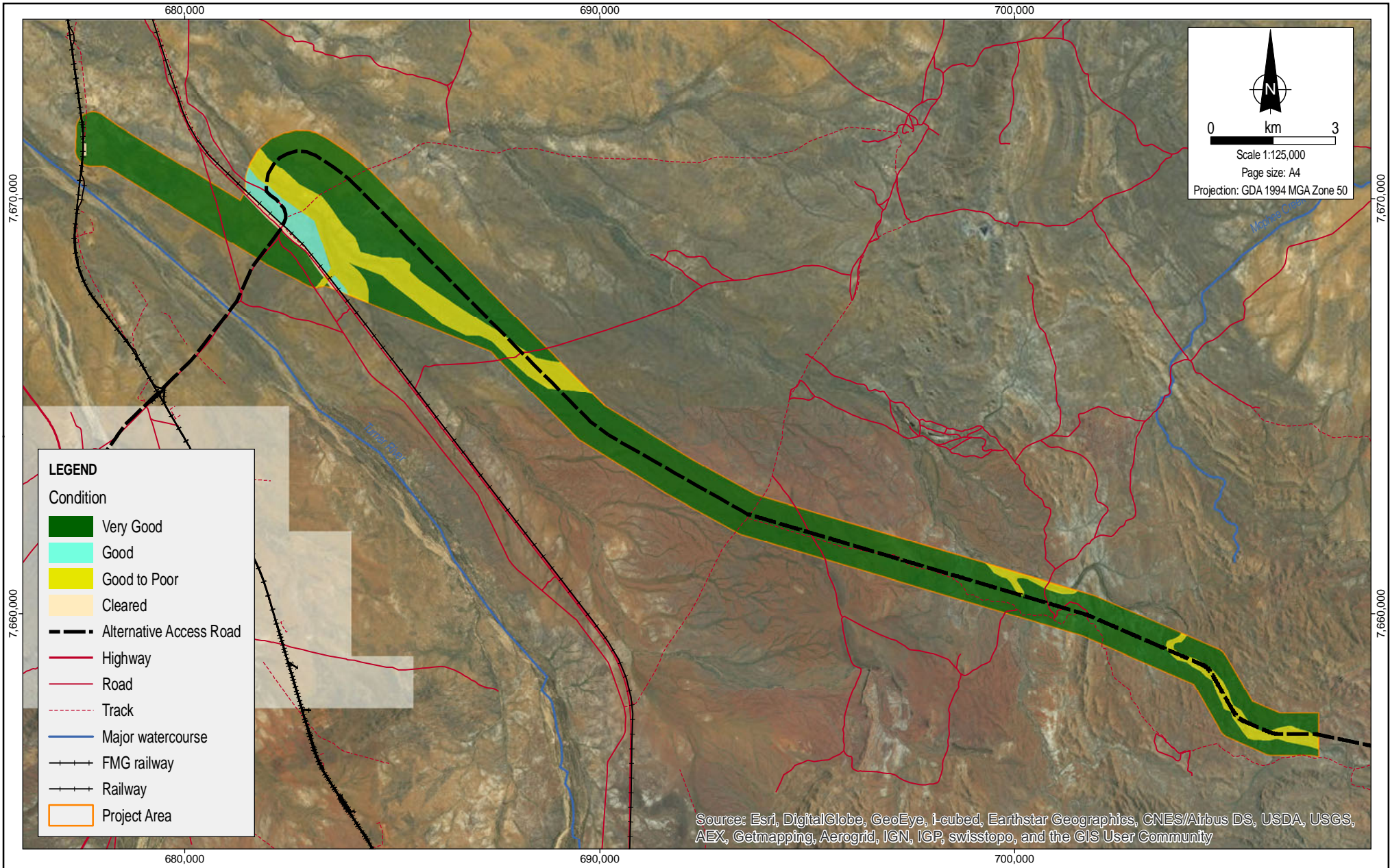
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**Fortescue Metals Group**  
**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**



**Vegetation Associations**

Figure No:  
**4E**



  
 0 km 3  
 Scale 1:125,000  
 Page size: A4  
 Projection: GDA 1994 MGA Zone 50

**LEGEND**

Condition

- Very Good
- Good
- Good to Poor
- Cleared
- Alternative Access Road
- Highway
- Road
- Track
- Major watercourse
- FMG railway
- Railway
- Project Area

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Source & Notes  
 Vegetation condition mapping from Coffey (July 2014)  
 Project area from FMG (March 2014)  
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 FMG railway from FMG (2007).  
 Aerial imagery from Bing Online and FMG (January 2014).



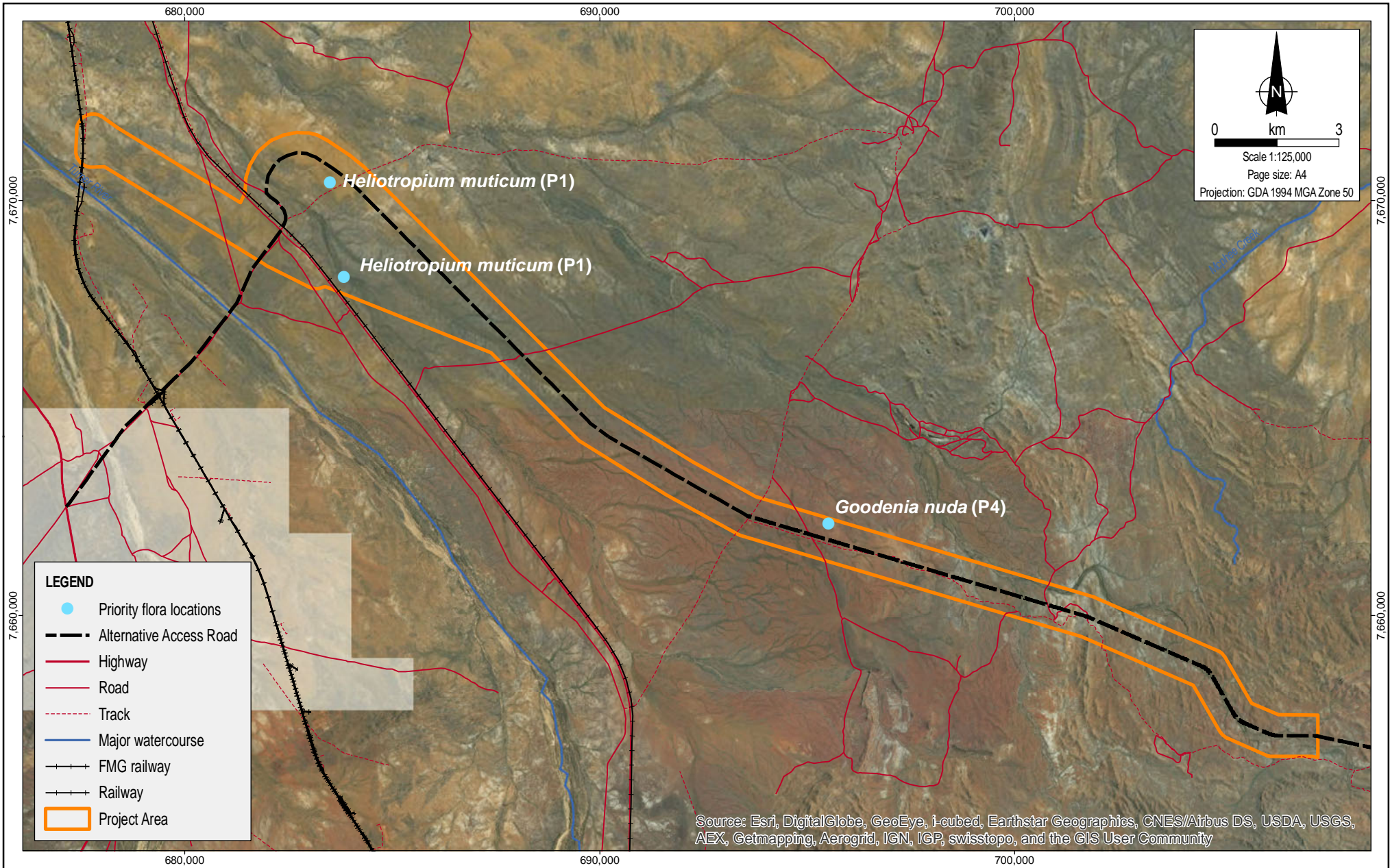
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**Fortescue Metals Group**  
**Flora and Vegetation Assessment**  
**North Star Alternative Access Road**



**Vegetation Condition**

Figure No:  
**6**



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Source & Notes  
 Roads, railway and Project area from FMG (March 2014)  
 Railways and watercourses from GEODATA 250K (optimum scale)  
 Aerial imagery from ArcGIS Online and FMG (January 2014)



Date:  
15.08.2014  
 MXD:  
4590\_02\_GIS006\_4  
 File Name:  
4590\_02\_F007\_GIS\_v0

Fortescue Metals Group  
 Flora and Fauna Assessment  
 North Star Alternative Access Road



Priority and Introduced Flora Locations

Figure No:  
7

# **Appendix A**

## **Database search results**

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**Coffey Environments**

PO Box 4223  
Victoria Park WA 6979

Attention: Clinton Van Den Bergh

Dear Clinton Van Den Bergh,

**REQUEST FOR THREATENED AND PRIORITY FLORA INFORMATION**

I refer to your request of 12 March 2014 for Threatened (Declared Rare) and Priority Flora information in the Marble Bar area. The search was conducted within the area of the polygon you submitted with an additional 25km buffer.

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) and Priority Flora* database (for results, *if any*, see "TPFL" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, *if any*, see "WAHERB"- coordinates are GDA94 – see condition number 9 in the attached 'Conditions in Respect of Supply' and **(3)**, the Department's *Threatened and Priority Flora List* [this list is searched using 'place names'. This list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "TP List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point, which refers to the requirement to undertake field investigations for the accurate determination of Threatened and Priority flora occurrence at a site. *The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for \$300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of Threatened and Priority flora you encounter in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss Threatened and Priority flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9334 0455.

Yours faithfully

Miss Myrto Robert

.....  
A/THREATENED FLORA DATABASE OFFICER  
for the Director General

17 March 2014

**Species and Communities Branch**

17 Dick Perry Ave, Technology Park, Kensington  
Phone: (08) 9334 0455 Fax: (08) 9334 0278

Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

[www.dpaw.wa.gov.au](http://www.dpaw.wa.gov.au)

## DEPARTMENT OF PARKS AND WILDLIFE

### THREATENED (DECLARED RARE) AND PRIORITY FLORA INFORMATION

#### CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Director General, Department of Parks and Wildlife, Attention: Threatened Flora Database Officer, Species and Communities Branch.
2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Director General, Department of Parks and Wildlife.
3. Specific locality information for Threatened and Priority Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information may not be used in public reports without the written permission of the Director General, Department of Parks and Wildlife. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of Threatened and Priority Flora information.
4. Note that the Department of Parks and Wildlife respects the privacy of private landowners who may have Threatened and Priority Flora on their property. Threatened and Priority Flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Parks and Wildlife.
5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Parks and Wildlife accepts no responsibility for this.
6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
7. **It should be noted that the supplied data do not necessarily represent a comprehensive listing of the Threatened and Priority Flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.**
8. Acknowledgment of the Department of Parks and Wildlife as source of the data is to be made in any published material. The unique reference number that is given upon the request for information should be quoted when referencing the data. Copies of all such publications are to be forwarded to the Department of Parks and Wildlife, Attention: The Manager, Species and Communities Branch.
9. The development of the PERTH Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being databased. It is only in recent times that collections have been submitted with GPS coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.

#### Species and Communities Branch

17 Dick Perry Ave, Technology Park, Kensington

Phone: (08) 9334 0455 Fax: (08) 9334 0278

Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

[www.dpaw.wa.gov.au](http://www.dpaw.wa.gov.au)

# DECLARED RARE AND PRIORITY FLORA LIST

## CONSERVATION CODES

for Western Australian taxa

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**T:**        **Threatened Flora** (Declared Rare Flora - Extant )  
Schedule 1 under the *Wildlife Conservation Act 1950* Rare Flora Notice

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.

**X:**        **Presumed Extinct Flora** (Declared Rare Flora – Extinct)  
Schedule 2 under the *Wildlife Conservation Act 1950* Rare Flora Notice

Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

---

Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria:

**CR:**        **Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild.

**EN:**        **Endangered** –considered to be facing a very high risk of extinction in the wild.

**VU:**        **Vulnerable** - considered to be facing a high risk of extinction in the wild.

A list of the current rankings can be downloaded from DEC's [Listing of species and ecological communities](http://www.dec.wa.gov.au/content/view/full/852/2010/) webpage at  
<http://www.dec.wa.gov.au/content/view/full/852/2010/>

---

**Species and Communities Branch**

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Phone: (08) 9334 0455 Fax: (08) 9334 0278

Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

[www.dpaw.wa.gov.au](http://www.dpaw.wa.gov.au)

Possibly threatened species that have not been adequately surveyed to be listed as Threatened are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

#### **1: Priority One: Poorly-known species**

Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. 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.

#### **2: Priority Two: Poorly-known species**

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. 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.

#### **3: Priority Three: Poorly-known species**

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.

#### **4: Priority Four: Rare, Near Threatened and other species in need of monitoring**

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that 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.

#### **5: Priority Five: Conservation Dependent species**

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

**Recommendations for additions, deletions or changes to the Declared Rare and Priority Flora List should be forwarded to the Flora Administration Officer or Senior Botanist Species and Communities Branch, DEC.**

#### **Species and Communities Branch**

17 Dick Perry Ave, Technology Park, Kensington

Phone: (08) 9334 0455 Fax: (08) 9334 0278

Locked Bag 104, Bentley Delivery Centre, Bentley, Western Australia 6983

[www.dpaw.wa.gov.au](http://www.dpaw.wa.gov.au)

**ABBREVIATIONS USED IN THREATENED AND PRIORITY FLORA DATABASE**

**VESTING**

AAP	Aboriginal Planning Authority
AGR	Chief Executive, Dep. of Agriculture
ALT	Aboriginal Land Trust
APB	Agricultural Protection Board of WA
BGP	Botanical Gardens & Parks Authority
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
CRW	Crown
DAG	Dep. of Agriculture
DOW	Dep. of Water
DPI	Dep. of Planning
EXD	Exec Direc CALM
FES	Fire and Emergency Services Aust.
HOW	Dep. of Housing/State Housing Commission
ILD	Industrial Lands Develop. Auth
LAC	LandCorp
LGA	Shire/LGA
MAG	Minister for Agriculture
MCB	Metropolitan Cemeteries Board
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
PLB	Pastoral Lands Board
PRI	Private/Freehold
RAI	Public Transport Authority
REL	Religious Organisation
SPC	State Planning Commission
SYN	Synergy (ex Western Power)
SWA	State of Western Australia
TEL	Telstra
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

**PURPOSES**

ABR	Aboriginal Reserve
ACC	Access Track
AER	Aerodrome
AIR	Airport
ARS	Agricultural Research Station
BAP	Baptist Union of WA
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CMN	Communications
COM	Common
CON	Conservation Park
CPK	Car Park
CRM	Conservation & Resource Management
DEF	Defence
DRA	Drain

EDE	Educational Endowment
EDU	Educational purposes UWA
ENE	Enjoyment of Natural Environ.
EPL	Ex-pastoral Lease (Sect 33(2) CALM Act)
EPS	Explosives
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
FP	Foreshore Purposes
GE	General Lease
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
LGA	LGA/Shire Requirements
LPR	Landscape Protection
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PCR	Proposed for Conservation
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
PMC	Protection of Meteorite Crater
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUR	Purchase Lease
PUT	Public Utility
QUA	Quarry
RAC	Racecourse
RAD	Radio Station
REC	Recreation
REH	Rehabilitation/Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAL	Saleyards
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
STK	Stock Route
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
UCL	Unallocated Crown Land
UNK	Unknown
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WLS	Wildlife Sanctuary
WOO	Firewood

## ABBREVIATIONS USED IN THE WESTERN AUSTRALIAN HERBARIUM DATABASE

**Geocode Method** - The method that was used to record the latitude and longitude.

**Auto** - Indicates that the coordinate data in the record was created automatically (i.e. by software), usually by creating a coordinate from information provided in the Nearest Named Place or Locality textual description fields.

**GAP** - Acronym for "Generalised Arbitrary Point" as used in HISPID. GAP indicates that the coordinate data was obtained manually from the Nearest Named Place or Locality textual description fields.

**GPS** - Acronym for "Global Positioning System". GPS indicates that the coordinate data in the record was obtained from a GPS unit by the collector of the specimen.

**MAN** - Shorthand for manual. MAN indicates that the coordinate data was created by hand using some method not allowed for by one of the other manual Geocode Method values, in particular, TOPO, GAP, or GPS.

**TOPO** - Shorthand for topographic map. TOPO indicates that the coordinate data was obtained by plotting textual locality details against a topographic map.

**None** - Indicates that no coordinate data has been supplied by the collector.

**Unknown** - Indicates that there is no known method for determining the coordinate data. Should be used if the collector provided no indication of how they sampled the specimen's coordinate data.

**PREC (Precision)** - precision ratings for coordinates.

**Precision 1:** Absolutely precise (to nearest 100m or nearest second) and must be GPS determined. For example 35°26'42"S 123°40'26"E

**Precision 2:** Falling within a diameter of 3km (ca 2 minutes) or if no GPS mentioned in collecting notes. (The location must be able to be pinpointed on a 1:250 000 map, a spot locality. For example 35°26'42"S 123°40'26"E

**Precision 3:** Falling within a diameter of 10km (ca 7 minutes) or for degrees and minutes, where seconds have not been given. For example 35°26'\_"S 123°40'\_"E

**Precision 4:** Falling within a diameter of ca 50km (30 minutes). For example 35°26'\_"S 123°40'\_"E

**Precision 5:** Where a location is a prescribed large geographical area within a state or only the state is given. Diameter is greater than 50km. For example 35°\_"\_"S 123°\_"\_"E

**Precision 6:** used when localities are New Holland, Eastern Australia or Not given. Fields will be left blank.

## Clinton Van Den Bergh

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**From:** Communities Data <Communities.Data@DPaW.wa.gov.au>  
**Sent:** Wednesday, 19 March 2014 3:46 PM  
**To:** Clinton Van Den Bergh  
**Subject:** Results of TEC/PEC Search - Coffey (MarbleBar) (Our Ref:23-0314EC) (Your Ref:PO1419)  
**Attachments:** Conditions of supplying TEC and PEC data.pdf; TEC-PEC\_metadata\_26072011.pdf

Hi,

I refer to your request on the Day of March 2014 for information on threatened and priority ecological communities occurring within the search area provided/ within the co-ordinates provided in the email below/ within a #km radius of the co-ordinates provided in the email below.

A search was undertaken on the Department's Threatened Ecological Communities database. Please note that there are no known occurrences of threatened ecological communities recorded within this boundary.

Please note not all priority ecological communities are currently recorded on our database. You may like to view the current list in related documents at [http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority\\_ecological\\_communities\\_list\\_Sept2013.pdf](http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority_ecological_communities_list_Sept2013.pdf)

Attached are the conditions under which this information has been supplied. The information supplied should be regarded as an indication only of the threatened and priority ecological communities that may be present.

It would be appreciated if any occurrences of threatened and priority ecological communities encountered by you in the area could be reported to this Department to ensure their ongoing management. An occurrence report form and associated manual can be found at <http://www.dpaw.wa.gov.au/plants-and-animals/monitoring/96-standards/140-standard-report-forms?showall=&start=2>

Search area response information is only accurate at the time of provision. Over time, new occurrences or modifications to existing occurrences may occur as information becomes available. It is recommended that searches be re-submitted every six months where projects occur over a long period of time.

An invoice for \$220 (including GST) for the supply of this information will be forwarded.

Your request for information reference number for this search is 23-0314EC. Please quote this unique reference number when acknowledging the Department of Parks and Wildlife as a source of the data in any published material.

*Kind Regards*

Wendy Chow | TEC Ecologist | Species & Communities Branch  
Department of Parks and Wildlife | Kensington | Ph. 9334 0554 | [wendy.chow@dpaw.wa.gov.au](mailto:wendy.chow@dpaw.wa.gov.au)



---

**From:** Clinton Van Den Bergh [<mailto:Clinton.VanDenBergh@coffey.com>]  
**Sent:** Wednesday, 12 March 2014 4:26 PM  
**To:** Flora Data; Fauna Data; Communities Data  
**Subject:** Flora, fauna and communities database search request

Hi DPaW team

Can you please complete threatened flora, fauna and ecological communities database searches according to the attached?

Please quote PO 1419 on all invoices.

Please send all results to this email.

If there are any issues, please do not hesitate to contact me on the numbers below.

Thank you in advance.

Clinton van den Bergh (BSc Hons)

Senior Environmental Scientist/ Botany

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m: +61 439 910 881





# EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/03/14 19:49:47

[Summary](#)

[Details](#)

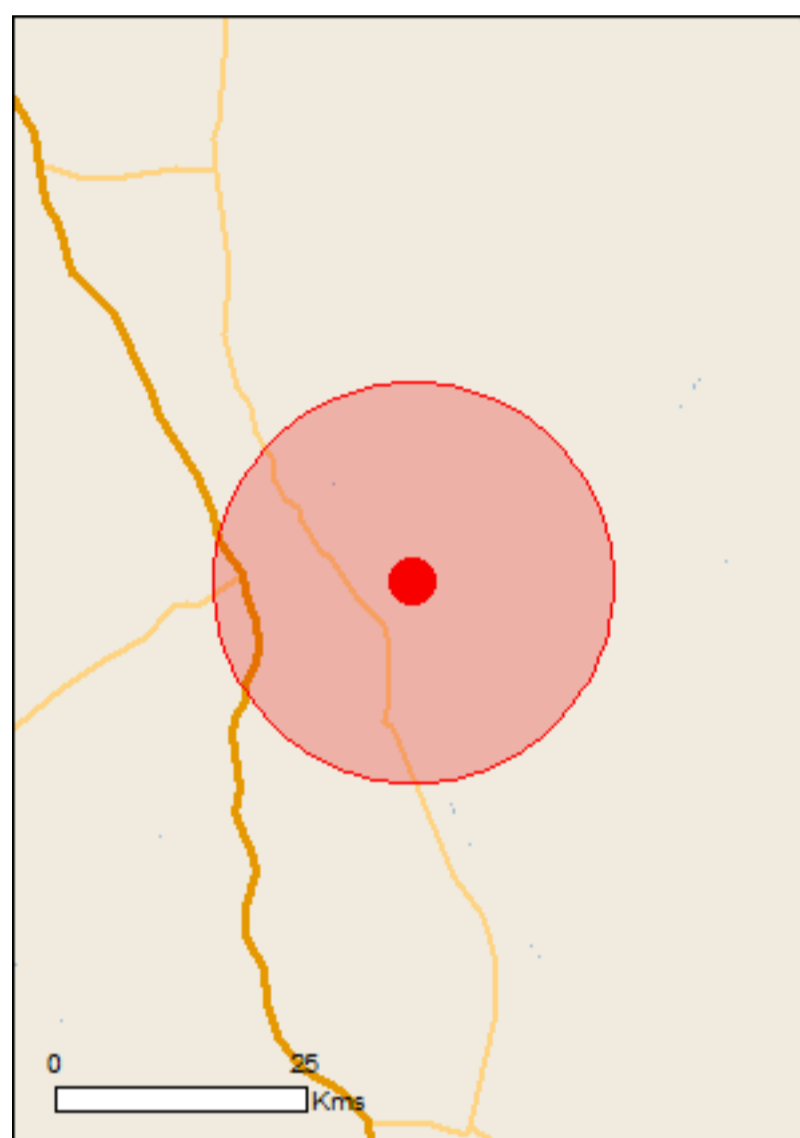
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

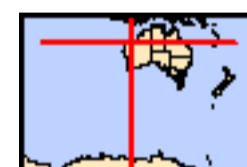
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 20.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Areas:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	6
<a href="#">Listed Migratory Species:</a>	9

## 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.

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.

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.

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	10
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine</a>	None

## 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>	10
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

## Details

### Matters of National Environmental Significance

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

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus hallucatus</a> Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Macrotis lagotis</a> Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Notoryctes caurinus</a> Karrarratul, Northern Marsupial Mole [295]	Endangered	Species or species habitat may occur within area
<a href="#">Rhinonicteris aurantia (Pilbara form)</a> Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
<b>Reptiles</b>		
<a href="#">Liasis olivaceus barroni</a> Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area

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

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area

#### Migratory Terrestrial Species

Name	Threatened	Type of Presence
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat likely to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species	<a href="#">[ Resource Information ]</a>	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat likely to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
<a href="#">Glareola maldivarum</a> Oriental Pratincole [840]		Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	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
<b>Birds</b>		
<a href="#">Columba livia</a> Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
<b>Mammals</b>		
<a href="#">Camelus dromedarius</a> Dromedary, Camel [7]		Species or species habitat likely to occur within area
<a href="#">Canis lupus familiaris</a> Domestic Dog [82654]		Species or species habitat likely to occur within area
<a href="#">Equus asinus</a> Donkey, Ass [4]		Species or species habitat likely to occur within area
<a href="#">Equus caballus</a> Horse [5]		Species or species habitat likely to occur within area
<a href="#">Felis catus</a> Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
<a href="#">Mus musculus</a> House Mouse [120]		Species or species habitat likely to occur within area
<a href="#">Sus scrofa</a> Pig [6]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Vulpes vulpes</a> Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
<a href="#">Cenchrus ciliaris</a> Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

# Coordinates

-21.12556 118.85778

## 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.

# 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](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

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

Please feel free to provide feedback via the [Contact Us](#) page.

## **Appendix B**

**State and Federal conservation codes**

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## State and Federal conservation codes

### 1 State conservation codes

#### 1.1 Flora

##### **T: Threatened species**

Specially protected under the *Wildlife Conservation Act 1950*, listed under Schedule 1 of the Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Species 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.

##### **X: Presumed extinct species**

Specially protected under the *Wildlife Conservation Act 1950*, listed under Schedule 2 of the Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora (which may also be referred to as Declared Rare Flora).

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

Threatened Fauna and Flora are further recognised by the Department of Parks and Wildlife according to their level of threat using IUCN Red List criteria. The ranking are:

**CR Critically Endangered** - considered to be facing an extremely high risk of extinction in the wild.

**EN Endangered** – considered to be facing a very high risk of extinction in the wild.

**VU Vulnerable** – considered to be facing a high risk of extinction in the wild.

Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora. Species that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation Dependent species are placed in Priority 5.

##### **1: Priority One: Poorly-known species**

Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, rail reserves and Main Roads WA road, gravel and soil reserves, and active mineral leases and 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.

## **2: Priority Two: Poorly-known species**

Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc. 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.

## **3: Priority Three: Poorly-known species**

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.

## **4: Priority Four: Rare, Near Threatened and other species in need of monitoring**

- (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
- (b) Near Threatened. Species that are considered to have been adequately surveyed and that 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.

## **5: Priority Five: Conservation dependent species**

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

## **1.2 Ecological Communities**

### **Presumed Totally Destroyed (PD)**

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.

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):

- A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or
- B) All occurrences recorded within the last 50 years have since been destroyed

### **Critically Endangered (CR)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe

modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

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):

- 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):
  - 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);
  - 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.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):
  - 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);
  - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;
  - 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.
- 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).

### **Endangered (EN)**

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

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 any one or more of the following criteria (A, B, or C):

- 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):
  - 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);
  - 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.
- B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

- 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);
  - 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;
  - 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.
- 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).

### **Vulnerable (VU)**

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

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):

- A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
- 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.
- 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.

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

### **Priority One: Poorly-known ecological communities**

Ecological communities that are known from very few occurrences with a very restricted distribution (generally  $\leq 5$  occurrences or a total area of  $\leq 100$ ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

### **Priority Two: Poorly-known ecological communities**

Communities that are known from few occurrences with a restricted distribution (generally  $\leq 10$  occurrences or a total area of  $\leq 200$ ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

### **Priority Three: Poorly known ecological communities**

- (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:
- (ii) Communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
- (iii) Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

### **Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.**

- (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
- (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
- (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

### **Priority Five: Conservation Dependent ecological communities**

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

## **2 Federal conservation codes**

### **2.1 Flora**

#### **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**

A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time:

- (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
- (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.

### **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**

A native species is eligible to be included in the endangered category at a particular time if, at that time:

- (a) it is not critically endangered; and
- (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.

### **Vulnerable**

A native species is eligible to be included in the vulnerable category at a particular time if, at that time:

- (a) it is not critically endangered or endangered; and
- (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.

### **Conservation dependent**

A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:

- (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
- (b) the following subparagraphs are satisfied:
  - (i) the species is a species of fish;
  - (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;
  - (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;
  - (iv) cessation of the plan of management would adversely affect the conservation status of the species.

## **2.2 Ecological communities**

### **Critically endangered**

An ecological community 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**

An ecological community is eligible to be included in the endangered category at a particular time if, at that time:

- (a) it is not critically endangered; and
- (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.

### **Vulnerable**

An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time:

- (a) it is not critically endangered nor endangered; and
- (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.



# **Appendix C**

**Quadrat data**

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## Appendix C

### Quadrat Data

**Site:** NAAR01  
**Described by:** CvdB **Date:** 5/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** Alternate access road  
**MGA Zone:** 50 706644mE; 7656766mN  
**Habitat:** Gently undulating stony plain, low in the landscape  
**Soil:** Stony fine-grained brown silty loam  
**Rock Type:** Calcrete and ironstone  
**Vegetation:** Sparse tall shrubland of *Acacia inaequilatera* over sparse mid shrubland of *Acacia acradenia* and *Petalostylis labicheoides* over low hummock grassland on *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	+1	1.8
<i>Acacia acradenia</i>	2	1.9
<i>Acacia inaequilatera</i>	2	4
<i>Boerhavia coccinea</i>	+	0.2
<i>Bonamia media</i>	+	0.2
<i>Cassyltha capillaris</i>	+	Creeper
<i>Corchorus parviflorus</i>	+	0.5
<i>Goodenia stobbsiana</i>	+	0.2
<i>Hakea lorea</i> subsp. <i>lorea</i>	+	2.5
<i>Indigofera monophylla</i>	+	0.7
<i>Petalostylis labicheoides</i>	+	2

<i>Ptilotus obovatus</i>	+	0.2
<i>Scaevola amblyanthera</i> var. <i>centralis</i>	+	0.4
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	2
<i>Triodia wiseana</i>	50	0.8

**Site:** NAAR02  
**Described by:** CvdB **Date:** 5/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 701778mE; 7659724mN  
**Habitat:** North facing, moderately inclined mid-slope with drainage gullies  
**Soil:** Stony, skeletal fine-grained red/brown silty loam  
**Rock Type:** Ironstone (+ decaying granite?)  
**Vegetation:** Sparse tall shrubland of *Acacia inaequilatera* over hummock grassland of *Triodia wiseana* and *Triodia brizoides*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia acradenia</i>	+	2
<i>Acacia inaequilatera</i>	3	3
<i>Boerhavia coccinea</i>	+	0.3
<i>Bonamia media</i>	+	0.2
<i>Corchorus parviflorus</i>	+	0.5
<i>Corymbia hamersleyana</i>	+	4
<i>Goodenia stobbsiana</i>	+	0.3
<i>Ptilotus obovatus</i>	+	0.2
<i>Triodia brizoides</i>	1	0.4
<i>Triodia wiseana</i>	60	0.6

**Site:** NAAR03  
**Described by:** CvdB **Date:** 5/06/2014 **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 700686mE; 7660712mN  
**Habitat:** Major drainage line  
**Soil:** Brown/ white/ grey sand with rocky (river rocks) substrate  
**Rock Type:** Ironstone, decaying granite and others  
**Vegetation:** Open woodland of *Eucalyptus camaldulensis* var. *obtusa* and *Eucalyptus victrix* over tall shrubland of *Acacia trachycarpa*, *Melaleuca linophylla* and *Atalaya hemiglauca* over shrubland of *Melaleuca lasiandra* over sparse hummock grassland of *Triodia longiceps* and *Triodia epactia* over open tussock grassland of *Cenchrus ciliaris*  
**Veg Condition:** Good to poor  
**Fire Age:** >5 years  
**Notes:** Weeds are prevalent (Buffel and Kapok) as are cattle who visit the area frequently due to pooling of water



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ampliceps</i>	+	3
<i>Acacia pyrifolia</i>	1	2.2
<i>Acacia trachycarpa</i>	5	3.5
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	3
<i>Aerva javanica</i>	+-1	0.7
<i>Atalaya hemiglauca</i>	2	4.5
<i>Boerhavia burbidgeana</i>	+	0.2
<i>Cajanus cinereus</i>	+	1.1
<i>Cenchrus ciliaris</i>	15	0.7
<i>Corchorus parviflorus</i>	+	0.8
<i>Cucumis maderaspatanus</i>	+	Creeper
<i>Cymbopogon</i> sp.	+	0.6
<i>Cyperus vaginatus</i>	+	0.7
<i>Enneapogon lindleyanus</i>	+	0.2
<i>Eucalyptus victrix</i>	5	16
<i>Euphorbia australis</i> var. <i>hispidula</i>	+	0.2
<i>Gossypium robinsonii</i>	+	1
<i>Indigofera monophylla</i>	+	0.8

<i>Melaleuca lasiandra</i>	10	2
<i>Melaleuca linophylla</i>	3	4.5
<i>Rhynchosia minima</i>	+	Creeper
<i>Triodia epactia</i>	1-2	0.7
<i>Triodia longiceps</i>	+1	0.9
<i>Triumfetta clementii</i>	+	0.4

**Site:** NAAR04  
**Described by:** CvdB **Date:** 5/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 700739mE; 7660349mN  
**Habitat:** Very gently undulating stony plain  
**Soil:** Stony, skeletal fine-grained red silty loam  
**Rock Type:** Ironstone, decaying granite?, calcrete  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* (outside) over scattered to sparse tall shrubland of *Acacia inaequilatera*, *Grevillea wickhamii* subsp. *aprica* and *Acacia acradenia* over low shrubland of *Acacia stellaticeps* and *Acacia ptychophylla* over hummock grassland of *Triodia* aff. sp. Shovelanna Hill (S. van Leeuwen 3835) and *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** > 5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	+	1.8
<i>Acacia acradenia</i>	+-1	2
<i>Acacia inaequilatera</i>	+	3.5
<i>Acacia ptychophylla</i>	1-2	1
<i>Acacia stellaticeps</i>	1-2	0.6
<i>Aristida latifolia</i>	+	1
<i>Cassyltha capillaris</i>	+	Creeper
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Corymbia hamersleyana</i>	+	0.3
<i>Goodenia stobbsiana</i>	+	0.3
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	2.1
<i>Ptilotus calostachyus</i>	+1	0.5
<i>Ptilotus obovatus</i>	+	0.4
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	2
<i>Triodia</i> aff. sp. Shovelanna Hill (S. van Leeuwen 3835)	55	0.6
<i>Triodia wiseana</i>	5	0.7

**Site:** NAAR05  
**Described by:** CvdB **Date:** 5/06/2014 **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 701803mE; 7659922mN  
**Habitat:** Minor drainage line located between rolling hills  
**Soil:** Brown/ red/ grey medium-grained sand with rocky substrate  
**Rock Type:** Ironstone, decaying granite and others  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall shrubland of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* over open to sparse hummock grassland of *Triodia epactia* and *Triodia wiseana* over sparse tussock grassland of *Chrysopogon fallax* and *Themeda triandra*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	+	1
<i>Acacia pyrifolia</i>	+	1.8
<i>Acacia tumida</i> var. <i>pilbarensis</i>	30	4
<i>Aristida contorta</i>	+	0.1
<i>Bonamia media</i>	+	0.2
<i>Cajanus cinereus</i>	1	1.2
<i>Cenchrus ciliaris</i>	+	0.7
<i>Chrysopogon fallax</i>	2	1.2
<i>Corchorus parviflorus</i>	+	0.6
<i>Corymbia hamersleyana</i>	2-3	5.5
<i>Cymbopogon bombycinus</i>	+	0.7
<i>Enneapogon lindleyanus</i>	+	0.2
<i>Gossypium robinsonii</i>	1	3.5
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	1	3
<i>Hybanthus aurantiacus</i>	+	0.7
<i>Indigofera monophylla</i>	+	0.7
<i>Paraneurachne muelleri</i>	+	0.3
<i>Petalostylis labicheoides</i>	5	2.5
<i>Santalum lanceolatum</i>	+	1.2
<i>Tephrosia rosea</i> var. <i>clementii</i>	+-1	0.9

<i>Themeda triandra</i>	+	0.7
<i>Triodia epactia</i>	20	1
<i>Triodia wiseana</i>	5	0.8

**Site:** NAAR06  
**Described by:** CvdB **Date:** 6/06/2014 **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 682868mE; 7669905mN  
**Habitat:** Major drainage line  
**Soil:** Red/ brown/ white coarse sand with rocky substrate  
**Rock Type:** Ironstone, decaying granite and others  
**Vegetation:** Woodland of *Eucalyptus camaldulensis* var. *obtusa* and *Eucalyptus victrix* over sparse low woodland of *Melaleuca argentea* over tall shrubland of *Acacia ampliceps* and *Melaleuca linophylla* over open hummock grassland of *Triodia epactia* over tussock grassland of *Bothriochloa ewartiana* and *Sorghum plumosum*  
**Veg Condition:** Good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Abutilon cunninghamii</i>	+	1.2
<i>Acacia ampliceps</i>	12	4
<i>Acacia bivenosa</i>	+	1.7
<i>Acacia pyrifolia</i>	+	1.8
<i>Acacia stellaticeps</i>	+	1
<i>Acacia trachycarpa</i>	2	3
<i>Ammannia baccifera</i>	+	0.2
<i>Bothriochloa ewartiana</i>	15	1.3
<i>Cajanus cinereus</i>	+	1.4
<i>Cenchrus ciliaris</i>	6	0.6
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.6
<i>Corchorus parviflorus</i>	+	0.5
<i>Crotalaria cunninghamii</i>	+	1.3
<i>Cymbopogon bombycinus</i>	+	0.9
<i>Cyperus vaginatus</i>	+	0.4
<i>Eragrostis tenellula</i>	+	0.2
<i>Eriachne benthamii</i>	+	0.7
<i>Eriachne obtusa</i>	+	0.4
<i>Eucalyptus victrix</i>	20	15
<i>Eulalia aurea</i>	+	1

<i>Euphorbia australis</i> var. <i>hispidula</i>	+	0.2
<i>Euphorbia biconvexa</i>	+	0.3
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	3
<i>Heteropogon contortus</i>	+	0.6
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Isotropis forrestii</i>	+	0.4
<i>Melaleuca argentea</i>	+	7
<i>Melaleuca linophylla</i>	1	2
<i>Petalostylis labicheoides</i>	+	1.8
<i>Phyllanthus maderaspatensis</i>	+	0.5
<i>Pluchea rubelliflora</i>	+	0.2
<i>Rhynchosia minima</i>	+	Creeper
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	+	1.6
<i>Sorghum plumosum</i>	2	1.4
<i>Stemodia grossa</i>	+	0.3
<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>	+	0.1
<i>Themeda triandra</i>	+	0.5
<i>Triodia epactia</i>	10	0.7

**Site:** NAAR07  
**Described by:** CvdB **Date:** 6/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 683501mE; 7670436mN  
**Habitat:** Sandplain  
**Soil:** Red/ brown medium-grained clayey sand  
**Rock Type:** Ironstone  
**Vegetation:** Scattered low trees of *Corymbia zygophylla* over shrubland of *Acacia ancistrocarpa* over hummock grassland of *Triodia* aff. *lanigera*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	12	1.9
<i>Bonamia erecta</i>	2	0.4
<i>Cleome viscosa</i>	+	0.3
<i>Corymbia zygophylla</i>	2	3.5
<i>Grevillea wickhamii</i>	+	0.3
<i>Heliotropium muticum</i>	+	0.1
<i>Mollugo molluginea</i>	+	0.2
<i>Petalostylis labicheoides</i>	+	0.9
<i>Ptilotus calostachyus</i>	+	0.4
<i>Ptilotus obovatus</i>	+	0.5
<i>Tephrosia uniovulata</i>	+	0.4
<i>Triodia</i> aff. <i>lanigera</i>	60	0.6

**Site:** NAAR08  
**Described by:** CvdB **Date:** 6/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 689857mE; 7664310mN  
**Habitat:** Stony plain  
**Soil:** Stony red/ brown fine to medium-grained silty loam  
**Rock Type:** Ironstone and decaying granite  
**Vegetation:** Shrubland of *Acacia acradenia* and *Acacia ancistrocarpa* over hummock grassland of *Triodia* aff. *lanigera* and *Triodia* aff. sp. Shovelanna Hill (S. van Leeuwen 3835)  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	5	2.2
<i>Acacia acradenia</i>	8	1.8
<i>Cleome uncifera</i>	+	0.3
<i>Corchorus parviflorus</i>	+	0.5
<i>Goodenia stobbsiana</i>	+	0.2
<i>Ptilotus calostachyus</i>	+	0.8
<i>Ptilotus obovatus</i>	+	0.5
<i>Triodia</i> aff. sp. Shovelanna Hill (S. van Leeuwen 3835)	3	0.6
<i>Triodia</i> aff. <i>lanigera</i>	45	0.8

**Site:** NAAR09  
**Described by:** CvdB **Date:** 6/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 690976mE; 7664427mN  
**Habitat:** Very gently undulating stony plain  
**Soil:** Stony red/ brown fine to medium-grained silty loam  
**Rock Type:** Ironstone, granite  
**Vegetation:** Scattered tall shrubs of *Grevillea wickhamii* subsp. *aprica* and *Acacia tumida* var. *pilbarensis* over shrubland of *Acacia ancistrocarpa* and *Acacia acradenia* over hummock grassland of *Triodia wiseana* and *Triodia* aff. sp. Shovelanna Hill (S. van Leeuwen 3835)  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	6	2
<i>Acacia acradenia</i>	20	1.8
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+-1	4
<i>Bonamia media</i>	+	0.2
<i>Cassyltha capillaris</i>	+	Creeper
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.4
<i>Goodenia stobbsiana</i>	+	0.4
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	3
<i>Hybanthus aurantiacus</i>	+	1.5
<i>Indigofera monophylla</i>	+	1
<i>Paraneurachne muelleri</i>	+	0.5
<i>Petalostylis labicheoides</i>	+	1.9
<i>Ptilotus calostachyus</i>	+	0.8
<i>Sida</i> sp. Articulation below (A.A. Mitchell PRP 1605)	+	1.8
<i>Triodia</i> aff. sp. Shovelanna Hill (S. van Leeuwen 3835)	5	0.5
<i>Triodia wiseana</i>	50	0.7

**Site:** NAAR10  
**Described by:** CvdB **Date:** 6/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 693789mE; 7662586mN  
**Habitat:** Very gently undulating stony plain  
**Soil:** Stony red/brown fine to medium-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Scattered tall shrubs of *Grevillea wickhamii* subsp. *aprica* over Shrubland of *Acacia acradenia* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	+1	1.8
<i>Acacia acradenia</i>	8	1.9
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	1.6
<i>Bonamia erecta</i>	+	0.2
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+1	2.8
<i>Indigofera monophylla</i>	+	0.7
<i>Mollugo molluginea</i>	+	0.2
<i>Ptilotus calostachyus</i>	+	1.1
<i>Triodia wiseana</i>	45	0.6

**Site:** NAAR11  
**Described by:** CvdB **Date:** 7/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 694315mE; 7661948mN  
**Habitat:** Flat sandplain (prone to flooding)  
**Soil:** Red/ brown fine-grained silty sand with clay surface  
**Rock Type:** Ironstone  
**Vegetation:** Tall scrub of *Acacia tumida* var. *pilbarensis* and *Grevillea wickhamii* subsp. *aprica* over sparse mid shrubland of *Acacia acradenia*, *Acacia ancistrocarpa* and *Petalostylis labicheoides* over hummock grassland of *Triodia epactia* and *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	2	2
<i>Acacia acradenia</i>	4	2
<i>Acacia tumida</i> var. <i>pilbarensis</i>	45	3
<i>Bonamia erecta</i>	+	0.4
<i>Corchorus parviflorus</i>	+-1	0.4
<i>Dampiera candidans</i>	+	0.5
<i>Dodonaea coriacea</i>	+	0.4
<i>Goodenia stobbsiana</i>	+	0.4
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	2.8
<i>Indigofera monophylla</i>	+-1	0.8
<i>Keraudrenia nephrosperma</i>	+	0.4
<i>Mollugo molluginea</i>	+	0.1
<i>Petalostylis labicheoides</i>	2	2
<i>Ptilotus calostachyus</i>	+	0.5
<i>Triodia epactia</i>	20	0.6
<i>Triodia wiseana</i>	15	0.7

**Site:** NAAR12  
**Described by:** CvdB **Date:** 7/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 695261mE; 7661480mN  
**Habitat:** Flat stony plain  
**Soil:** Stony red/ brown silty loam with rocky substrate  
**Rock Type:** Ironstone  
**Vegetation:** Shrubland of *Acacia ancistrocarpa* and *Acacia acradenia* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** 2-5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	2-3	1.8
<i>Acacia acradenia</i>	10	1.7
<i>Corchorus parviflorus</i>	+	0.5
<i>Dampiera candidans</i>	+	0.4
<i>Goodenia stobbsiana</i>	+	0.2
<i>Indigofera monophylla</i>	+	0.3
<i>Petalostylis labicheoides</i>	+	1.1
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus obovatus</i>	+	0.4
<i>Triodia epactia</i>	+	0.6
<i>Triodia wiseana</i>	35	0.7

**Site:** NAAR13  
**Described by:** CvdB **Date:** 7/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 695514mE; 7662205mN  
**Habitat:** mid to upper slope, moderately sloping to the south-east  
**Soil:** Rocky red/ brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Low shrubland of *Acacia ancistrocarpa* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Good to very good  
**Fire Age:** 12-18 months  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	+-1	0.5
<i>Acacia acradenia</i>	+	0.4
<i>Acacia inaequilatera</i>	+	1.8
<i>Bonamia media</i>	+	0.1
<i>Cleome uncifera</i>	+	0.4
<i>Corchorus parviflorus</i>	+-1	0.4
<i>Dampiera candidans</i>	+	0.3
<i>Goodenia microptera</i>	+	0.3
<i>Goodenia nuda</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.2
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	0.5
<i>Indigofera monophylla</i>	+-1	0.3
<i>Mollugo molluginea</i>	+	0.1
<i>Ptilotus axillaris</i>	+	0.2
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus obovatus</i>	+	0.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.6
<i>Stackhousia muricata</i>	+	0.4
<i>Tephrosia</i> aff. <i>supina</i>	+	0.1
<i>Tephrosia</i> aff. <i>uniovulata</i>	+	0.3
<i>Tribulus platypterus</i>	1-2	0.7
<i>Tribulus suberosus</i>	+	0.5
<i>Triodia wiseana</i>	20	0.5

**Site:** NAAR14  
**Described by:** CvdB **Date:** 7/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 698078mE; 7661335mN  
**Habitat:** The upper slope of a small rise, facing north-east  
**Soil:** Rocky brown/ red fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Tall open shrubland of *Acacia inaequilatera* over scattered shrubs of *Petalostylis labicheoides* over low shrubland of *Acacia ptychophylla* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia inaequilatera</i>	1	4
<i>Acacia ptychophylla</i>	15	0.5
<i>Bonamia media</i>	+	0.1
<i>Corchorus parviflorus</i>	+	0.5
<i>Corymbia hamersleyana</i>	+	0.4
<i>Dampiera candidans</i>	+	0.5
<i>Eriachne pulchella</i>	+	0.1
<i>Goodenia stobbsiana</i>	+	0.1
<i>Indigofera monophylla</i>	+	0.5
<i>Mollugo molluginea</i>	+	0.1
<i>Petalostylis labicheoides</i>	+-1	1.7
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus obovatus</i>	+	0.5
<i>Solanum lasiophyllum</i>	+	0.4
<i>Trianthera glossostigma</i>	+	0.1
<i>Tribulus hirsutus</i>	+	0.1
<i>Triodia wiseana</i>	35-40	0.7

**Site:** NAAR15  
**Described by:** CvdB **Date:** 7/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 697320mE; 7661570mN  
**Habitat:** Very gently undulating stony plain  
**Soil:** Brown fine-grained clayey silt with rocky surface and substrate  
**Rock Type:** Quartz, decaying granite, ironstone  
**Vegetation:** Scattered low trees (outside) of *Eucalyptus leucophloia* subsp. *Leucophloia* over scattered shrubs (outside) of *Acacia ancistrocarpa* over hummock grassland of *Triodia wiseana* over scattered low shrubs of *Acacia stellaticeps*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia stellaticeps</i>	+1	0.4
<i>Bonamia media</i>	+	0.1
<i>Corymbia hamersleyana</i>	+	1
<i>Eriachne pulchella</i>	+	0.1
<i>Fimbristylis simulans</i>	+	0.1
<i>Fimbristylis</i> sp.	+	0.1
<i>Goodenia microptera</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.3
<i>Indigofera monophylla</i>	+	0.3
<i>Mollugo molluginea</i>	+	0.1
<i>Portulaca oleracea</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.9
<i>Ptilotus obovatus</i>	+	0.2
<i>Senna symonii</i>	+	1.6
<i>Solanum lasiophyllum</i>	+	0.4
<i>Trianthema triquetra</i>	+	0.1
<i>Triodia</i> aff. sp. Shovelanna Hill (S. van Leeuwen 3835)	+	0.4
<i>Triodia wiseana</i>	35	1

Site: NAAR16

**Described by:** CvdB                      **Date:** 7/06/2014                      **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 698031mE; 7660978mN  
**Habitat:** Ridge top in a north to south alignment  
**Soil:** Skeletal red/ brown fine-grained silt  
**Rock Type:** Ironstone, shale?  
**Vegetation:** Scattered trees (outside) of *Eucalyptus leucophloia* subsp. *Leucophloia* over scattered tall shrubs of *Acacia inaequilatera* over scattered mid shrubs of *Acacia ancistrocarpa* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Abutilon</i> sp.	+	0.3
<i>Acacia ancistrocarpa</i>	+-1	1.7
<i>Acacia bivenosa</i>	1+	1.4
<i>Acacia acradenia</i>	1	1.2
<i>Acacia inaequilatera</i>	+-1	3
<i>Acacia ptychophylla</i>	+-1	0.7
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	1.2
<i>Cassyltha capillaris</i>	+	Creeper
<i>Dodonaea coriacea</i>	+	1.2
<i>Eriachne mucronata</i>	+	0.3
<i>Eriachne pulchella</i>	+	0.1
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+	1.7
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Gossypium australe</i>	+	0.5
<i>Hibiscus coatesii</i>	+	0.7
<i>Hybanthus aurantiacus</i>	+	0.2
<i>Indigofera monophylla</i>	+	0.2
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.1
<i>Senna glutinosa</i> subsp. <i>x luerksenii</i>	+	0.5
<i>Senna symonii</i>	+-1	1.2
<i>Solanum lasiophyllum</i>	+	0.3
<i>Tribulus suberosus</i>	+	0.4

*Triodia wiseana*

30

0.6

**Site:** NAAR17  
**Described by:** CvdB **Date:** 8/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 683832mE; 7668145mN  
**Habitat:** Floodplain along the banks of the Gillam Creek  
**Soil:** Red/ brown fine-grained silty clay  
**Rock Type:** None  
**Vegetation:** Hummock grassland of *Triodia epactia* and *Triodia* aff. *lanigera* over low shrubland of *Pluchea ferdinandi-muelleri*  
**Veg Condition:** Good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia orthocarpa</i>	+	1.4
<i>Acacia stellaticeps</i>	+	0.6
<i>Aristida holathera</i>	+	0.3
<i>Cenchrus ciliaris</i>	+	0.3
<i>Corchorus parviflorus</i>	+	0.6
<i>Dactyloctenium radulans</i>	+	0.1
<i>Eragrostis cumingii</i>	+	0.1
<i>Eragrostis dielsii</i>	+	0.1
<i>Eragrostis eriopoda</i>	+	0.3
<i>Eriachne mucronata</i>	+	0.2
<i>Heliotropium muticum</i>	+	0.1
<i>Indigofera monophylla</i>	+	0.4
<i>Mollugo molluginea</i>	+	0.2
<i>Pluchea ferdinandi-muelleri</i>	12	1
<i>Ptilotus calostachyus</i>	+	0.5
<i>Ptilotus obovatus</i>	+	0.3
<i>Sporobolus actinocladus</i>	+	0.2
<i>Triodia</i> aff. <i>lanigera</i>	8	0.9
<i>Triodia epactia</i>	30	1
<i>Triodia secunda</i>	2	0.4

**Site:** NAAR18  
**Described by:** CvdB **Date:** 8/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 690426mE; 7663920mN  
**Habitat:** Sandplain  
**Soil:** Red/ brown medium-grained clayey sand  
**Rock Type:** None  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall scrub of *Acacia tumida* var. *pilbarensis* and *Acacia ancistrocarpa* over hummock grassland of *Triodia epactia* and *Triodia* aff. *lanigera*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	15	2.4
<i>Acacia acradenia</i>	+1	1.8
<i>Acacia tumida</i> var. <i>pilbarensis</i>	60	3
<i>Bonamia media</i>	+	0.4
<i>Chrysopogon fallax</i>	1-2	0.4
<i>Corchorus parviflorus</i>	+	0.3
<i>Corymbia hamersleyana</i>	2	6
<i>Dampiera candicans</i>	+	0.6
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	2.7
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Indigofera monophylla</i>	+	0.4
<i>Mollugo molluginea</i>	+	0.1
<i>Petalostylis labicheoides</i>	+	2.8
<i>Ptilotus obovatus</i>	+	0.4
<i>Triodia</i> aff. <i>lanigera</i>	+	1.1
<i>Triodia epactia</i>	35	1.2

**Site:** NAAR19  
**Described by:** CvdB **Date:** 8/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 700969mE; 7660203mN  
**Habitat:** Gently undulating small hills dissected by minor drainage lines  
**Soil:** Brown/ white skeletal fine-grained silty loam  
**Rock Type:** Calcrete, decaying granite  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall open shrubland of *Hakea lorea* subsp. *Lorea*, *Acacia inaequilatera* and *Grevillea wickhamii* subsp. *aprica* over open shrubland of *Acacia bivenosa*, *Acacia acradenia* and *Petalostylis labicheoides* over scattered low shrubs of *Acacia ptychophylla* and *Corchorus lasiocarpus* subsp. *parvus* over hummock grassland of *Triodia wiseana* and *Triodia* aff. sp. Shovelanna Hill (S. van Leeuwen 3835)  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	1-2	1.8
<i>Acacia acradenia</i>	+1	2
<i>Acacia inaequilatera</i>	1	2.2
<i>Acacia ptychophylla</i>	2	1
<i>Bonamia media</i>	+	0.3
<i>Cassytha capillaris</i>	+	Creepers
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+1	0.6
<i>Corymbia hamersleyana</i>	+	2
<i>Goodenia stobbsiana</i>	+	0.3
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	2	3.2
<i>Hakea lorea</i> subsp. <i>lorea</i>	+	3
<i>Hybanthus aurantiacus</i>	+	0.3
<i>Indigofera monophylla</i>	+	0.4
<i>Petalostylis labicheoides</i>	2	1.6
<i>Ptilotus obovatus</i>	+	0.3
<i>Scaevola amblyanthera</i> var. <i>centralis</i>	+	0.2
<i>Solanum lasiophyllum</i>	+	0.3
<i>Solanum phlomoides</i>	+	0.4
<i>Triodia</i> aff. sp. Shovelanna Hill (S. van Leeuwen 3835)	15	0.4
<i>Triodia wiseana</i>	25	0.6

**Site:** NAAR20  
**Described by:** CvdB **Date:** 8/06/2014 **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 701920mE; 7660282mN  
**Habitat:** Ridge line along a north to south alignment  
**Soil:** Skeletal red/ brown silty loam  
**Rock Type:** Ironstone, granite  
**Vegetation:** Scattered tall shrubs of *Grevillea pyramidalis* subsp. *Leucadendron* and *Acacia inaequilatera* over scattered low shrubs of *Gossypium australe* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia inaequilatera</i>	+-1	2.1
<i>Boerhavia coccinea</i>	+	0.2
<i>Corchorus parviflorus</i>	+	0.3
<i>Cymbopogon obtectus</i>	+	0.5
<i>Cyperus iria</i>	+	0.3
<i>Eriachne mucronata</i>	+-1	0.4
<i>Fimbristylis</i> sp.	+	0.1
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Gossypium australe</i>	2-3	1
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	1-2	3
<i>Indigofera monophylla</i>	+	0.4
<i>Polycarpaea longiflora</i>	+	0.2
<i>Rhyncharrhena linearis</i>	+	0.9
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Solanum lasiophyllum</i>	+	0.4
<i>Tribulus suberosus</i>	+	0.4
<i>Triodia wiseana</i>	30	0.8

**Site:** NAAR21  
**Described by:** CvdB **Date:** 8/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 702267mE; 7659424mN  
**Habitat:** Undulating stony hills  
**Soil:** Stony brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Tall open shrubland of *Acacia inaequilatera* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia acradenia</i>	+	1.2
<i>Acacia inaequilatera</i>	8	3.6
<i>Acacia ptychophylla</i>	+	0.7
<i>Bonamia media</i>	+	0.3
<i>Corchorus parviflorus</i>	+	0.4
<i>Corymbia hamersleyana</i>	+	1.1
<i>Goodenia microptera</i>	+	0.2
<i>Goodenia stobbsiana</i>	+	0.1
<i>Mollugo molluginea</i>	+	0.1
<i>Portulaca oleracea</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	1.5
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.9
<i>Senna symonii</i>	+	1
<i>Solanum phlomoides</i>	+	0.7
<i>Triodia wiseana</i>	45	0.8

**Site:** NAAR22  
**Described by:** CvdB **Date:** 9/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 702507mE; 7659921mN  
**Habitat:** Gently undulating rocky hills, incised by small flowlines  
**Soil:** Brown/ black fine-grained silty loam with rocky surface and substrate  
**Rock Type:** Ironstone and calcrete  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over scattered tall shrubs of *Acacia inaequilatera* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	+	1.2
<i>Acacia acradenia</i>	+-1	1.8
<i>Acacia inaequilatera</i>	2	3
<i>Boerhavia coccinea</i>	+	0.2
<i>Bonamia media</i>	+	0.3
<i>Cassytha capillaris</i>	+	Creeper
<i>Corchorus parviflorus</i>	+	0.4
<i>Corymbia hamersleyana</i>	1	5.5
<i>Hibiscus</i> sp.	+	0.2
<i>Phyllanthus maderaspatensis</i>	+	0.4
<i>Ptilotus auriculifolius</i>	+	0.2
<i>Ptilotus obovatus</i>	+	0.4
<i>Solanum phlomoides</i>	+	0.4
<i>Tephrosia</i> aff. <i>supina</i>	+	0.1
<i>Triodia wiseana</i>	40-45	0.7

**Site:** NAAR23  
**Described by:** CvdB **Date:** 9/06/2014 **Type:** Quadrat (100m x 25m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 702670mE; 7659759mN  
**Habitat:** Minor drainage line which feeds into the Gillam Creek  
**Soil:** Stony brown coarse-grained sand with rocky substrate  
**Rock Type:** Ironstone and other river rocks  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall open scrub of *Acacia tumida* var. *pilbarensis*, *Gossypium robinsonii* and *Petalostylis labicheoides* over scattered mid shrubs of *Indigofera monophylla* and *Tephrosia rosea* var. *clementii* over open hummock grassland of *Triodia epactia* over tussock grassland of *Chrysopogon fallax*, *Cenchrus ciliaris* and *Good contortus*  
**Veg Condition:** Good  
**Fire Age:** >5 years  
**Notes:** Buffel grass along drainage and evidence of cattle grazing along the banks of the minor drainage line



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia ancistrocarpa</i>	+	3
<i>Acacia bivenosa</i>	+	2
<i>Acacia acradenia</i>	+	1.6
<i>Acacia pyrifolia</i>	+	2.5
<i>Acacia trachycarpa</i>	+	0.6
<i>Acacia tumida</i> var. <i>pilbarensis</i>	40	4
<i>Cenchrus ciliaris</i>	1	0.4
<i>Chrysopogon fallax</i>	3	0.5
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.7
<i>Corymbia hamersleyana</i>	+	5
<i>Cymbopogon bombycinus</i>	+-1	0.5
<i>Enneapogon lindleyanus</i>	+	0.2
<i>Gossypium robinsonii</i>	1	3.5
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	4.5
<i>Hakea lorea</i> subsp. <i>lorea</i>	+	1.2
<i>Heteropogon contortus</i>	+-1	0.9
<i>Indigofera monophylla</i>	+-1	1.5
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	Creeper

<i>Petalostylis labicheoides</i>	1	2.5
<i>Psyrax latifolia</i>	+	1.5
<i>Rhynchosia minima</i>	+	Creeper
<i>Cullen leucanthum</i>	+	1.5
<i>Tephrosia rosea</i> var. <i>clementii</i>	+-1	1
<i>Themeda triandra</i>	+	0.6
<i>Triodia epactia</i>	30	0.8
<i>Triodia wiseana</i>	+	0.6

**Site:** NAAR24  
**Described by:** CvdB **Date:** 9/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 702703mE; 7659350mN  
**Habitat:** Undulating stony hills, incised by flowlines  
**Soil:** Stony red/ brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Scattered tall shrubs of *Acacia inaequilatera* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia acradenia</i>	+	1.5
<i>Acacia inaequilatera</i>	1-2	3
<i>Bonamia media</i>	+	0.1
<i>Cassyltha capillaris</i>	+	Creeper
<i>Eriachne pulchella</i>	+	0.1
<i>Fimbristylis simulans</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.6
<i>Ptilotus obovatus</i>	+	0.2
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	0.7
<i>Solanum phlomoides</i>	+	0.4
<i>Triodia wiseana</i>	45	0.7

**Site:** NAAR25  
**Described by:** CvdB **Date:** 9/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 703610mE; 7659274mN  
**Habitat:** Floodplain besides Gillam Creek  
**Soil:** Brown/ red medium-grained deep sands  
**Rock Type:** None  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall scattered shrubs of *Grevillea pyramidalis* subsp. *leucadendron*, *Petalostylis labicheoides* and *Hakea lorea* subsp. *Lorea* over open shrubland of *Acacia bivenosa* and *Acacia pyrifolia* over hummock grassland of *Triodia epactia*  
**Veg Condition:** Very good to good  
**Fire Age:** >5 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	3	1.8
<i>Acacia acradenia</i>	+	1.3
<i>Acacia pyrifolia</i>	1-2	1.9
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	3
<i>Atalaya hemiglauca</i>	1-2	1.8
<i>Boerhavia coccinea</i>	+	0.4
<i>Bonamia pannosa</i>	+	0.2
<i>Bonamia rosea</i>	+	0.3
<i>Cajanus cinereus</i>	+	0.5
<i>Cenchrus ciliaris</i>	7	0.4
<i>Chrysopogon fallax</i>	12	0.9
<i>Corchorus parviflorus</i>	+	0.6
<i>Corymbia hamersleyana</i>	1	6
<i>Eragrostis eriopoda</i>	+	0.3
<i>Gossypium australe</i>	+	1.1
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	2	3
<i>Hakea lorea</i> subsp. <i>lorea</i>	+	3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	Creeper
<i>Mollugo molluginea</i>	+	0.1
<i>Petalostylis labicheoides</i>	2	2
<i>Ptilotus obovatus</i>	+	0.2
<i>Rhynchosia minima</i>	+	Creeper

<i>Sida echinocarpa</i>	+	1.6
<i>Tephrosia rosea</i> var. <i>clementii</i>	+	0.9
<i>Triodia epactia</i>	30	1.3

**Site:** NAAR26  
**Described by:** CvdB **Date:** 9/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 702992mE; 7658981mN  
**Habitat:** Undulating rocky hills  
**Soil:** Rocky brown/ red fine-grained silty loam  
**Rock Type:** Ironstone with patches of calcrete  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall scattered shrubs of *Acacia inaequilatera* over scattered shrubs of *Acacia acradenia* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia acradenia</i>	+-1	1.6
<i>Acacia inaequilatera</i>	+-1	4.5
<i>Boerhavia coccinea</i>	+	0.3
<i>Bonamia media</i>	+	0.4
<i>Corchorus parviflorus</i>	+	0.5
<i>Corymbia hamersleyana</i>	+-1	4.5
<i>Goodenia stobbsiana</i>	+	0.2
<i>Hakea lorea</i> subsp. <i>lorea</i>	+	1.3
<i>Indigofera monophylla</i>	+	0.4
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus obovatus</i>	+	0.3
<i>Solanum phlomoides</i>	+	0.6
<i>Triodia wiseana</i>	45	0.7

**Site:** NAAR27  
**Described by:** CvdB **Date:** 10/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 707213mE; 7657320mN  
**Habitat:** Very steep slope facing west  
**Soil:** Skeletal, rocky red/ brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Scattered low trees of *Eucalyptus leucophloia* subsp. *leucophloia* over scattered shrubs of *Acacia bivenosa* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** 2 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	1	0.7
<i>Acacia acradenia</i>	+	0.4
<i>Acacia inaequilatera</i>	+-1	1
<i>Bonamia media</i>	+	0.2
<i>Cheilanthes sieberi</i>	+	0.1
<i>Corchorus parviflorus</i>	+-1	0.7
<i>Cymbopogon obtectus</i>	+	0.4
<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	+-1	5
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+	0.9
<i>Gomphrena cunninghamii</i>	+	0.1
<i>Goodenia microptera</i>	+	0.3
<i>Gossypium australe</i>	+	0.8
<i>Mollugo molluginea</i>	+	0.1
<i>Ptilotus axillaris</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.7
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+-1	1.2
<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)	+	0.3
<i>Solanum phlomoides</i>	+	0.3
<i>Sporobolus australasicus</i>	+	0.1
<i>Tephrosia</i> aff. <i>supina</i>	+	0.1
<i>Terminalia canescens</i>	+	0.3
<i>Triodia wiseana</i>	30	0.6

**Site:** NAAR28  
**Described by:** CvdB **Date:** 10/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 706533mE; 7657175mN  
**Habitat:** Floodplain adjacent to the Gillam Creek  
**Soil:** Pink/ brown medium-grained clayey sand  
**Rock Type:** None  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over scattered shrubs of *Petalostylis labicheoides* and *Grevillea wickhamii* subsp. *aprica* over low open shrubland of *Acacia stellaticeps* over hummock grassland of *Triodia epactia*  
**Veg Condition:** Good to poor  
**Fire Age:** 2-4 years  
**Notes:** Weeds and heavy cattle grazing



#### SPECIES

Name	Cover (%)	Height (m)
<i>Acacia pyrifolia</i>	+	1.2
<i>Acacia stellaticeps</i>	6	0.5
<i>Acacia trachycarpa</i>	+	0.7
<i>Acacia tumida</i> var. <i>pilbarensis</i>	+	0.7
<i>Bonamia pannosa</i>	+	0.1
<i>Bonamia erecta</i>	+	0.2
<i>Cajanus cinereus</i>	+	0.6
<i>Cenchrus ciliaris</i>	+-1	0.2
<i>Cleome uncifera</i>	+	0.3
<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>	+	0.8
<i>Corchorus parviflorus</i>	+	0.4
<i>Corymbia hamersleyana</i>	1	4.5
<i>Eragrostis xerophila</i>	+	0.3
<i>Evolvulus alsinoides</i>	+	0.1
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	+-1	1.8
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	1.7
<i>Hakea lorea</i> subsp. <i>lorea</i>	+-1	3
<i>Hibiscus leptocladus</i>	+	0.3
<i>Indigofera monophylla</i>	+-1	0.3
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	Creeper
<i>Petalostylis labicheoides</i>	1-2	2
<i>Ptilotus obovatus</i>	+	0.3
<i>Scaevola spinescens</i>	1	0.4

#### LIST:

<i>Senna notabilis</i>	+	0.2
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)		1
<i>Tephrosia rosea</i> var. <i>clementii</i>	+1	0.6
<i>Triodia epactia</i>	35	0.5

**Site:** NAAR29  
**Described by:** CvdB **Date:** 10/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 706026mE; 7657570mN  
**Habitat:** Undulating rocky hills feeding into a small basin and drainage line  
**Soil:** Rocky red/ brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over scattered tall shrubs of *Hakea lorea* subsp. *Lorea* over open shrubland of *Acacia acradenia* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** >5 years  
**Notes:**



**SPECIES LIST:**

Name	Cover (%)	Height (m)
<i>Acacia acradenia</i>	3	1.9
<i>Acacia inaequilatera</i>	2	3.8
<i>Corymbia hamersleyana</i>	+1	4
<i>Goodenia stobbsiana</i>	+	0.3
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+1	2.5
<i>Indigofera monophylla</i>	+	0.6
<i>Mollugo molluginea</i>	+	0.1
<i>Pentalepis trichodesmoides</i>	+	0.7
<i>Petalostylis labicheoides</i>	+1	1.9
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus obovatus</i>	+	0.4
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.1
<i>Triodia wiseana</i>	45	1.2

**Site:** NAAR30  
**Described by:** CvdB **Date:** 10/06/2014 **Type:** Quadrat (50m x 50m)  
**Location:** North Star Alternate Access Road  
**MGA Zone:** 50 704979mE; 7657597mN  
**Habitat:** Undulating rocky hills dissected with flowlines  
**Soil:** Rocky red/ brown fine-grained silty loam  
**Rock Type:** Ironstone  
**Vegetation:** Scattered low trees of *Corymbia hamersleyana* over tall open shrubland of *Acacia inaequilatera* and *Hakea lorea* subsp. *Lorea* over scattered shrubs of *Acacia acradenia* over hummock grassland of *Triodia wiseana*  
**Veg Condition:** Very good  
**Fire Age:** 2-4 years  
**Notes:**



#### SPECIES LIST:

Name	Cover (%)	Height (m)
<i>Acacia bivenosa</i>	+	0.6
<i>Acacia acradenia</i>	+	0.9
<i>Acacia inaequilatera</i>	1	3.5
<i>Acacia ptychophylla</i>	1	0.5
<i>Bonamia media</i>	+	0.2
<i>Cassytha capillaris</i>	+	Creeper
<i>Cleome uncifera</i>	+	0.3
<i>Clerodendrum floribundum</i>	+	0.9
<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	+	1.1
<i>Corchorus parviflorus</i>	+	0.4
<i>Corymbia hamersleyana</i>	+-1	3
<i>Cucumis maderaspatanus</i>	+	Creeper
<i>Eriachne pulchella</i>	+	0.1
<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	+	1
<i>Fimbristylis simulans</i>	+	0.1
<i>Goodenia cusackiana</i>	+	0.1
<i>Goodenia microptera</i>	+	0.3
<i>Goodenia stobbsiana</i>	+	0.5
<i>Grevillea pyramidalis</i> subsp. <i>leucadendron</i>	+	1.4
<i>Grevillea wickhamii</i> subsp. <i>aprica</i>	+	2
<i>Hakea lorea</i> subsp. <i>lorea</i>	+-1	3
<i>Indigofera monophylla</i>	+	0.1
<i>Jasminum didymum</i> subsp. <i>lineare</i>	+	Creeper

<i>Mollugo molluginea</i>	+	0.1
<i>Ptilotus calostachyus</i>	+	0.7
<i>Ptilotus obovatus</i>	+	0.3
<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	+	1.2
<i>Solanum lasiophyllum</i>	+	0.5
<i>Stackhousia muricata</i>	+	0.4
<i>Tribulus platypterus</i>	+	0.9
<i>Tribulus suberosus</i>	+	0.5
<i>Triodia wiseana</i>	35	0.6



## **Appendix D**

**Taxa recorded in the Project area**

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## Appendix D

### Taxa Recorded in the Project Area

**29 PTERIDACEAE**

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*Cheilanthes sieberi*

**80 LAURACEAE**

---

*Cassytha capillaris*

**148 TYPHACEAE**

---

*Typha domingensis*

**156 CYPERACEAE**

---

*Cyperus iria*

*Cyperus vaginatus*

*Fimbristylis simulans*

*Fimbristylis* sp.

*Schoenoplectus subulatus*

**163 POACEAE**

---

*Aristida contorta*

*Aristida holathera*

*Aristida latifolia*

*Bothriochloa ewartiana*

\* *Cenchrus ciliaris*

Weed

*Chrysopogon fallax*

*Cymbopogon bombycinus*

*Cymbopogon obtectus*

*Cymbopogon* sp.

*Dactyloctenium radulans*

*Enneapogon lindleyanus*

*Eragrostis cumingii*

*Eragrostis dielsii*

*Eragrostis eriopoda*

*Eragrostis tenellula*

*Eragrostis xerophila*

*Eriachne benthamii*

*Eriachne mucronata*

*Eriachne obtusa*

*Eriachne pulchella*

*Eulalia aurea*

*Heteropogon contortus*  
*Paraneurachne muelleri*  
*Sorghum plumosum*  
*Sporobolus actinocladus*  
*Sporobolus australasicus*  
*Themeda triandra*  
*Triodia brizoides*  
*Triodia aff. lanigera*  
*Triodia aff. sp. Shovelanna Hill (S. van Leeuwen 3835)*  
*Triodia epactia*  
*Triodia longiceps*  
*Triodia secunda*  
*Triodia wiseana*

**169 MENISPERMACEAE**

---

*Tinospora smilacina*

**175 PROTEACEAE**

---

*Grevillea pyramidalis* subsp. *leucadendron*  
*Grevillea wickhamii*  
*Grevillea wickhamii* subsp. *aprica*  
*Grevillea wickhamii* subsp. *hispidula*  
*Hakea chordophylla*  
*Hakea lorea* subsp. *lorea*

**199 ZYGOPHYLLACEAE**

---

*Tribulus hirsutus*  
*Tribulus platypterus*  
*Tribulus suberosus*

**201 FABACEAE**

---

*Acacia acradenia*  
*Acacia ampliceps*  
*Acacia ancistrocarpa*  
*Acacia bivenosa*  
*Acacia colei*  
*Acacia colei* var. *ileocarpa*  
*Acacia inaequilatera*  
*Acacia orthocarpa*  
*Acacia ptychophylla*  
*Acacia pyrifolia*  
*Acacia stellaticeps*  
*Acacia trachycarpa*  
*Acacia tumida* var. *pilbarensis*  
*Cajanus cinereus*  
*Crotalaria cunninghamii*  
*Cullen leucanthum*  
*Indigofera colutea*

*Indigofera linifolia*  
*Indigofera monophylla*  
*Indigofera rugosa*  
*Isotropis forrestii*  
*Petalostylis labicheoides*  
*Rhynchosia minima*  
*Senna artemisioides* subsp. *oligophylla*  
*Senna glutinosa* subsp. *glutinosa*  
*Senna glutinosa* subsp. x *luerssenii*  
*Senna notabilis*  
*Senna symonii*  
*Swainsona formosa*  
*Tephrosia rosea* var. *clementii*  
*Tephrosia* aff. *supina*  
*Tephrosia* aff. *uniovulata*  
*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601)

**211 MORACEAE**

---

*Ficus brachypoda*

**224 CUCURBITACEAE**

---

*Cucumis maderaspatanus*

**229 CELASTRACEAE**

---

*Stackhousia muricata*

**242 EUPHORBIACEAE**

---

*Euphorbia australis* var. *hispidula*  
*Euphorbia biconvexa*  
*Euphorbia tannensis* subsp. *eremophila*

**247 PHYLLANTHACEAE**

---

*Phyllanthus maderaspatensis*

**261 VIOLACEAE**

---

*Hybanthus aurantiacus*

**277 COMBRETACEAE**

---

*Terminalia canescens*

**278 LYTHRACEAE**

---

*Ammannia baccifera*

**281 MYRTACEAE**

---

*Corymbia hamersleyana*  
*Corymbia zygophylla*

*Eucalyptus camaldulensis* subsp. *obtusa*  
*Eucalyptus leucophloia* subsp. *leucophloia*  
*Eucalyptus victrix*  
*Melaleuca argentea*  
*Melaleuca lasiandra*  
*Melaleuca linophylla*

**299      SAPINDACEAE**

---

*Atalaya hemiglauca*  
*Dodonaea coriacea*

**309      MALVACEAE**

---

*Abutilon* sp.  
*Abutilon cunninghamii*  
*Corchorus lasiocarpus* subsp. *parvus*  
*Corchorus parviflorus*  
*Gossypium australe*  
*Gossypium robinsonii*  
*Hibiscus coatesii*  
*Hibiscus leptocladus*  
*Hibiscus* sp.  
*Keraudrenia velutina* subsp. *elliptica*  
*Keraudrenia nephrosperma*  
*Sida echinocarpa*  
*Sida fibulifera*  
*Sida* sp. Articulation below (A.A. Mitchell PRP 1605)  
*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)  
*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)  
*Triumfetta clementii*

**328      GYROSTEMONACEAE**

---

*Codonocarpus cotinifolius*

**331      CLEOMACEAE**

---

*Cleome uncifera*  
*Cleome viscosa*

**338      SANTALACEAE**

---

*Santalum lanceolatum*

**355      CARYOPHYLLACEAE**

---

*Polycarpaea longiflora*

**357      AMARANTHACEAE**

---

\* *Aerva javanica* Weed  
*Gomphrena cunninghamii*  
*Ptilotus auriculifolius*

*Ptilotus axillaris*  
*Ptilotus calostachyus*  
*Ptilotus exaltatus*  
*Ptilotus fusiformis*  
*Ptilotus obovatus*

**358 CHENOPODIACEAE**

---

*Salsola australis*

**364 AIZOACEAE**

---

*Trianthema glossostigma*  
*Trianthema triquetra*

**367 NYCTAGINACEAE**

---

*Boerhavia burbridgeana*  
*Boerhavia coccinea*

**368 MOLLUGINACEAE**

---

*Mollugo molluginea*

**374 PORTULACACEAE**

---

*Portulaca oleracea*

**409 RUBIACEAE**

---

*Psydrax latifolia*  
*Synaptantha tillaeacea* var. *tillaeacea*

**413 APOCYNACEAE**

---

*Rhyncharrhena linearis*

**415 BORAGINACEAE**

---

*Heliotropium muticum*  
*Trichodesma zeylanicum*

Priority 1

**416 CONVULVULACEAE**

---

*Bonamia erecta*  
*Bonamia media*  
*Bonamia pannosa*  
*Evolvulus alsinoides*

**417 SOLANACEAE**

---

*Solanum lasiophyllum*  
*Solanum phlomoides*

**423 OLEACEAE**

---

*Jasminum didymum* subsp. *lineare*

---

**427 PLANTAGINACEAE**

---

*Stemodia grossa*

---

**432 LAMIACEAE**

---

*Clerodendrum floribundum*

*Clerodendrum floribundum* var. *angustifolium*

---

**458 GOODENIACEAE**

---

*Dampiera candicans*

*Goodenia cusackiana*

*Goodenia microptera*

*Goodenia nuda*

Priority 4

*Goodenia stobbsiana*

*Scaevola amblyanthera* var. *centralis*

*Scaevola spinescens*

---

**460 ASTERACEAE**

---

*Pentalepis trichodesmoides*

*Pluchea ferdinandi-muelleri*

*Pluchea rubelliflora*

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Native taxa	164
Introduced taxa	2
<b>Total taxa</b>	<b>166</b>

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# **Appendix E**

**Rare flora report forms**

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