Report

Red Hill Mining Lease

Flora Survey Report

30 SEPTEMBER 2013

Prepared for

BM Alliance Coal Operations Pty Ltd

42627136

URS

Project Manager:

Chris Taylor
Senior Associate

URS Australia Pty Ltd

Level 17, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

Principal-In-Charge:

Chris Pigott
Senior Principal

Author:

pp. Kirsty Macpherson
Senior Environmental
Scientist

Reviewer:

Dan Simmons
Senior Associate
Environmental Scientist

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Abbreviations

Abbreviation	Description
BMA	BM Alliance Coal Operations Pty Ltd
BoM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment V1.3
BRM	Broadmeadow Underground Mine
CSR	Crown Separation Ratio
DAFF	Department of Agricultrue, Fisheries and Forestry
DERM	Department of Environment and Resource Management
DSEWPaC	Department for Sustainability, Environment, Water, Population and Communities
EHP	Department of Environment and Heritage Protection
EIS	Environmental Impact Statement
EPBC Act	*Environmental Protection and Biodiversity Act 1999*
ESA	Environmentally Sensitive Areas
FHA	Fish habitat area
FPC	Foliage Protection Cover
GBRWHA	Great Barrier Reef World Heritage Area
GPS	Global Positioning System
GRB	Goonyella Riverside and Broadmeadow (mine complex)
GRM	Goonyella Riverside Mine
HVR	High value regrowth
MNES	Matters of National Environmental Significance
NC Act	*Nature Conservation Act 1992*
NRM	Department of Natural Resources and Mines
RE(s)	Regional Ecosystem(s)
REDD	Regional Ecosystems Description Database
RHM	Red Hill Mine
TEC(s)	Threatened Ecological Communities
URS	URS Australia Pty Ltd
VM Act	*Vegetation Management Act 1999*
VM Status	Vegetation management status

Executive Summary

Systematic flora surveys were carried out by URS Australia Pty Ltd (URS) in 2005, 2006, 2009 and 2011 for the Red Hill Mining Lease (the project). The aim of these studies was to document the floral values within the Environmental Impact Statement (EIS) study area, with particular reference to the occurrence of conservation significant vegetation communities and species.

This study was undertaken in two parts; a comprehensive literature review followed by systematic field surveys. The literature review utilised online databases and existing ecological reports to generate a list of conservation significant vegetation communities and species that were likely to occur within the study site. Targeted flora surveys were subsequently undertaken based on the results of the literature review.

The ecological values of the survey area are considered typical for the northern Bowen Basin, with large areas of land historically cleared for grazing. Although some areas of remnant vegetation remain intact, most have been modified to some extent by historical and current land management practices. The most common modification has been the removal of the shrub and ground layers and replacement with pasture grass species.

The literature review identified that two *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) threatened ecological communities (TECs) are potentially present on site; the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and *Brigalow (*Acacia harpophylla *dominant and co-dominant)* TECs. The presence of both these communities has been confirmed on site with 368 hectares (ha) of *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and 1,097 ha of *Brigalow (Acacia harpophylla dominant and co-dominant)* present.

The flora survey identified within the survey area a total of 19 Regional Ecosystems, including six listed as endangered (1,097 ha), seven of concern (2,196 ha) and six not of concern (4,418 ha).

The literature review identified seven species of conservation significance as potentially occurring in the survey area. Of those seven, field surveys confirmed the presence of one; *Dichanthium setosum* (bluegrass) which is listed as vulnerable under the EPBC Act. An additional conservation significant plant species was identified on site; *Cerbera dumicola,* which is listed as near threatened under the NC Act. Additional species of conservation significance; *Dichanthium queenslandicum* (king bluegrass) and *Digitaria porrecta* (finger panic grass), were identified as being potentially present given the types of habitat available on site but were not recorded.

Of the 46 exotic species described in this survey, five species were identified as being of management concern; *Eriocereus martinii** (harrisia cactus), *Parthenium hysterophorus** (parthenium), *Sporobolus fertilis** (giant Parramatta grass), *Opuntia stricta* var. *stricta** (prickly pear) and *Opuntia tomentosa** (velvety tree pear). These are species currently declared as Class 2 pest species under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act).

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Introduction

1.1 Background

BHP Billiton Mitsubishi Alliance (BMA), through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA70421) to enable the continuation of existing mining operations associated with the GRB mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion option of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM.

The three project elements described above are collectively referred to as 'the project'.

The project is located adjacent to the existing Goonyella, Riverside and Broadmeadow (GRB) mine complex in the Bowen Basin, approximately 20 kilometres north of Moranbah and 135 kilometres from Mackay, Queensland (**Figure 5–1**). The Moranbah area possesses a long history of grazing and extraction of coal. The survey area extends across the existing GRM and BRM mining lease areas, covering approximately 31,180 hectares (ha).

For the purposes of this report, the 'survey area' refers to the boundaries of the terrestrial ecology surveys for 2009 and 2011. This area extends further than the environmental impact statement (EIS) study area, as shown on (**Figure 5–1**).

1.2 Aims and Objectives

The aims of this investigation are to identify the vegetation communities and conservation values of the survey area.

In meeting these aims, the objectives of the flora survey are to assess ecological values for the affected area including:

- the species diversity;
- the floristics and structure of the vegetation communities;
- tntegrity of ecological processes, including habitats of rare and threatened species;
- the diversity and extent of weed species for the survey area; and
- assessment of conservation values of the survey area.

1.3 Legislative Context

1.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment, especially Matters of National Environmental Significance (MNES), and is administered by the Commonwealth Department of the Environment. It is designed to provide for the conservation of biodiversity through the protection of threatened species and ecological communities, migratory, marine and other protected species listed under the EPBC Act. In general, the Act aims to streamline national environmental assessment and approvals processes, protect Australian biodiversity and integrate management of important natural and cultural places.

1 Introduction

1.3.2 *Nature Conservation Act 1992*

The Queensland *Nature Conservation Act 1992* (NC Act) is administered by the Department of Environment and Heritage Protection (EHP) and is the principal legislation for the conservation and management of the State's native flora and fauna. The primary objective of the NC Act is the conservation of nature, namely the preservation of endangered, vulnerable and near threatened species of flora and fauna as listed under the *Nature Conservation (Wildlife) Regulation 2006.*

1.3.3 *Land Protection (Pest and Stock Route Management) Act 2002*

The Queensland *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) provides pest management for agricultural lands. The LP Act lists species of flora and fauna that are considered Class 1, 2 or 3 pests.

1.3.4 *Vegetation Management Act 1999*

The purpose of the Queensland *Vegetation Management Act 1999* (VM Act) is to regulate the clearing of native vegetation, (i.e. remnant Regional Ecosystems (REs)) to reduce the loss of biodiversity and land degradation from vegetation clearing. It also aims to maintain ecological processes and reduce greenhouse gas emissions. Additionally, areas of remnant vegetation specific to conservation significant species (listed under the NC Act) are further classified as essential habitat.

EHP uses certified mapping of remnant vegetation and essential habitat to administer the VM Act. Clearing of native vegetation mapped as REs and/or essential habitat within the survey area is subject to assessment by EHP against the applicable Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions (NRM 2012).

Vegetation is mapped as remnant by EHP where the dominant canopy has greater than 70 per cent of the height and greater than 50 per cent of the cover relative to the undisturbed height and cover of that stratum (EHP 2012). The vegetation community must also be dominated by species characteristic of the vegetation's undisturbed canopy.

1.3.5 Biodiversity Offset Policy

The Policy on Biodiversity Offsets is a 'specific–issue offsets policy' under the framework of the Queensland Government Environmental Offset Policy. This policy applies to important biodiversity values including: the protected area estate, Marine Park zoning protection, high conservation value wetlands, endangered, vulnerable and rare species and endangered and of concern REs (EHP 2013a).

2 Assessment Methodology

2.1 Literature review

A desktop review of ecological data and literature was undertaken to characterise the ecological values and identify the potential presence of conservation significant species, habitats and vegetation communities within the survey area. The objectives of the desktop study included:

- Review of relevant biodiversity databases and conservation reports for the survey area and surrounding region.
- Assessment of the broad conservation values of vegetation communities present in the survey area.
- Identification of the potential presence of conservation significant flora species and communities.

2.1.1 Search Area

In order to identify the range of species and communities that may be present within the survey area and surrounding region, reviews of existing data were conducted for an area bound by the following co-ordinates: Latitude: -21.6405 to -21.8692; Longitude: 148.0584 to 147.8635.

2.1.2 Data Sources

Existing data sources and literature on the flora values of the survey area was compiled through investigation of key references including:

- Queensland EHP Herbarium flora database (HERBRECS) (NRM 2013b);
- Queensland EHP fauna and flora record database (Wildlife Online) (EHP 2013c);
- Queensland EHP 1:100,000 RE mapping v.6.0b (EHP 2013a);
- Queensland EHP Environmentally Sensitive Areas mapping database (EHP 2013b);
- Commonwealth Department of the Environment (formerly Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)) MNES database (DSEWPaC 2011);
- Commonwealth Department of the Environment Australian Heritage Database (DSEWPaC 2011a);
- Biodiversity Planning Assessment for the Brigalow Belt (EHP 2012a); and
- current distribution texts for vascular flora taxa.

These references were reviewed and an assessment was undertaken to identify the potential presence of significant flora species and vegetation communities as listed under the Queensland NC Act and the Commonwealth EPBC Act.

2.1.3 Biodiversity Values

Biodiversity significance for the survey area was identified from the Biodiversity Planning Assessment V1.3 (BPA) for the Brigalow Belt (EHP 2012a). The BPA implements the use of Biodiversity Assessment and Mapping Methodology (EPA 2002) to consistently determine the biodiversity significance of habitats and communities. The information produced is largely based upon remnant vegetation mapping generated by the Queensland Herbarium (RE mapping) and identifies three levels of biodiversity significance – State, regional and local (**Figure 5-2**). Other factors that contribute to significance ranking include diversity, fragmentation, habitat condition, resilience, threats and ecosystem processes. For the purpose of this assessment BPA values are treated as potential values due to the reliance upon the Queensland Herbarium RE mapping.

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2.1.4 Regional Ecosystem Mapping

EHP uses REs to describe the relationships between vegetation communities and the environment at the bioregional scale. REs are mostly derived from linking vegetation mapping units recognised at a scale of 1:100,000 to land zones that represent major environmental variables, in particular geology, rainfall and landform.

The Queensland Herbarium has developed a program for mapping remnant REs across Queensland, however it should be noted that there are inaccuracies inherent in RE mapping at a scale of 1:100,000. As a result these maps provide an indication of what is potentially present and cannot be relied upon as an inherently correct source of vegetation mapping. On-site ground truthing is required to confirm the presence of RE types and extents, verify floristics and structure and confirm conservation status.

Under the VM Act, REs are assigned a conservation status (vegetation management status (VM status)) based on an assessment of the pre-clearing and remnant extent of a RE. A second status rating (biodiversity status) is defined by EHP and is based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a RE. Criteria for defining the VM status and the biodiversity status are defined below.

Vegetation is mapped as remnant by EHP where the dominant canopy has greater than 70 per cent of the height and greater than 50 per cent of the cover relative to the undisturbed height and cover of that stratum (EHP 2012c). The vegetation community must also be dominated by species characteristic of the REs undisturbed canopy.

Endangered

An RE is listed as having an endangered VM status when remnant vegetation is:

- less than 10 per cent of its pre-clearing extent across the bioregion; or
- 10 to 30 per cent of its pre-clearing extent remains, and the remnant vegetation is less than 10,000 ha.

An RE is listed as having an endangered biodiversity status when:

- less than 10 per cent of the pre-clearing extent of remnant remains unaffected by severe degradation and/or biodiversity loss;
- 10 to 30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 ha; or
- it is a rare RE subject to a threatening process.

Of Concern

An RE is listed as having an of concern VM status when remnant vegetation is:

- 10 to 30 per cent of its pre-clearing extent across the bioregion; or
- more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 ha.

An RE is listed as having an of concern biodiversity status when remnant vegetation is:

- 10 to 30 per cent of its pre-clearing extent across the bioregion; or

- more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 ha, and if 10 to 30 per cent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.

Not of Concern / No Concern at Present

An RE is listed as not of concern VM status when remnant vegetation is:

- over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 ha.

An RE is listed as not of concern biodiversity status when remnant vegetation is:

- over 30 per cent of its pre-clearing extent across the bioregion, the remnant area is greater than 10,000 ha and the degradation criteria listed above for endangered or of concern REs are not met.

2.1.5 High Value Regrowth Mapping

The Queensland Government introduced laws on 8 October 2009 to regulate the clearing of high value regrowth (HVR) and regrowth watercourse vegetation. HVR vegetation comprises "Regional ecosystems that are endangered, of concern and least concern, and have not been cleared since 31 December 1989" (DERM 2009). Regrowth watercourse vegetation is defined as "all native woody vegetation that is located within 50 metres of identified regrowth watercourses and excludes vegetation that is either mapped as remnant regional ecosystems or mapped as high-value regrowth" (DERM 2009).

2.1.6 Essential Habitat Mapping

Essential habitat mapping is provided by EHP under the VM Act and is currently maintained in the essential habitat database (version 3). Essential habitat is compiled from a combination of species habitat models and buffered species records.

Essential habitat for threatened species is defined as an extent of vegetation depicted on RE mapping as remnant or HVR vegetation;

(a) that has at least three essential habitat factors for the species, that are stated as mandatory for the protected wildlife in the essential habitat database; or

(b) in which the threatened species, at any stage of its life cycle, has been located (NRM 2013a).

2.1.7 HERBRECS

HERBRECS is a database maintained by the Queensland Herbarium that provides a list of specimens kept within the Queensland Herbarium collections for a specified search area. Data provided is derived from specimen label information and includes details on specimen, geographic location and habitat (DERM 2011).

2.1.8 EHP Wildlife Online

The EHP Wildlife Online database contains recorded wildlife sightings and listings of plants, fungi, protists, mammals, birds, reptiles, amphibians, freshwater fish, marine cartilaginous fish and butterflies in Queensland. The database is based on collated species lists and wildlife records acquired by EHP

through a range of sources including specimen collections, research and monitoring programs, and community wildlife recording programs (EHP 2013c).

2.1.9 EPBC MNES

The Department of the Environment MNES database generates a list of protected matters (as per the EPBC Act) that may occur in or near the survey area. The database incorporates information from a range of sources including government, research and community organisations (DSEWPaC 2011).

The MNES database has inherent limitations based on the accuracy of geographic data for some matters. In particular, confirmation of the presence of threatened or migratory species at a given site is not possible from the database, as data presented are for potential occurrences of species within a general area, rather than for known occurrences at a specific site.

The relative reliability of this database must be borne in mind as species highlighted by this search do not necessarily correlate to an actual observation. Species are highlighted by the database if their currently known distribution overlaps with the search area by one degree of latitude or longitude (approximately 100 km). This indication of potential presence does not take into account whether suitable vegetation, geology, soil, climate or habitat types are present to support the occurrence of a significant species or community.

2.1.10 Previous Ecological Reports

The following ecological reports were reviewed to provide a regional context for the survey area:

- WBM (2002) Fauna & Flora Surveys of Unmined Lands Associated with the Proposed Ramp Four Underground Mining Goonyella Riverside Mine;
- Ecoserve (2005a) 2005 Summer Season Flora and Fauna Surveys for Peak Downs Mine. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
- Ecoserve (2005b) An Investigation of Flora, Fauna and Biodiversity Values associated with Brigalow Remnants along the Proposed Heyford Back Access Road. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
- Ecoserve (2006a) Draft - Flora & Fauna Baseline Surveys for the BMA Isaac River Project. Prepared by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
- Ecoserve (2006b) Draft- Preliminary Flora and Fauna Investigations – Land at Station Road, Moranbah. Prepared for Shaun Ferris, BMA Project Development by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
- Ecoserve (2007) A review of Habitat Values for Biodiversity Species of Conservation Significance – Peak Downs Mine. Prepared for BMA Peak Downs Mine by Ecoserve Environmental Consultants and Landscape Assessment, Management and Rehabilitation Pty Ltd;
- Emmerton and Elsol (2007) Peak Downs Mine Rehabilitation Monitoring August September 2006. Prepared by B.R. Emmerton Pty Ltd and J & J Elsol;
- URS (2007) Goonyella Riverside Mine Expansion EIS - Terrestrial Flora Report; Unpublished Draft; and
- URS (2009) Goonyella Riverside Mine Expansion EIS – Chapter 8 Terrestrial Ecology, Unpublished draft.

2.2 Field Survey

The flora survey assessed floral taxa and vegetation communities in keeping with the methodology employed by the Queensland Herbarium for the survey of REs and vegetation communities (Neldner *et al.* 2005). Preliminary identification of the vegetation communities and target field sites was conducted prior to the commencement of fieldwork. Preliminary identification included vegetation community definition from stereo image 1: 33,000, 1: 35,000 and 1: 36,000 colour aerial photography (AAM Hatch 2003, 2005 & 2008) and interpretation of 1:100,000 RE coverage Version 6.0b for the region (EHP 2013a).

Field surveys involved a botanical assessment at a number of representative sites within each remnant and non-remnant and regrowth vegetation community. The surveys employed a number of standard methods including: secondary survey sites, tertiary survey sites, quaternary survey sites and random meander search areas. A number of vehicle traverses of the survey area were also undertaken throughout the survey periods to identify changes in landform and identify community boundaries. Community structural formation classes were assessed according to Neldner *et al.* (2005). RE classification of communities was determined as per Sattler and Williams (1999), and in accordance with the Regional Ecosystems Description Database (REDD) (EHP 2013a). The survey was conducted under Queensland Environmental Protection Agency Scientific Purposes Permit numbers WISP02056304 (2005 to 2006) and WISP06537209 (2009 and 2011).

2.2.1 Transect Surveys

Secondary Transects

Field surveys employed 73 secondary survey sites within the survey area during the 2005 to 2006 survey period and 30 secondary survey sites during the 2009 survey (**Figure 5-3**). Secondary survey sites were comprised of 10 m x 50 m (500 m^2) transects. Fieldwork within secondary survey sites included detailed floristic and structural analysis.

Floristic analysis included plant identification and species diversity characterisation of all flora present. Relative abundance was assigned for all species recorded. Plant identification and estimation of relative abundance was undertaken by an experienced botanist with previous survey experience of the bioregion.

Structural analysis included recording the height class and life form of the dominant species within each strata present. The height of each strata was recorded using a hand help Optilogic laser rangefinder. The Crown Separation Ratio (CSR) of the mid and upper strata was calculated along the transect; crown gaps (distance between crowns) were recorded using an Optilogic laser rangefinder and crown widths (spread) were recorded using ocular estimation. Foliage projection of the canopy and mid strata (where applicable) was calculated by converting CSR to Foliage Protection Cover (FPC) (Walker and Hopkins 1999). The FPC of the ground layer was determined using ocular estimation of cover within five 1 m^2 subplots along the secondary transect.

Evidence of previous disturbance, fire history, incidence of exotic species and general notes on soil type and ecological integrity were compiled for each secondary survey site. Several time-encoded digital photographs were taken at each plot as a reference. Locations of data collection sites were recorded using a handheld Global Positioning System (GPS) unit.

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Tertiary Transects

The 2011 field surveys employed 16 tertiary transects within the survey area (**Figure 5-3**). Tertiary transects were comprised of 10 m x 50 m (500 m^2) transects as per the Queensland Herbarium methodology (Neldner *et al.* 2005).

Descriptive site information recorded at tertiary transects included location, aspect, slope, soil type, landform, disturbance, fire history, an assessment of bio-condition and general notes on ecological integrity.

Structural analysis included recording the height class and distribution of the dominant species within each strata present. FPC of each strata was calculated along each transect, where foliage projection intersected a 50 m centre tape. FPC of the ground layer was determined using ocular estimation of cover within five 1 m^2 subplots spaced at 10 m intervals along the transect.

Evidence of previous disturbance, fire history, incidence of exotic species and general notes on soil type and ecological integrity were compiled for each quaternary survey site. Several time-encoded digital photographs were taken at each plot as a reference. Locations of data collection sites were recorded using a handheld GPS unit.

Quaternary Transects

Quaternary surveys were undertaken at 51 sites in the 2005 to 2006 survey, 51 sites in the 2009 survey and nine sites in the 2011 survey. Quaternary-level sites were utilised to ground truth vegetation units and confirm dominant characteristic species (**Figure 5-3**). Structural analysis included recording the height class and life form of the dominant species within the mid and canopy strata as per Neldner *et al.* (2005). RE classification (Sattler & Williams 1999) was determined based on estimated structural and floristic analysis.

Evidence of previous disturbance, fire history, incidence of exotic species and general notes on soil type and ecological integrity were compiled for each quaternary survey site. Several time-encoded digital photographs were taken at each plot as a reference. Locations of data collection sites were recorded using a handheld GPS unit.

2.2.2 Meander Searches

Following the assessment at the secondary, tertiary and quaternary sites, an area of approximately 1 ha surrounding each plot was searched for 20 minutes utilising the random meander technique (Cropper 1993). Care was taken to avoid sampling in different vegetation types to those of the plots. Meander searches were employed to:

- identify additional less abundant species not recorded within survey plots;
- identify any potential significant threatened or species not identified within the survey plot;
- confirm the representativeness of plot locations; and
- confirm boundaries and ecotonal areas between vegetation communities.

2.2.3 Targeted Grassland Survey

Targeted grassland surveys for the remnant grassland RE 11.8.11 were undertaken in the north-east of the survey area (**Figure 5-3**) to determine whether the grasslands mapped at this location met the criteria for the endangered *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* threatened ecological communities (TECs).

The following survey methodology, consisting of key diagnostic characteristics and condition thresholds was employed for the surveys. It is taken directly from the EPBC Listing Advice for the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (DSEWPaC 2008a).

Key Diagnostic Characteristics

The Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin TEC may be recognised by the following diagnostic features:

- Distribution: Occurs within the Brigalow Belt North and South, which are largely within the Central Highlands and northern Fitzroy River Basin regions of Queensland.
- Tree canopy absent or sparse (less than 10 per cent projective crown cover). If it can be demonstrated, beyond reasonable doubt, that the grassland was derived from cleared woodland then it is not part of the national ecological community.
- The ground layer is typically dominated by perennial native grasses and contains at least three of the indicator native species listed below:
  - *Aristida latifolia* (feather-top wiregrass);
  - *Aristida leptopoda* (white speargrass);
  - *Astrebla elymoides* (hoop Mitchell grass);
  - *Astrebla lappacea* (curly Mitchell grass);
  - *Astrebla squarrosa* (bull Mitchell grass);
  - *Bothriochloa erianthoides* (satin-top grass);
  - *Dichanthium queenslandicum* (king bluegrass);
  - *Dichanthium sericeum* (Queensland bluegrass);
  - *Eriochloa crebra* (cup grass);
  - *Panicum decompositum* (native millet);
  - *Panicum queenslandicum* (yabila grass);
  - *Paspalidium globoideum* (shot grass); and
  - *Thellungia advena* (coolibah grass).

Note that in dry season or drought conditions, the only visible evidence of natural grassland may be scattered tussocks that are difficult to identify to species level. Therefore, condition of the ecological community must be assessed during a good season; two months after cessation of disturbance (fire/grazing/mowing/slashing) and within two months of effective rain.

Condition Thresholds

The *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC comprises those patches that meet the key diagnostic characteristics above, and the condition thresholds in **Table 2-1**, below. Both the 'Best quality' and 'Good quality' patches are included in the listed ecological community.

2 Assessment Methodology

Table 2-1 Condition Classes for the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC

	Best quality	Good quality
Patch size	At least 1 ha; and	At least 5 ha; and
Grasses	At least 4 native perennial grass species from the list of perennial native grass indicator species; and	At least 3 native perennial grass species from the list of perennial native grass indicator species; and
Tussock cover	At least 200 native grass tussocks; and	At least 200 native grass tussocks; and
Woody shrub[1] cover	Total projected canopy cover of shrubs is less than 30%; and	Total projected canopy cover of shrubs is less than 50%; and
Introduced species	Perennial non-woody introduced species are less than 5% of the total projected perennial plant cover.	Perennial non-woody introduced species are less than 30% of the total projected perennial plant cover.

1 The shrub layer is typically absent. However, where shrubs are present, they are defined as woody plants, more than 0.5 m tall that occupy the mid vegetation layer. The upper, or tree canopy layer, also is typically absent but may comprise scattered trees to less than 10% projective crown cover. Sampling should be based upon a quadrat size of 0.1 ha (e.g. 50 m x 20 m) selected in an area with the most apparent native perennial grass species. Unless exceptional circumstances apply, to maximise the assessment of condition, sites must be assessed during a good season, two months after cessation of disturbance (fire/grazing/mowing/slashing) and within two months of effective rain.

It should be noted that the Brigalow TEC is confirmed by standard flora survey techniques and the classification of REs as prescribed by Sattler and Williams (1999), and in accordance with the REDD. Therefore, targeted surveys for this TEC are not required (as required for the grassland TEC).

2.2.4 Specimen Identification

Where plant species could not be identified in the field, fruiting and/or flowering specimens were taken to assist with identification. For those species not field identified, samples were pressed and dried and positive identifications of plant specimens were subsequently made under laboratory conditions or submitted to the Queensland Herbarium for identification (Herbarium references: LN:EJT:mh 676/09 and MBT/LN:548/09). A sample of conservation significant species recorded was also submitted to the Herbarium for confirmation.

2.2.5 Nomenclature

Taxonomic nomenclature used for the description of floral species is according to Bostock and Holland (2010). Exotic flora species are signified in all text by an asterix (*). Field references utilised for the identification and description of floral species include: Andersen (2003); Brooker and Kleinig (1994); Milson (2000); and Stanley and Ross (1983, 1986, 1989).

2.2.6 Survey Limitations

Data acquisition during flora surveys generally has inherent limitations associated with variability of vegetation communities across a site, and changes to the detectability and presence of species with time. A high level of confidence in comprehensiveness is implicit in this study as survey sites were strategically located to capture representative samples of all communities. Further, the seasonal conditions during which this survey was undertaken were conducive to a relatively high degree of detectable floral diversity (**Appendix B**). However, given the above, it is recognised that field studies with a temporal limitation cannot always account for 100 per cent of potential floral diversity present within a site.

3

Results

3.1 Literature Review Results

A literature review of current legislation, regional information, and RE and regrowth mapping pertaining to the survey area is summarised below. It includes information on the region's vegetation communities, remnant and regrowth REs and essential habitat mapped in the area, and MNES flora data for the area.

3.1.1 Regional Context

Bioregion

The survey area is situated within the northern Brigalow Belt bioregion. Queensland's bioregions are based on landscape patterns that reflect changes in geology and climate, as well as major changes in floral and faunal assemblages at a broad scale and are used as the fundamental framework for the planning and conservation of biodiversity.

Nature conservation of the northern Brigalow Belt bioregion has received increasing attention due to the rapid and extensive loss of habitat that has occurred. Major impacts upon vegetation of the Brigalow Belt include tree clearing, high grazing pressure and the proliferation of exotic species such as the prickly pear (*Opuntia* spp.). As a consequence of habitat modification, many flora and fauna species have undergone severe range reductions and localised extinctions have occurred for several fauna species (Young *et al.* 1999).

Vegetation clearing has occurred on most of the lowland landscapes and those formed on shales. The more rugged topography associated with the sandstone and metamorphic ranges remain relatively undisturbed (Young *et al.* 1999).

Subregion

The Brigalow Belt bioregion contains 36 subregions or provinces that delineate significant differences in geology and geomorphology (Young *et al.* 1999). The survey area is situated within the Northern Bowen Basin Province. The landscape of this province is predominantly undulating country dominated by *Acacia harpophylla* (brigalow) communities on clay soils and *Eucalyptus crebra* (narrow-leaved ironbark) and *E. populnea* (poplar box) open woodland communities on the shallower textured-contrast soils. Areas of sandstone are dominated by both narrow-leaved iron bark and bloodwood (*Corymbia*) species. Streams are often fringed by *E. raveretiana* (black ironbox) (Sattler and Williams 1999).

3.1.2 Conservation Significant Communities

EPBC Act Threatened Ecological Communities

Two EPBC Act TECs were identified from desktop sources as likely to occur on site; *Brigalow (*Acacia harpophylla *dominant and co-dominant)* (1,710 ha mapped by EHP); and *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* (969 ha mapped by EHP). **Table 3-1** below outlines the EPBC Act TECs and the analogous REs under the VM Act that correspond with the EPBC Act listings.

3 Results

Table 3-1 EPBC Act-listed Threatened Communities and related Regional Ecosystems

EPBC Threatened Ecological Community	Analogous REs	EPBC Status	VMA Status
Brigalow (*Acacia harpophylla* dominant and co-dominant)	RE 11.3.1 RE 11.4.8 RE 11.4.9 RE 11.9.1	endangered	endangered
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	RE11.8.11 RE 11.3.21	endangered	of concern

Regional Ecosystems

Current State Government RE mapping shows 19 REs are mapped within the EIS study area, including seven listed as endangered, four as of concern and eight as least concern (under the VM Act).

Of the REs mapped, 1,402 ha are mapped as dominant endangered vegetation communities, 2,419 ha are mapped as of concern communities and 3,550 ha are mapped as least concern RE's.

3.1.3 Conservation Significant Species

A review of the existing databases and literature on terrestrial flora for the region identified a total of seven conservation significant flora species as being potentially present within the EIS study area. Of the species identified, six are listed as near threatened and one is listed as Vulnerable under the NC Act. Two of these species are listed as vulnerable and one is listed as endangered under the EPBC Act. A summary of the literature review results is provided in **Table 3-2.**

Species of cultural significance that might potentially be present within the broader region include species traditionally utilised for food or medicinal purposes, tree species utilised for their bark for painting, and wildflower species traditionally collected for decoration or adornment. No cultural values have previously been identified for any species as described in previous flora surveys or studies undertaken for the survey area (WBM 2002; Ecoserve 2005a; URS 2007).

Table 3-2 Conservation Significant Flora Determined as Potentially Present from Database Searches

Scientific Name (common name)	NC Act Status[1]	EPBC Act Status[2]	Distribution/Habitat[3]	Likelihood of presence	Data source[4/5]
Bertya sharpeana	NT	Not listed	Hairy shrub to 2 m on steep cliffs of Mt. Coolum, south-east Queensland. Also known from central coastal Queensland north of Mackay.	Unlikely	(A)
Melaleuca pearsonii formerly *Callistemon pearsonii*	NT	Not listed	Blackdown Tablelands, central Queensland.	Unlikely	(A)

3 Results

Scientific Name (common name)	NC Act Status[1]	EPBC Act Status[2]	Distribution/Habitat[3]	Likelihood of presence	Data source[4/5]
Desmodium macrocarpum	NT	Not listed	Known from the Great Dividing Range in northern Queensland between Blackall and Pentland.	Unlikely	(A)
Dichanthium setosum	Not listed	V	An upright bluegrass less than 1 m tall. Associated with heavy basaltic black soils and found in moderately disturbed areas. In Queensland its distribution includes the Leichhardt, Moreton, North Kennedy and Port Curtis regions.	Presence confirmed on site.	(A); (B); EPA (i); EPA (ii), Department of the Environment
Dichanthium queenslandicum (king blue-grass)	V	E	Endemic to Queensland where it occurs mostly on black clay soils around Emerald and more rarely on the Darling Downs.	Likely	(A); (B); EPA(i) Department of the Environment
Digitaria porrecta (finger panic grass)	NT	E	Occurs in four disjunct areas: in Queensland this includes the Nebo District, south-west of Mackay; the Central Highlands between Springsure and Rolleston; and from Jandowae south to Warwick. Found in grasslands on extensive basaltic plains and undulating woodlands / open forests with basaltic geology.	Likely	(A); (B); Department of the Environment
Paspalidium scabrifolium	NT	Not listed	Occurs along coastal and sub-coastal Queensland from Tin Can Bay to Cape Melville.	Unlikely	(A); (B)

1 NC Act Status: Indicates the conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are; Extinct in the wild (PE), Endangered (E), Vulnerable (V), Near threatened (NT) and Least concern (C).

2 EPBC Act Status: Indicates the conservation status of each taxon under the EPBC Act. The codes are: Vulnerable (V), Conservation Dependent (CD), Critically Endangered (CE), Endangered (E) and Extinct (EX).

3 Information based on a number of sources including: Anderson (1993); DSEWPaC (2008); Milson (2000); and PlantNET (2009).

4 EPA (i): Queensland Herbarium records retrieved 1/2/11. EPA (ii): Queensland EHP Wildlife Online database records retrieved 21.1.11. Department of the Environment: Commonwealth EPBC online MNES search generated 21.1.11 and 12.6.13.

5 Indicates previous flora studies identified potentially significant species occurring in the region. (A): WBM, 2002; (B): Ecoserve, 2005.

3.1.4 Essential Habitat Mapping

Essential Habitat for *Dichanthium setosum* has been mapped in the eastern portion of the survey area in RE 11.8.11 (EHP 2012b). This is depicted on **Figure 5-4**. This species has recently been delisted from the NC Act and therefore it is expected that subsequent updates to the EHP essential habitat map will not include this species.

3.1.5 Significant Biodiversity Values

An analysis of the Biodiversity Planning Assessment (BPA) for the Brigalow Belt shows that 3,929.31 ha of state significant habitat, 2,068.94 ha of regionally significant habitat and 1,612.47 ha of locally significant habitat is present within the EIS study area. Regional connectivity and biodiversity corridors identified from the BPA are displayed in **Figure 5-2**. Areas of conservation significance identified within a 100 km radius of the survey area are depicted in **Figure 5-5**.

Both the Brigalow Belt BPA and the Fitzroy Basin Association bioregional corridor mapping (Cook *et al.* 2006) indicate that the Isaac River and its associated riparian vegetation contribute to habitat connectivity from north to south on both a regional and State level. Regionally significant habitat exists within the far north-east and the south-west of the EIS study area where it connects to a larger tract of regional and locally significant habitat.

3.2 Field Survey results

This section documents the results of detailed field surveys of the flora and vegetation communities of the survey area and includes a summary of species diversity, remnant and regrowth REs, conservation significant flora, condition of grasslands, regional connectivity and weeds of concern. Detailed community descriptions and quantitative data including detail of the floristics and structure for each survey site are provided in **Appendix A**. A complete list of all taxa identified is provided in **Appendix B**. The field assessment of the survey area was carried out using the methodology outlined in **Section 2.2**. The sites surveyed are depicted on **Figure 5-3**.

Flora field surveys were undertaken over six periods during 2005, 2006, 2009 and 2011. **Table 3-3** indicates the survey timing and effort (secondary, tertiary and quaternary sites surveyed) during these periods. The terrestrial ecology survey areas from A to F are delineated in **Figure 5-6**. The seasonal weather conditions for each survey period are described below.

Table 3-3 Number of Flora Survey Sites for each Survey Period

Survey Period	A: 17-26 October 2005	B: 30 January-3 February 2006	C: 22- 28 May 2006	D: 18-28 March 2009	E: 11- 26 May 2009	F: March 2011	Total sites
Secondary Sites	39	11	23	16	14	0	103
Tertiary sites	0	0	0	0	0	16	16
Quaternary Sites	31	3	17	14	37	9	111

3 Results

3.2.1 Survey Conditions

Fieldwork for the floral survey was conducted over six independent survey periods:

- Survey A was a ten day survey undertaken for vegetation across the centre of the survey area, conducted between 17 and 26 October 2005;
- Survey B was a five day survey of the Isaac River Diversion survey area conducted between 30 January and 3 February 2006;
- Survey C was a seven day survey for the vegetation within the current mining operations lease undertaken between 22 and 28 May 2006;
- Survey D was an 11 day survey for vegetation in the Red Hill mining exploration area, conducted between 18 and 28 March 2009;
- Survey E was undertaken over a 16 day period for vegetation in the Western Exploration Area between 11 and 26 May 2009; and
- Survey F was undertaken between 16 and 20 May 2011 over the entire revised Red Hill exploration area with particular attention paid to:
  - areas not previously surveyed within the exploration site; and
  - a resurvey of the native grasslands following the good rainfall experienced during the preceding wet season.

Survey A

Weather for the initial survey period was typical for mid-spring in the region; fine and clear with minimal afternoon cloud build up and occasional storms. Bureau of Meteorology (BoM) daily weather observations from Moranbah for October 2005 indicate the average minimum temperature for the survey period was 21.2°C, and the mean daily maximum was 33.8°C. Rainfall was minimal for the period, however one significant storm event on the afternoon of the 21 October 2005 yielded the highest precipitation for the month with 36.4 mm. Prevailing wind was relatively calm and primarily from the north-west during the period (BoM 2006a).

Survey B

Weather conditions for the second survey period were typical for mid-summer in the region; hot and dry with minimal precipitation. BoM daily weather observations from Moranbah for May 2006 indicate the average minimum temperature for the survey period was 30.9°C, and the mean daily maximum was 36.9°C. Rainfall was minimal for the period with only 0.2 mm of precipitation recorded. Wind movement was relatively calm and primarily from the south-east (BoM 2006b).

Survey C

Conditions for the third survey period were fine and clear with minimal precipitation. BoM daily weather observations from Moranbah for May 2006 indicate the average minimum temperature for the survey period was 15.1°C, and the mean daily maximum was 20.6°C. Rainfall was minimal, however one significant storm event on the afternoon of 23 May yielded the highest precipitation for the month with 27.6 mm. Wind movement was relatively calm and primarily from the north-west (BoM 2006c).

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Survey D

Weather conditions for the fourth survey period were warm and dry with minimal precipitation. BoM Meteorology daily weather observations from Moranbah for March 2009 indicate the average minimum temperature for the survey period was 18.8°C, and the mean daily maximum was 31.8°C. Rainfall was minimal with only 1.4 mm recorded on a single day during that period. Wind movement was relatively calm and primarily from the south-east (BoM 2009a).

Survey E

Conditions for the fifth survey period were typical for the season in the region; warm to cool and dry with minimal precipitation. BoM daily weather observations from Moranbah for May 2009 indicate the average minimum temperature for the survey period was 11.8°C, and the mean daily maximum was 25.1°C. Rainfall was minimal for the period, with only 1.5 mm recorded. Wind movement was relatively calm and primarily from the south-east (BoM 2009b).

Survey F

Weather conditions on the 2011 survey ranged from warm to cool and dry although the survey was conducted following significant rainfall. BoM daily weather observations from Moranbah for May 2011 indicate the average minimum temperature for the survey period was 11.5°C and the mean daily maximum was 24.5°C. Rainfall was minimal for the period with only 0.4 mm recorded. Rainfall in the two weeks preceding the survey was 12 mm, while for the two months preceding the survey was 145.6 mm. Wind movement was relatively calm and primarily from the south-east (BoM 2011).

3.2.2 Regional Connectivity

Continued grazing practices and historical tree clearing throughout the region have greatly altered vegetation patterns from large extents of woodlands to open modified grasslands and discrete patches of disturbed *Eucalyptus populnea* (poplar box), *Eucalyptus cambageana* (Dawson gum), *Acacia harpophylla* (brigalow) and *Acacia shirleyi* (lancewood) woodlands. Grazing impacts have left the majority of woodland habitat in the region with a highly modified and mostly absent mid-strata. Only the remnant woodland vegetation in the south-east of the survey area represents significant habitat connectivity at a state scale (**Figure 5-2**).

Contiguous tracts of vegetation within the survey area representing local connectivity of habitat are primarily provided by riparian corridors associated with the local creek and river systems. These connect areas of remnant vegetation across the survey area.

Connectivity in the east is primarily provided by the Isaac River riparian corridor. The Isaac River corridor joins a large tract of vegetation at the Burton Range approximately 10 km to the north-west. Vegetation in the Burton Range has been protected from clearing by the hilly topography in this area and represents a contiguous extent of woodland approximately 18 km long varying in width from 1 to 5 km.

Connectivity of habitat at the local scale is relatively limited in an east-west pattern across the survey area. This is a result of grazing and land use impacts, including the current Goonyella Riverside and Broadmeadow (GRB) mine complex. Vegetation clearing and grazing disturbance have impeded local

connectivity to the east and north of the survey area. The Isaac River affords connectivity of habitat to the north and south on the local scale (**Figure 5-2**).

3.2.3 Species Diversity

The field surveys identified the presence of 368 taxa representing 67 families and 202 genera. Families represented by three or more genera included Amaranthaceae (7 genera), Apocynaceae (4), Asteraceae (13), Caesalpiniaceae (6), Chenopodiaceae (7), Euphorbiaceae (8), Fabaceae (14), Malvaceae (7), Mimosaceae (3), Myrtaceae (3), Poaceae (42), Rubiaceae (7) and Rutaceae (3).

Genera represented by three or more species included *Acacia* (13 species), *Alectryon* (3), *Amyema* (4), *Aristida* (13), *Atriplex* (3), *Bothriochloa* (5), *Brachychiton* (3), *Chamaesyce* (3), *Chloris* (4), *Corymbia* (6), *Cyperus* (7), *Dichanthium* (4), *Digitaria* (4), *Enneapogon* (6), *Enteropogon* (3), *Eragrostis* (9), *Eremophila* (3), *Eucalyptus* (12), *Hibiscus* (4), *Indigofera* (4), *Jasminum* (4), *Leptochloa* (4), *Lysiphyllum* (3), *Melaleuca* (6), *Paspalidium* (5), *Phyllanthus* (3), *Sclerolaena* (4), *Sida* (9) and *Sporobolus* (7).

The surveys identified 46 exotic taxa representing 18 families. Families with three or more exotic weed taxa include Asteraceae (3), Cactaceae (3), Malvaceae (5) and Poaceae (15). Weed species present are discussed further below.

A full flora species list including exotic species identified from each survey period is provided in **Appendix B**.

3.2.4 Conservation Significant Vegetation Communities

EPBC Threatened Ecological Communities

The literature review identified two EPBC Act TECs likely to be present on site; *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and *Brigalow (*Acacia harpophylla *dominant and co-dominant)*. The presence of both these communities have been confirmed on site (**Figure 5-7**), with 368 ha of *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and 1,465 ha of *Brigalow (*Acacia harpophylla *dominant and co-dominant)* TECs ground truthed and delineated. **Table 3-4** outlines the EPBC Act TECs and analogous REs.

Table 3-4 EPBC Listed Threatened Communities and Related Regional Ecosystems

EPBC threatened Community	Analogous REs	EPBC Status	VMA Status
Brigalow (*Acacia harpophylla* dominant and co-dominant)	RE 11.3.1 RE 11.4.7 RE 11.4.8 RE 11.4.9 RE 11.5.16 RE 11.9.1	endangered	endangered
Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	RE11.8.11	endangered	of concern

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Endangered and Of Concern Regional Ecosystems

Thirteen REs are identified as either of concern or endangered under the VM Act. A total of 1,097 ha of endangered REs and 2,196 ha of concern REs have been described and mapped within the study area boundary (**Figure 5-7**). All RE descriptions and status can be seen in **Section 3.2.6**.

Table 3-5 Endangered and Of Concern Regional Ecosystems

Regional Ecosystem status	RE
Endangered	11.3.1, 11.4.7, 11.4.8, 11.4.9, 11.5.16, 11.9.1
Of Concern	11.3.2, 11.3.3, 11.3.4, 11.3.4a, 11.3.36, 11.4.2, 11.8.11

3.2.5 Conservation Significant Flora Species

The literature review identified seven flora species of conservation significance as potentially occurring in the survey area (**Section 3.1.3**). Of those seven species, field surveys confirmed the presence of one; *Dichanthium setosum* (bluegrass), which is listed as vulnerable under the EPBC Act.

An additional threatened plant species was identified on site; *Cerbera dumicola,* which is listed as near threatened under the NC Act. *Dichanthium queenslandicum* (king bluegrass) and *Digitaria porrecta* (finger panic grass), were identified as being likely to be present given the types of habitat available although they were not identified during the field surveys.

Dichanthium setosum (bluegrass) was recorded in the east of the survey area (**Figure 5-7**) where it was observed within RE 11.8.11 (*Dichanthium sericeum* (Queensland bluegrass) grassland on Cainozoic igneous rocks) which forms part of the *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* EPBC Act TEC. Only one specimen of *Dichanthium setosum* was observed during the 2009 field survey. However, the area was heavily grazed at the time of survey and it is anticipated that additional specimens would be recorded with decreased grazing pressure and improved growing conditions. Suitable habitat for the species was observed to extend approximately 1 km to the north of its recorded location.

Cerbera dumicola was recorded at a single location in the east of the survey area (**Figure 5-7**) where it was identified within non-remnant modified open grassland. The grassland was dominated by a dense layer of *Pennisetum ciliare** (buffel grass), with *Cerbera dumicola* observed as a shrub species growing one to three metres in height.

3.2.6 Regional Ecosystems

Twenty-four vegetation communities were described and mapped in the survey area on the basis of stereo pair aerial photo analysis and field survey results (**Figure 5–8a, Figure 5–8b** and **Figure 5–8c**). The survey area contained a total of 19 REs, including six REs listed as endangered, eight as of concern and seven as least concern under the VM Act.

Table 3-6 provides a summary of the classification of vegetation communities and REs identified during the flora survey. Vegetation communities for the survey areas have been delineated on the basis of REs. The area of each RE within the survey area varies considerably; some REs are represented only marginally. Vegetation community descriptions including RE description, general structural and floristic character, evidence of previous disturbance, fire history, incidence of exotic

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species and general disturbance notes are provided for each secondary and tertiary survey site in **Appendix A**.

Table 3-6 Extent of Vegetation Communities mapped by URS within survey area

Unit	Community Description	Land zone	Regional Ecosystem	Status			Area (ha)	Survey sites [1]
				EPBC	Biodiv	VMA		
1a	*Acacia harpophylla* open woodland on alluvial plains	Quaternary alluvial soils (Landzone 3)	RE 11.3.1	E	E	E	332	a11, a13, a22, q65, q68, q69, d12, e12, q133
1b	*Eucalyptus populnea* woodland on alluvial plains		RE 11.3.2	NL	OC	OC	307	a16, b9
1c	*Eucalyptus coolabah* woodland on alluvial plains		RE 11.3.3	NL	OC	OC	61	a8, a21
1d	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains		RE 11.3.4	NL	OC	OC	83	a13, a15, e9
1di	*Corymbia tessellaris* woodland on alluvial sand ridges to elevated levees and level terraces		RE 11.3.4a	NL	OC	OC	158	a29
1e	*Acacia cambagei* woodland on alluvial plains		RE 11.3.5	NL	OC	LC	9	q64
1f	*Corymbia* spp. woodland on alluvial plains. Sandy soils		RE 11.3.7	NL	OC	LC	116	a30, a31, c16
1g	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines		RE 11.3.25e	NL	OC	LC	309	a14, a30, a31, b10, c15, q106
1h	*Eucalyptus crebra* and/or *E. populnea* and/or *E. melanophloia* on alluvial plains.		RE 11.3.36	NL	OC	OC	13	c15
2a	*Eucalyptus populnea/brownii* woodland on Cainozoic clay plains	Flat to gently undulating Cainozoic clay plains (Landzone 4)	RE 11.4.2	NL	OC	OC	874	f25, a9, a15, a16, a17, c19, d2, a18, q92, q61, q62, q89, q102, d11, d14
2b	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* Open forest to woodland *on* Cainozoic clay plains		RE 11.4.7	E	E	E	111	a10, a32, b7

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Unit	Community Description	Land zone	Regional Ecosystem	Status			Area (ha)	Survey sites [1]
				EPBC	Biodiv	VMA		
2c	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains		RE 11.4.8	E	E	E	380	f23, c5, e13, e14, q104, q121, q126, q128, q131, q137
2d	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains		RE 11.4.9	E	E	E	516	f24, a5, a7, c8, c18, d8, e3, e6, q108, q132
3a	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces	Plains and plateaus on Tertiary land surfaces, with medium to coarse textured soils (Landzone 5)	RE 11.5.3	NL	NCP	LC	4,329	f5, f7, f12, f13, c10, c12 c14, c26, c35 q59, q60, q61, q67, d4, q90, q95, q99, q100, e2, e4, q105, q107, q109, q110, q111, q112, q113, q114, q116, q117, q120, q122, q123, q127, q130, q134, q135, q139
3b	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests		RE 11.5.9	NL	NCP	LC	646	f9, c20, q81, d3, q91, d6, q97, q98
3c	*Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces		RE 11.5.16	E	E	E	74	q48,
4a	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. macrocarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrusts	Exposed or shallowly covered duricrusts (Landzone 7)	RE 11.7.1	NL	OC	LC	21	d10
4b	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone		RE 11.7.2	NL	NCP	LC	729	f20, f21, a26, a27, q50, d7, q97, d9, e5, e8, e10, e11, q119, q124, q125

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Unit	Community Description	Land zone	Regional Ecosystem	Status			Area (ha)	Survey sites [1]
				EPBC	Biodiv	VMA		
5a	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Basalt associated with undulating to gently undulating rises (Landzone 8)	RE 11.8.11	E	OC	OC	254	f14, f15, f16, f17, f18, f19, f22, c4
5b	*Dichanthium sericeum* grassland on Cainozoic igneous rocks		RE 11.8.11/ non remnant grassland	NL	OC	OC	114	c3, q40, epbc1, epbc 2
6a	*Eucalyptus thozetiana* with *Acacia harpophylla* open woodland	Fine grained sediments with little or no deformation (Landzone 9)	RE 11.9.1	E	E	E	53	a14, d5
7a	Non remnant modified open grassland	Landzones 3, 4, 5 7, 8 and 9	n/a	NL	NL	NL	10,717	a1, a4, c17, a36, a38, q40, q58, d1, q94, q103, q115, q129, q140
7b	Non remnant mixed shrubby regrowth		n/a	NL	NL	NL	2,475	a2, a 28, a39, q87, q94, q101, e7, q118
7c	Non remnant *Acacia harpophylla* regrowth		Analogous to HVR11.4.8/9	NL	NL	NL	856	c9 c26, q85, d13, e1, q136, q138

[1] Survey sites coding- a= Secondary sites surveyed 17-26/10/05; b= Secondary sites surveyed 30/01-03/02/06; c= Secondary sites surveyed 22-28/05/06; d= Secondary sites surveyed 18-28/03/09; e= Secondary sites surveyed 11-26/05/09; q39- q69: = Quaternary sites surveyed 17-26/10/05; q70- q73 =: Quaternary sites surveyed 30/01-03/02/06; q74- q90= Quaternary sites surveyed 22-28/05/06; q90- q103= Quaternary sites surveyed 18-28/03/09; q104 – q140= Quaternary sites surveyed 11-26/05/09; epbc1 and epbc 2= Surveyed 28/03/09; f= Sites surveyed 16-21/05/11

The majority of the vegetation associations surveyed have been disturbed or modified by grazing practices to some degree. Low open grassland communities were common across the survey area and have been modified with heavy grazing and the introduction of exotic grass species. Ground cover was dominated in most communities by the exotic grass species *Pennisetum ciliare** (buffel grass), introduced for cattle grazing. Although grazing impacts are evident in both the ground layer and much of the mid strata for woodland communities of the survey area, pastures do not appear to have been overstocked and excessive trampling of groundcover was not evident at the time of survey. Existing land management has minimised grazing impacts and incidences of problematic declared weed species such as *Parthenium hysterophorus** (parthenium) were found to be relatively low.

The west of the survey area is dominated by non-remnant grasslands and large stands of *Eucalyptus populnea* (poplar box) woodland (RE 11.5.3), with isolated pockets of *Acacia harpophylla* (brigalow) woodland (RE 11.4.9) and *A. shirleyi* forest (RE 11.7.2) scattered in relatively small remnants across the landscape (**Figure 5–8a**). Significant stands of *Acacia shirleyi* (lancewood) woodland are situated upon the elevated lateritic duricrusts present. These appear to be the most integral communities present, with less disturbance evident in the understorey and ground layers. Several *Acacia harpophylla* (brigalow) associations that were present in the west of the site have been thinned to allow for improved grazing and are now only present as regrowth communities.

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The east of the survey area is dominated by large stands of *Eucalyptus crebra* (narrow-leaved ironbark) woodland on sand plains (RE 11.5.9), particularly in the south (**Figure 5–8b**). Several pockets of lateritic duricrust are evident within these areas and support densely vegetated *Acacia shirleyi* (lancewood) dominated communities (11.7.2). Non-remnant grassland dominates the north-east of the survey area, with large stands of *Eucalyptus populnea* (poplar box) woodland on clay plains (RE 11.4.2) and some *Acacia harpophylla* (brigalow) regrowth present (HVR 11.4.8).

3.2.7 Targeted Grassland Survey

A detailed ground truthing survey in 2011 of areas delineated by EHP RE mapping as RE 11.8.11 (*Dichanthium sericeum* grassland on Cainozoic igneous rocks) (refer to **Section 2.2.3** for methodology) confirmed some areas to be 100 per cent RE 11.8.11 and some areas to be RE 11.8.11 / non-remnant modified open grassland at the time of survey (50 per cent / 50 per cent respectively).

The areas mapped during the survey as RE 11.8.11 fit the criteria for the EPBC Act TEC: *Natural grassland of the Queensland Central Highlands and the Northern Fitzroy Basin*, listed as endangered under the EPBC Act (**Figure 5–8b**). The 0.1 ha plots surveyed under the methodology outlined by the Department of the Environment for determining this community met the condition threshold of 'Good quality' for the EPBC Act-listed community.

The areas surveyed and mapped as RE 11.8.11 / non remnant grassland (**Figure 5–8b**) do not currently meet the criteria. However, under suitable conditions, including absence of grazing, management of weeds and optimal seasonal weather conditions, it is likely that the entire area mapped as mixed RE 11.8.11/non-remnant modified open grassland would qualify for the EPBC Act-listed community. For this reason the entire area has been mapped as an EPBC Act TEC (refer to **Figure 5-7**).

3.2.8 Riparian communities

In general, the riparian communities of the survey area are confined to the upper banks of the smaller creeks and the upper and lower banks of the Isaac River, with the majority of these areas showing evidence of cattle disturbance. The west of Eureka Creek is dominated by *Acacia harpophylla* (brigalow) and *Casuarina cristata* (belah) open forest (RE 11.3.1), changing to a *Eucalyptus tereticornis* (forest red gum) dominated community (RE 11.3.4) on alluvial plains directly to the south of the GRB mine complex, before reverting to RE 11.3.1. In the south-west of the survey area, Fisher Creek and Platypus Creek are predominantly *Eucalyptus tereticornis* (forest red gum) dominated community fringing drainage lines (RE 11.3.25). To the east of the survey area, the Isaac River is dominated by tall *Eucalyptus tereticornis* (forest red gum) and *Casuarina cunninghamiana* (river sheoak) (RE 11.3.25e) fringing the river. Significant alluvial areas adjacent to Isaac River on the north-east of the survey area support exclusive stands of *Corymbia tessellaris* (Moreton Bay ash) (RE11.3.25e).

3.2.9 Weeds of concern

Of the 46 exotic species described in this survey, five species were identified as being of management concern. These are described below. These are species currently declared as pest species under the LP Act. Declaration under the LP Act requires landholders to manage declared pests on the land under their control. **Figure 5-9** shows survey point locations where weeds were found. A full list of all exotic species is included in **Appendix B**.

3 Results

Harrisia Cactus

*Eriocereus martinii** (harrisia cactus) is Class 2 declared weed recorded in low densities across the survey area (**Figure 5-9**). It is a perennial plant introduced to Queensland in the 1980s. The species is mainly a pest of *Acacia harpophylla* (brigalow) and associated softwood country, however, infestations are now appearing in box and ironbark stands. Harrisia cactus is shade tolerant and reaches its maximum development in the shade and shelter of brigalow scrub, though established infestations can persist once scrub is cleared. Dense infestations choke out pasture and the sharp spines, even in light infestations, make pasture unfavourable to stock (DAFF 2011b). Forms of control employed in the management of harrisia cactus include biological controls, mechanical removal and herbicide.

Prickly Pear and Velvety Tree Pear

Opuntia stricta var. *stricta** (prickly pear) and *Opuntia tomentosa** (velvety tree pear) are both Class 2 declared weeds and were found in a number of vegetation communities across the survey area (**Figure 5-9**), although densities were consistently low. These species were introduced into pastoral districts in the 1840's and by 1925 the pest had invaded over 24 million ha. The introduction of the moth, *Cactoblastis cactorum*, in the 1920's controlled the pest, and by the mid-1930's, prickly pear was no longer a major problem (DAFF 2012).

Parthenium

*Parthenium hysterophorus** (parthenium) is a Class 2 declared weed and was found at a small number of survey sites within woodland communities and non-remnant grassland mainly on clay soils (**Figure 5-9**). Native to South and North America, parthenium is an annual herb with a deep tap root and an erect stem that becomes woody with age. The species invades pastures, disturbed bare areas along roadsides, and heavily stocked areas around yards and watering points (DAFF 2012).

*Parthenium hysterophorus** (parthenium), is also listed as a Weed of National Significance (WONS). The WONS is a list of exotic species which are identified as weeds causing significant environmental damage on a National scale.

Giant Parramatta grass

*Sporobolus fertilis** (giant Parramatta grass) is also a Class 2 declared weed and was identified as present at a single location within a non-remnant *Acacia harpophylla* (brigalow) shrubby regrowth community (**Figure 5-9**) (Vegetation Unit 7c). *Sporobolus fertilis** is a weedy Sporobolus grass and looks similar to another declared weed species; giant rat's tail grass. It is a clumping grass 0.8 to 1.6 m high that invades pastures aggressively and replaces more productive types of grass, particularly following overgrazing or soil disturbance (DAFF 2011a). Major impacts to the grazing industry include causing a loss in carrying capacity and decreased production by up to 80 per cent (DAFF 2011a).

4

Conclusions

The ecological values of the survey area are considered typical for the northern Bowen Basin, with large areas of land historically cleared for grazing and cropping. Although some areas of remnant vegetation remain intact, most have been modified to some extent by historical and current land management practices. The most common modification is the removal of the shrub and ground layers and replacement with pasture grass species.

The survey area features areas of habitat connected at State and regional scales. The remnant woodland vegetation in the south-east of the survey area represents significant habitat connectivity within the corridor system at a State scale. Contiguous tracts of vegetation within the survey area, representing local connectivity of habitat, are primarily linked by riparian corridors associated with the local creek and river systems. Connectivity in the east is primarily provided by the Isaac River riparian corridor. The Isaac River corridor joins a large tract of integral vegetation at the Burton Range approximately 10 km to the north-west. The Burton Range represents a contiguous extent of woodland approximately 18 km long varying in width from 1 km to 5 km.

Vegetation surveys mapped 19 REs; six as endangered, seven as of concern and six as least concern. Further, 1,097 ha of endangered REs, and 2,196 ha of concern REs are located within the survey boundaries.

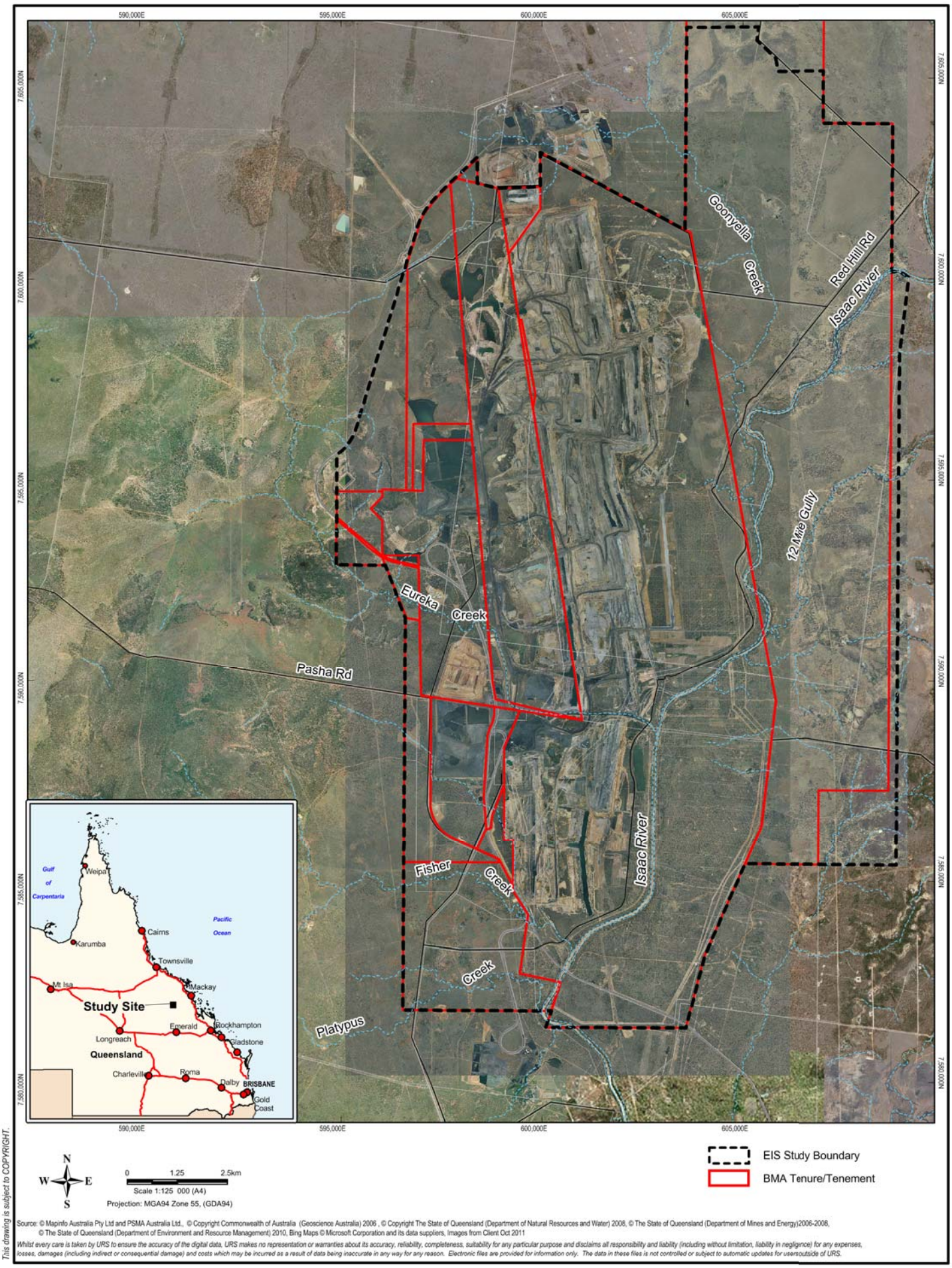
The literature review identified two EPBC Act TECs likely to be present; *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* and *Brigalow (Acacia harpophylla dominant and co-dominant)*. The presence of these communities has been confirmed on site with 254 ha of the former TEC and 1,097 ha of the latter TEC. The *Natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin* TEC were surveyed using the methodology outlined by the Department of the Environment for determining whether the grasslands met the criteria for classification as a TEC. This community met the condition threshold of 'Good quality' for the EPBC Act-listed community.

The literature review identified seven flora species of conservation significance as potentially occurring in the survey area. Of the seven species, field surveys confirmed the presence of one; *Dichanthium setosum* (bluegrass) which is listed as vulnerable under the EPBC Act. An additional threatened plant species was identified on site; *Cerbera dumicola,* which is listed as near threatened under the NC Act. Additional species of conservation significance; *Dichanthium queenslandicum* (king bluegrass) and *Digitaria porrecta* (finger panic grass), were identified as being likely to be present given the types of habitat available.

Of the 46 exotic species recorded during the vegetation surveys, five species were identified as being of management concern. These include *Eriocereus martinii** (harrisia cactus), *Opuntia stricta* var. *stricta** (prickly pear), *Opuntia tomentosa** (velvety tree pear), *Parthenium hysterophorus** (parthenium), and *Sporobolus fertilis** (giant Parramatta grass). These are declared as Class 2 pest species under the LP Act.

5

Figures



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RED HILL MINING LEASE
FLORA SURVEY REPORT

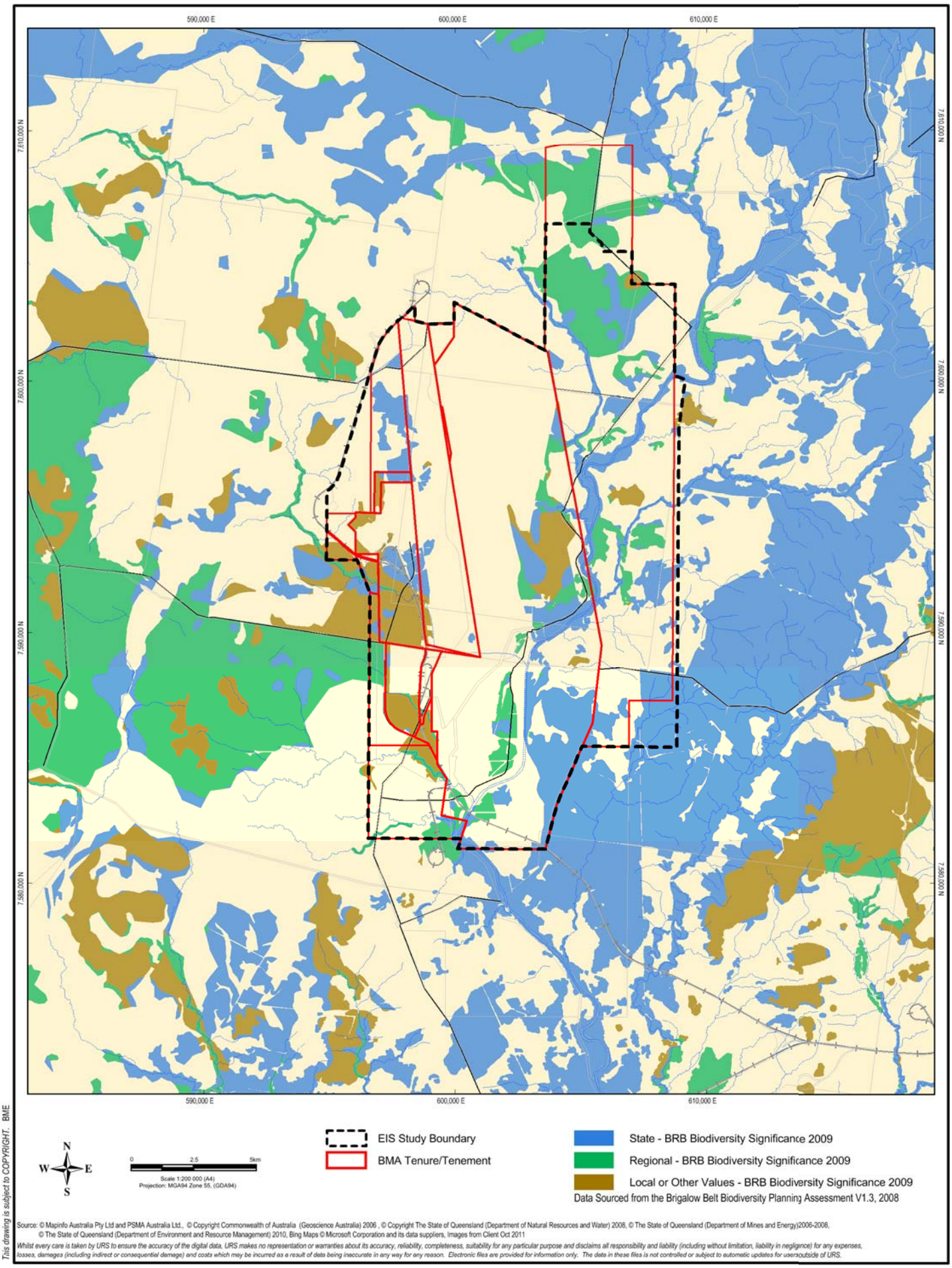
STUDY AREA BOUNDARY

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-1**

File No: **42627136-g-2009.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4



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RED HILL MINING LEASE
FLORA SURVEY REPORT

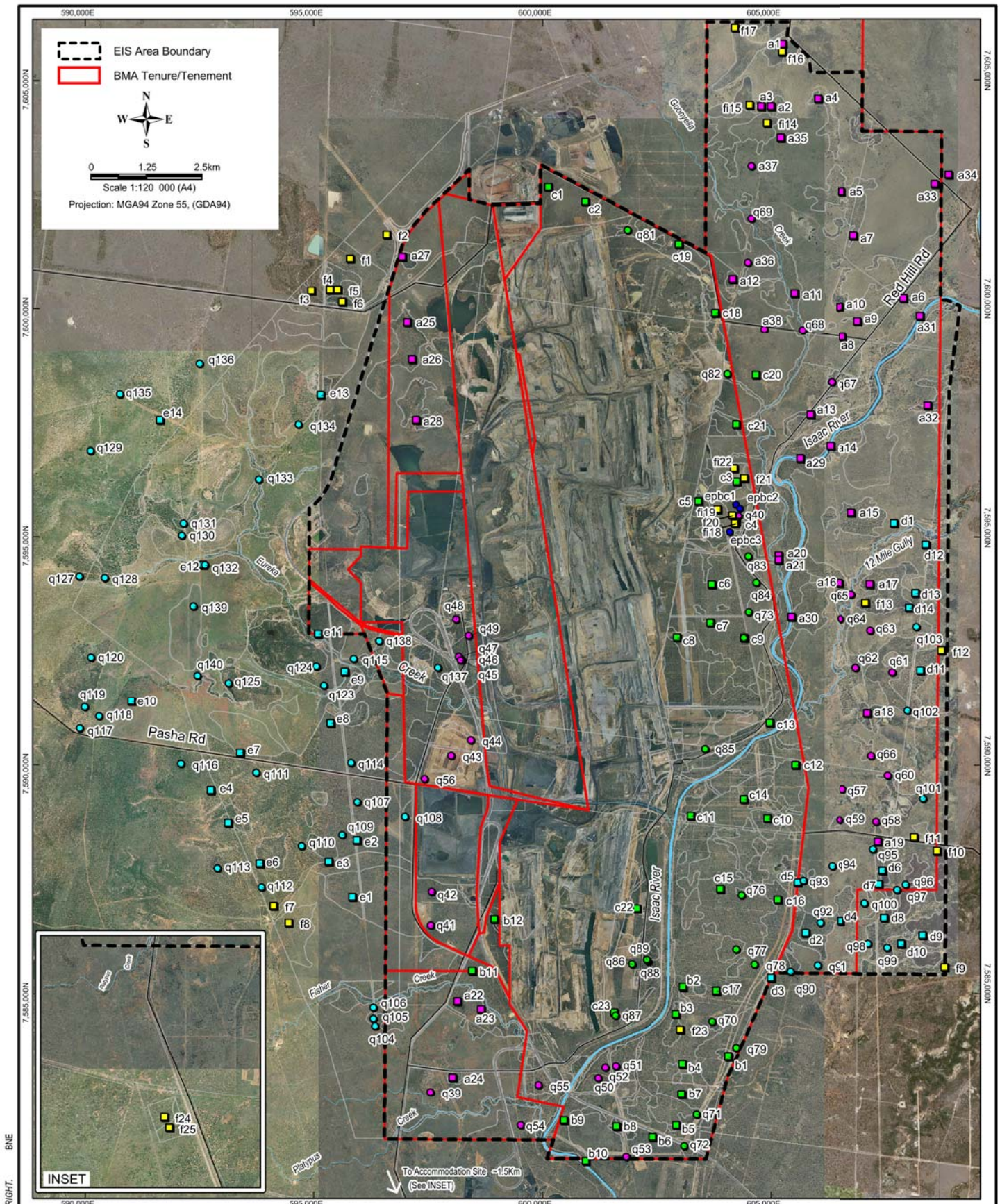
BIODIVERSITY PLANNING ASSESSMENT FOR BRIGALOW BELT - STATE, REGIONAL AND LOCAL BIODIVERSITY SIGNIFICANCE

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-2**

File No: **42627136-g-2012.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4



Secondary Survey 'a ' 17 to 26/10/2005

Secondary Survey 'b ' and Survey 'c ' 30/01to 03/02/2006 and 22 to 28/05/2006

Secondary Survey 'd ' and Survey 'e ' 18 to 28/03/2009 and 11-26/05/2009

Field Stes Survey 'f ' 16 to 21/05/11 ('fi ' Targeted Grassland Survey)

Quaternary Survey 'q39- q69 ' 17 to 26/10/2005

Quaternary Survey 'q70- q73 ' and 'q74- q90 ' 30/01to 03/02/2006 and 22 to 28/05/2006

Quaternary Survey 'q90 - q103 ' and 'q104 - q140 ' 18 to 28/03/2009 and 11-26/05/2009

Survey Location 'epbc1 - 3 ' 28/03/2009

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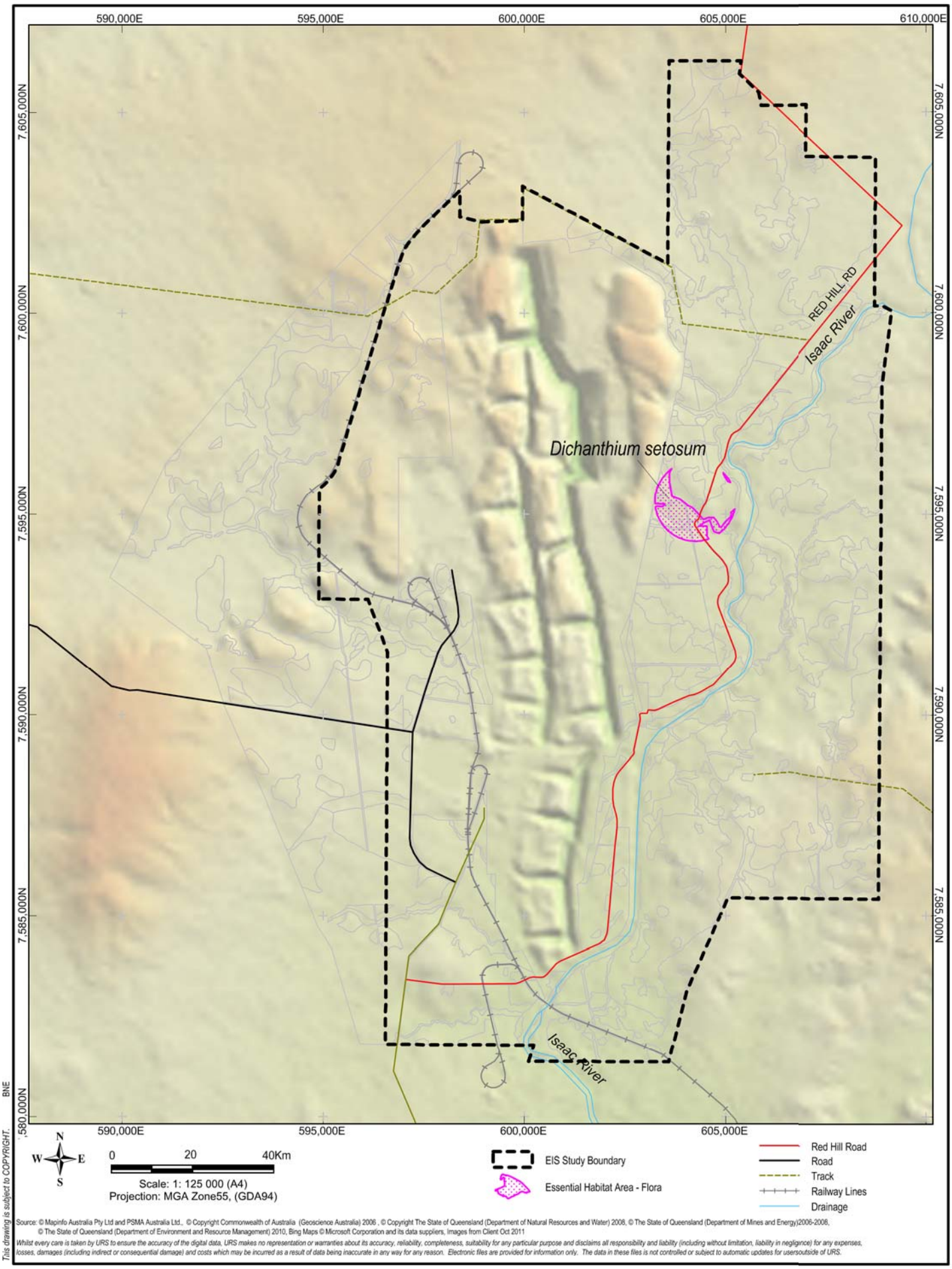
FLORA SURVEY REPORT

SURVEY LOCATIONS

URS | **ECOLOGICAL ASSESSMENT - FLORA** | Figure: **5-3**

File No: **42627136-g-2010.wor** | Drawn: **VH** | Approved: **CT** | Date: **17-06-2013** | Rev.**A** | A4



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RED HILL MINING LEASE
FLORA SURVEY REPORT

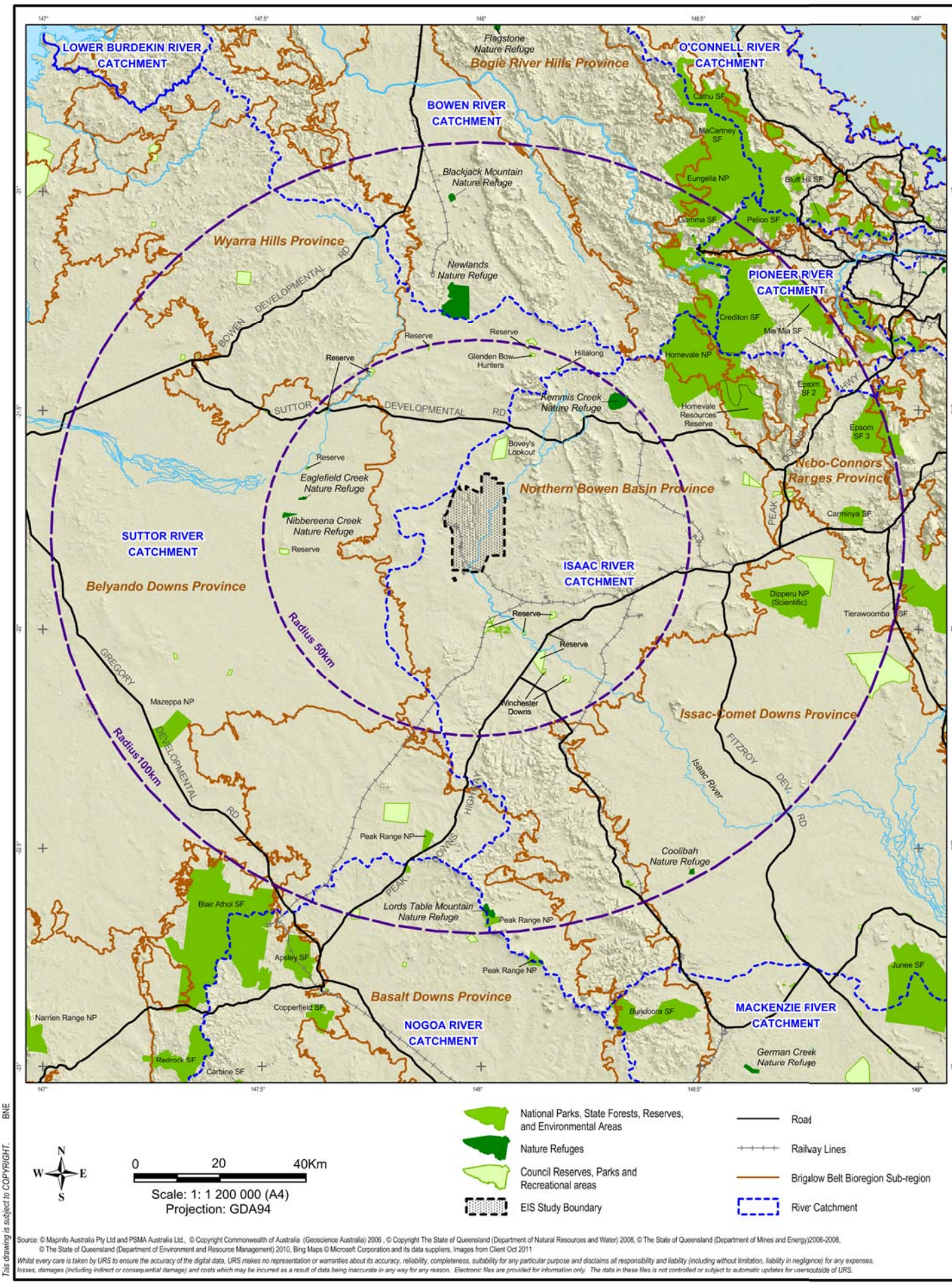
ESSENTIAL HABITAT MAPPING

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-4**

File No: **42627136-g-2011.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4



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FLORA SURVEY REPORT

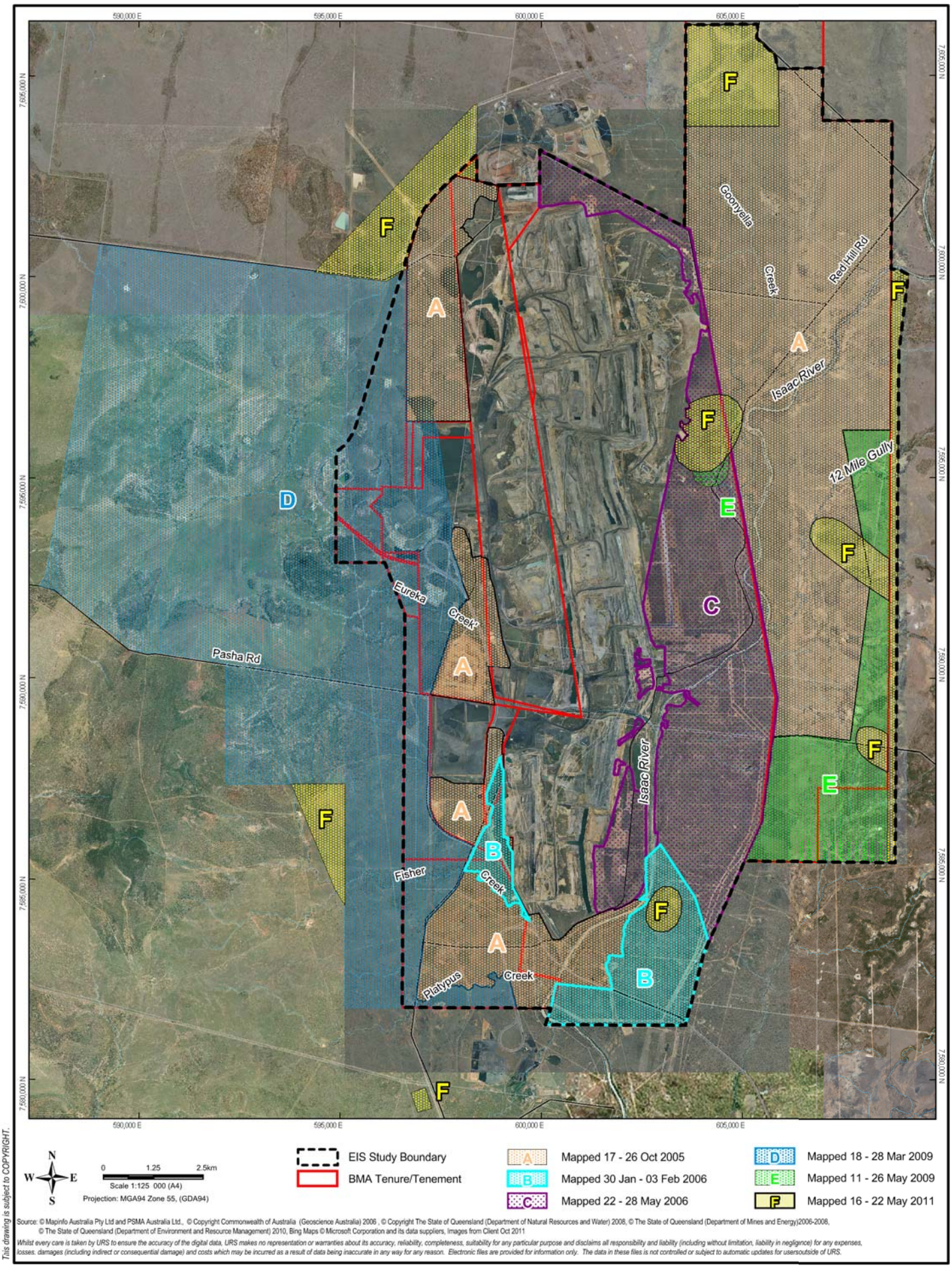
BIOREGIONAL AND CATCHMENT MAP SHOWING AREAS OF CONSERVATION SIGNIFICANCE

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: 5-5

File No: 42627136-g-2013.wor | Drawn: VH | Approved: CT | Date: 17-06-2013 | Rev.A | A4



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RED HILL MINING LEASE
FLORA SURVEY REPORT

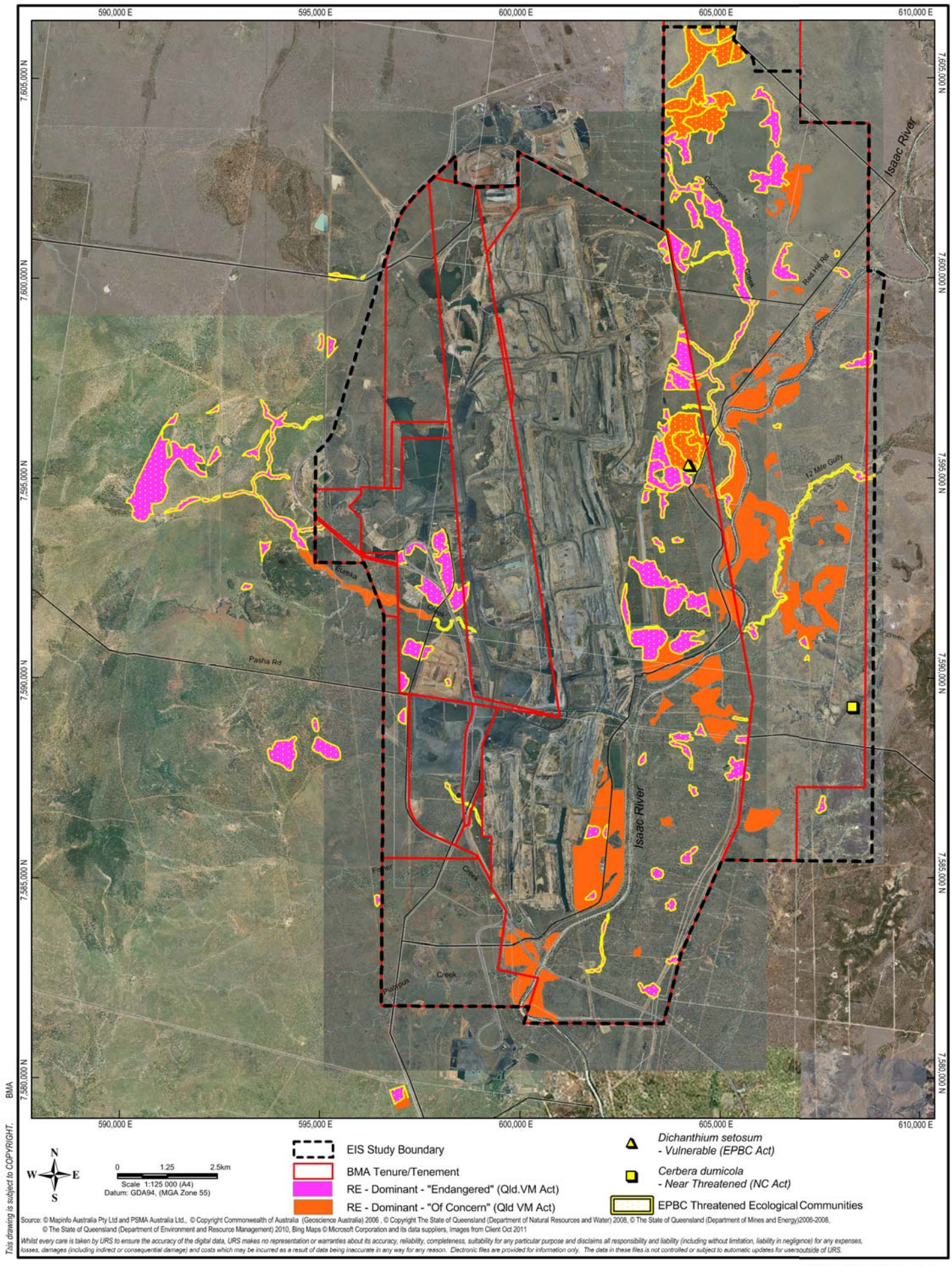
FLORA SURVEY TIMING

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-6**

File No: **42627136-g-2014.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4



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RED HILL MINING LEASE
FLORA SURVEY REPORT

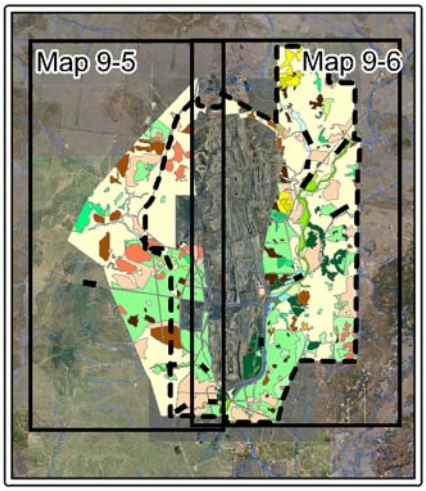
MAPPED VEGETATION COMMUNITIES OF CONSERVATION SIGNIFICANCE AND LOCATION OF CONSERVATION SIGNIFICANT FLORA SPECIES

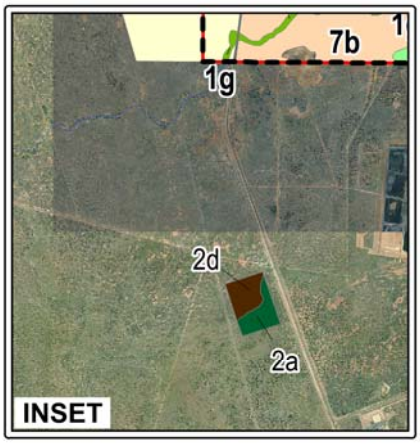
URS

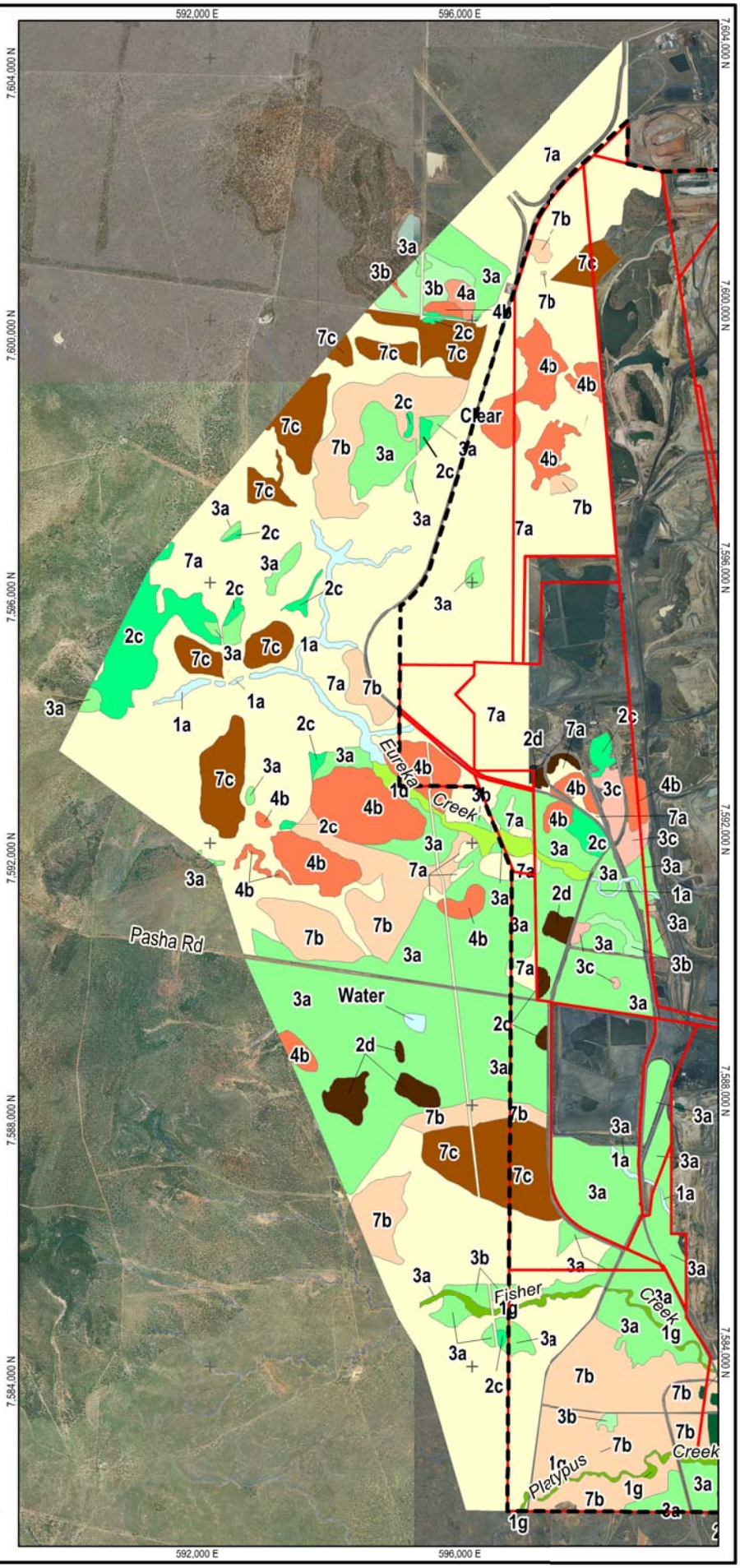
ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-7**

File No: **42627136-g-2016.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4







NOTE:
Description of Vegetation Community Code presented in Figure 5-8c.

EIS Study Boundary

BMA Tenure/Tenement

"7a" Vegetation Community Code

N W E S

0 1.25 2.5km

Scale 1:95 000 (A4)
Projection: GDA94, MGA Zone 55

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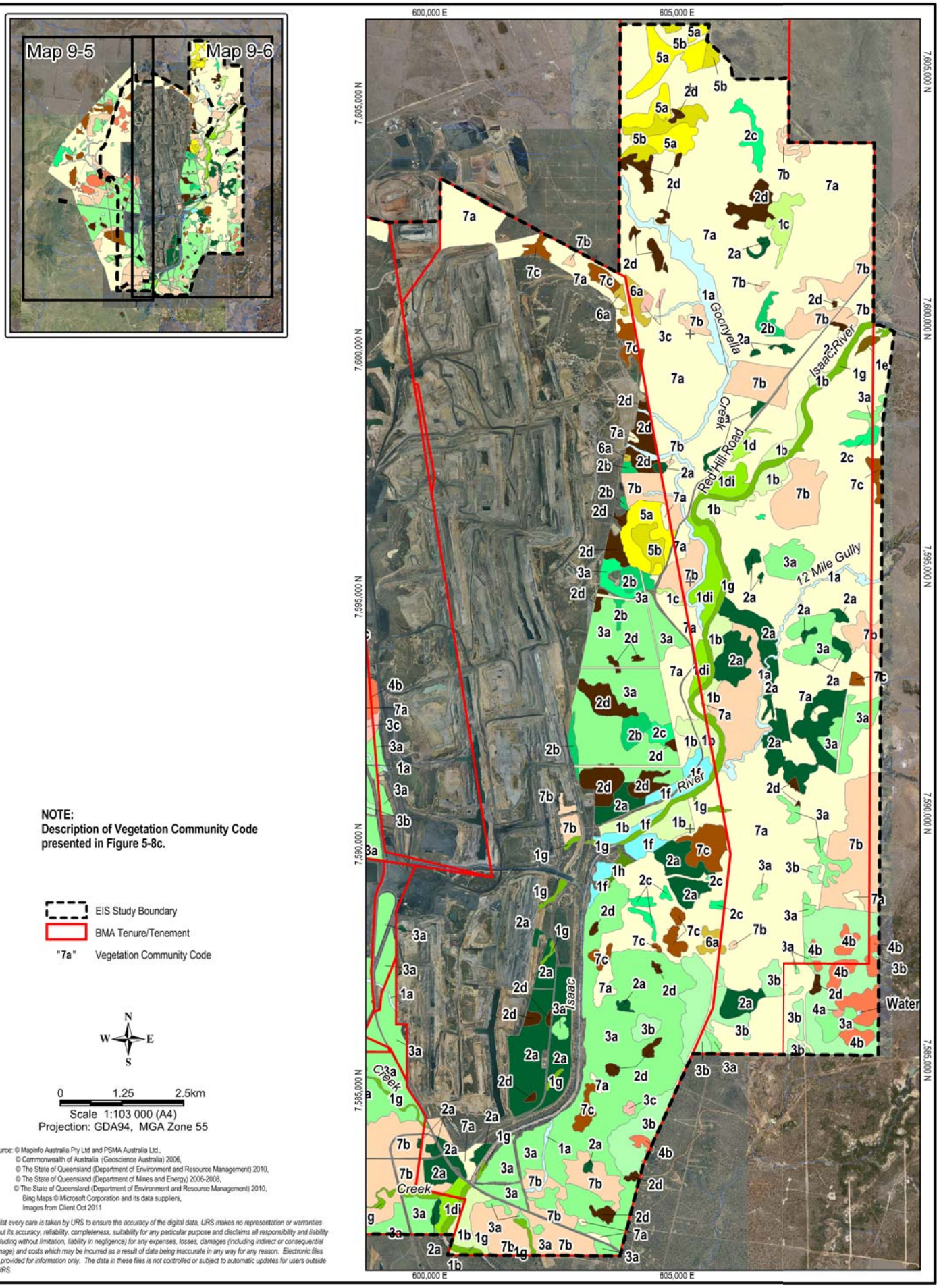
RED HILL MINING LEASE
FLORA SURVEY REPORT

VEGETATION COMMUNITIES - WESTERN SECTOR

URS | **ECOLOGICAL ASSESSMENT - FLORA** | Figure: **5-8a**

File No: **42627136-g-2015.wor** | Drawn: **VH** | Approved: **CT** | Date: **17-06-2013** | Rev.**A** | A4



NOTE:
Description of Vegetation Community Code presented in Figure 5-8c.

EIS Study Boundary

BMA Tenure/Tenement

"7a" Vegetation Community Code

N
W E
S

0 1.25 2.5km

Scale 1:103 000 (A4)
Projection: GDA94, MGA Zone 55

BNE

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RED HILL MINING LEASE
FLORA SURVEY REPORT

VEGETATION COMMUNITIES - EASTERN SECTOR

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-8b**

File No: **42627136-g-2015.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4

Vegetation Community Code	Community Description	Regional Ecosystem	VMA Status	EPBC Status
1a	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains.	RE 11.3.1	Endangered	Endangered
1b	*Eucalyptus populnea* woodland on alluvial plains.	RE 11.3.2	Of Concern	Not Listed
1c	*Eucalyptus coolabah* woodland on alluvial plains.	RE 11.3.3	Of Concern	Not Listed
1d	*Eucalyptus tereticornis* and/or Eucalyptus spp. woodland on alluvial plains.	RE 11.3.4	Of Concern	Not Listed
1di	*Corymbia tessellaris* woodland on alluvial sand ridges to elevated levees and level terraces.	RE 11.3.4a	Of Concern	Not Listed
1e	*Acacia cambagei* woodland on alluvial plains.	RE 11.3.5	Least Concern	Not Listed
1f	*Corymbia* spp. woodland on alluvial plains. Sandy soils	RE 11.3.7	Least Concern	Not Listed
1g	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.	RE 11.3.25e	Least Concern	Not Listed
1h	*Eucalyptus crebra* and/or *E. populnea* and/or *E.melanophloia* on alluvial plains, higher terraces.	RE 11.3.36	Of Concern	Not Listed
2a	*Eucalyptus populnea/brownii* woodland on Cainozoic clay plains.	RE 11.4.2	Of Concern	Not Listed
2b	*Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* Open forest to woodland on Cainozoic clay plains.	RE 11.4.7	Endangered	Endangered
2c	*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains.	RE 11.4.8	Endangered	Endangered
2d	*Acacia harpophylla* shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains.	RE 11.4.9	Endangered	Endangered
3a	*Eucalyptus populnea* and/or *E. melanophloia* and/or *Corymbia clarksoniana* on Cainozoic sand plains/remnant surfaces.	RE 11.5.3	Least Concern	Not Listed
3b	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests.	RE 11.5.9	Least Concern	Not Listed
3c	*Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces.	RE 11.5.16	Endangered	Endangered
4a	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. macrocarpa* woodland on lower scarp slopes on Caino zoic lateritic duricrusts.	RE 11.7.1	Least Concern	Not Listed
4b	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone.	RE 11.7.2	Least Concern	Not Listed
5a	*Dichanthium sericeum grassland on Cainozoic igneous rocks.*	RE 11.8.11	Of Concern	Endangered
5b	*Dichanthium sericeum grassland on Cainozoic igneous rocks/ non remnant modified grassland (50%/50%).*	RE11.8.11/ n/a	Of Concern/ Not Listed	Not Listed
6a	*Eucalyptus thozetiana with Acacia harpophylla open woodland.*	RE 11.9.1	Endangered	Endangered
7a	Non remnant modified open grassland.	n/a	Not Listed	Not Listed
7b	Non remnant mixed shrubby regrowth.	n/a	Not Listed	Not Listed
7c	Non remnant *Acacia harpophylla* regrowth.	n/a	Not Listed	Not Listed

NOTE: This Figure 5-8c must be viewed in conjunction with Figures 5-8a and 5-8b.

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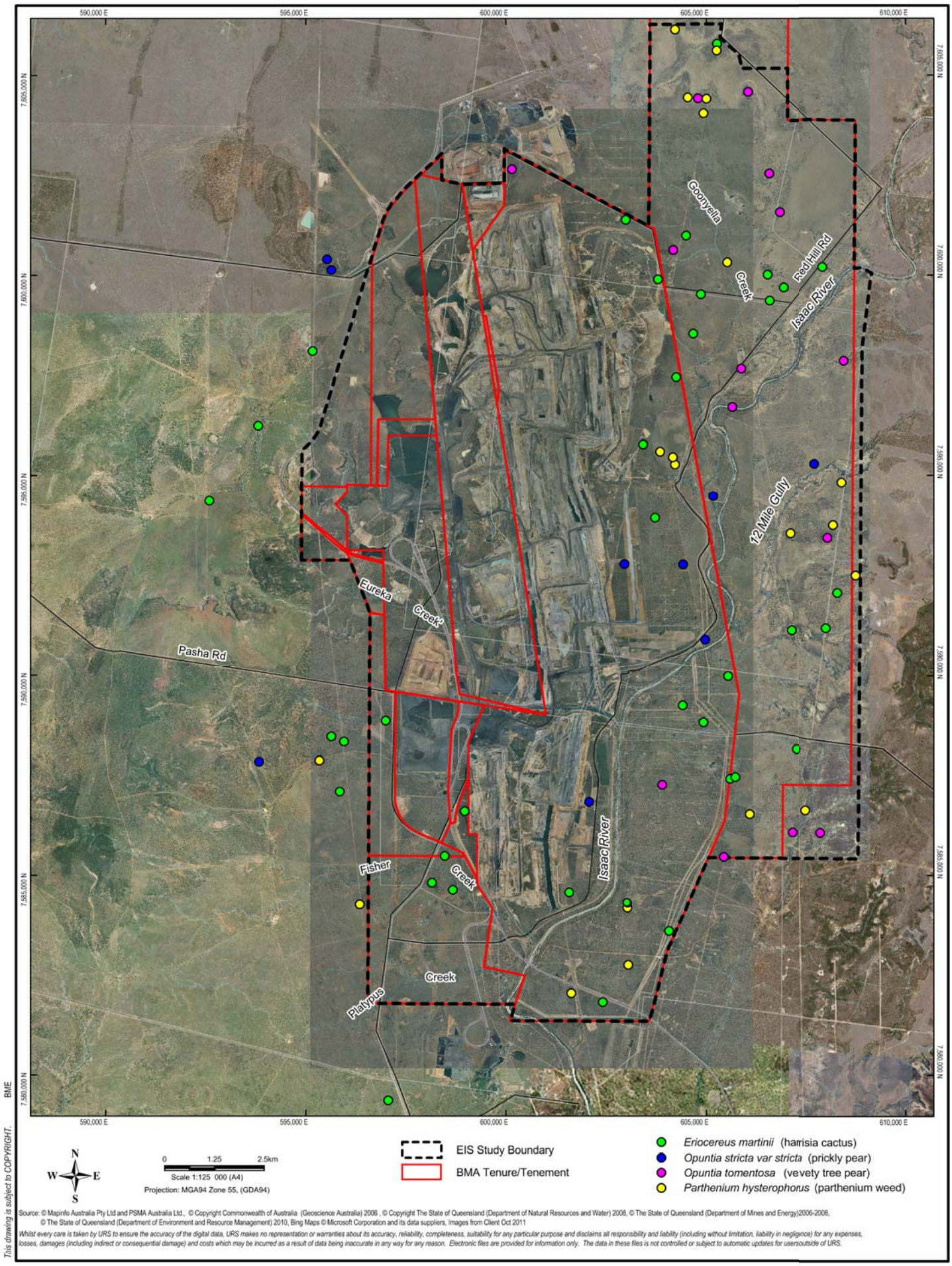
RED HILL MINING LEASE
FLORA SURVEY REPORT

LEGEND - VEGETATION COMMUNITIES

URS | **ECOLOGICAL ASSESSMENT - FLORA** | Figure: **5-8c**

File No: **42627136-g-2015.wor** | Drawn: **VH** | Approved: **CT** | Date: **17-06-2013** | Rev.**A** | A4



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RED HILL MINING LEASE
FLORA SURVEY REPORT

WEEDS OF MANAGEMENT CONCERN

URS

ECOLOGICAL ASSESSMENT - FLORA

Figure: **5-9**

File No: **42627136-g-2017.wor** Drawn: **VH** Approved: **CT** Date: **17-06-2013** Rev.**A** A4

6

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A

Appendix A - Survey Site Descriptions

A.1 Alluvial Plains (Landzone 3) field survey results

A.1.1 Vegetation Unit 1a: *Acacia harpophylla* (brigalow) open forest on alluvial plains (RE 11.3.1)

Description: This brigalow vegetation community was found to be restricted to alluvial plains and banks of the smaller water courses of the survey area including Goonyella Creek, Eureka Creek and 12 Mile Gully. This community is characterised by the dominance of *Acacia harpophylla* (brigalow) with occasional scattered emergent *Eucalyptus coolabah* (coolibah) and *Eucalyptus populnea* (poplar box) in the canopy. *Acacia harpophylla, Lysiphyllum hookeri* (white-flowered bauhinia) and *Lysiphyllum carronii* (red bauhinia) co-dominate the mid strata. The understorey is typically low open grassland modified from grazing disturbance, primarily dominated by *Pennisetum ciliare** (buffel grass) and a number of other introduced grass species.

Representative structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the tables below.

2005 2006 Survey

Vegetation Unit 1a (RE 11.3.1)	
Strata	Dominant species
Canopy 10-15 m **CSR: 14 / 2.9** **FPC: 2.3%**	*Acacia harpophylla*
	Eucalyptus coolabah
	Lysiphyllum carronii
Mid-Storey 5-8 m	*Acacia harpophylla*
	Lysiphyllum carronii
Shrub Layer 1-2 m	*Acacia harpophylla*
	Alectryon diversifolius
	Alstonia constricta
	Archidendropsis basaltica
	Eremophila mitchellii
	Lysiphyllum carronii
	Terminalia oblongata ssp. *voluvris*
Ground Layer <1 m **FPC: 70%** **Bare: 20%**	*Aristida leptopoda*
	Bothriochloa ewartiana
	Capparis lasiantha
	*Pennisetum ciliare**
	Citrus glauca
	*Eriocereus martinii **
	*Opuntia stricta v stricta **
	*Parthenium hysterophorus **
	Portulaca oleracea

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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2009 Survey

Photo 1: Example of Vegetation Unit 1a (RE 11.3.1) along Eureka Creek at the west of the survey area.

Secondary Survey Site e12 (RE 11.3.1) **RED HILL Survey D: 23/05/09**	
Transect Start	592592 mE; 7594371 mN
Transect End (50m)	592634 mE; 7594375 mN
Bearing	15° E
Aspect	Flat
Slope	Undulating
Soil	Fine, brown-grey Quaternary alluvium
Weeds	*Eriocereus martinii* *
Erosion	Moderate
Grazing impacts	Severe
Fire history	> 10 years
Fauna habitat	occasional fallen and decayed logs/debris
Notes	Dense *Acacia harpophylla* in surrounding area, riparian strip
Strata	**Dominant Species**
Canopy (T1): 6-8 m **FPC: 50%**	*Acacia harpophylla*
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-3m **FPC: 5%**	*Eremophila mitchellii*
	Terminalia oblongata

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Secondary Survey Site e12 (RE 11.3.1) **RED HILL Survey D: 23/05/09**	
	Atalaya hemiglauca
Ground (G): <1 m **FPC: 2%** **Litter: 33%** **Bare: 65%**	*Pennisetum ciliare**
	*Urochloa mosambicensis**
	Dactyloctenium radulans
Basal Count (Factor 1 cm)	
	Acacia harpophylla: 6
	Eremophila mitchellii: 1

FPC: Foliage Projection Cover

A.1.2 Vegetation Unit 1b: *Eucalyptus populnea* woodland on alluvial plains (RE 11.3.2)

Description: This vegetation community was found to be distributed along the flat river beds and associated river banks of the Isaac River and smaller water courses of the survey area. This community is characterised by the dominance of *Eucalyptus populnea* (poplar box) in the canopy layer, with *Acacia salicina* (sally wattle) and regenerating *E. populnea* co-dominating in the mid strata. Some dieback was evident in the larger canopy trees. The shrub layer is generally sparse and is dominated by *Eremophila mitchellii* (false sandalwood), *Cassia brewsteri* (Leichhardt bean) and *Archidendropsis basaltica* (dead finish). The ground cover is typically a low open grassland modified from grazing, primarily dominated by *Pennisetum ciliare** (buffel grass). Native ground cover species include *Carissa ovata* (currant bush) and *Capparis lasiantha* (wait-a-while).

The typical characteristic structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the table below.

2005 - 2006 Survey

Vegetation Unit 1b (RE11.3.2)	
Strata	Dominant species
Canopy 15-18 m **CSR: 20.4 / 4.6** **FPC: 2.8%**	*Eucalyptus populnea*
Mid-Storey 10-12 m **CSR: 9.1 / 2.6** **FPC: 3.9%**	*Acacia salicina*
	Cymbidium canaliculatum
	Eucalyptus populnea
Shrub Layer 2-3 m	*Archidendropsis basaltica*
	Cassia brewsteri
	Eremophila mitchellii
	Eucalyptus populnea
Ground Layer <1 m	*Acacia excelsa* ssp *excelsa*
	Capparis lasiantha

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Vegetation Unit 1b (RE11.3.2)	
FPC: 60% **Litter: 10%** **Bare: 30%**	*Carissa ovata*
	*Pennisetum ciliare**
	Enchylaena tomentosa v glabra
	Grevillea parallela
	Indigofera linnaei
	Parsonsia lanceolata
	Urochloa mosambicensis *

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 Survey

Secondary Survey Site d12 (RE 11.3.2) RED HILL Survey D: 26/03/09	
Transect Start	608412 mE; 7594827 mN
Transect End (50m)	608464 mE; 7594809 mN
Bearing	20° E
Aspect	N
Slope	undulating
Soil	light brown/grey fines, Quaternary alluvium; mixed range of pebbles
Weeds	nil
Erosion	nil
Grazing impacts	occasional to moderate
Fire history	> 10 years
Fauna habitat	Beside creek; tall, dense grass (native and exotic)
Notes	-
Strata	**Dominant Species**
Canopy (T1): 12-15 m **FPC: 33%**	*Eucalyptus populnea*
	Eucalyptus tereticornis
Mid-Storey (T2): 6-10 m	*Eucalyptus populnea*
	Acacia harpophylla
	Lysiphyllum hookeri
Shrub (S1): 1-2 m **FPC: 5%**	*Terminalia oblongata*
	Carissa ovata
Ground (G): <1 m **FPC: 81%** **Litter: 19%** **Bare: 0%**	*Pennisetum ciliare**
	Megathyrsus maximus var *maximus**
	Cyperus gracilis
	Paspalidium caespitosum
Basal Count (Factor 1 cm)	
	Terminalia oblongata: 6
	Eucalyptus populnea: 1

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Secondary Survey Site d12 (RE 11.3.2) **RED HILL Survey D: 26/03/09**	
	Acacia harpophylla: 1
	Lysiphyllum hookeri: 1

A.1.3 Vegetation Unit 1c: *Eucalyptus coolabah* woodland on alluvial plains (RE 11.3.3)

Description: This vegetation community was found to be restricted to alluvial plains in the north-east of the site. This community is characterised by an open canopy dominated by *Eucalyptus coolabah* (coolibah). Sub-dominant canopy species include *Eucalyptus camaldulensis* (river red gum), *Lysiphyllum carronii* (red bauhinia) and *Acacia salicina* (Sally wattle). The mid stratum is characteristically sparse, dominated by *Lysiphyllum carronii* (red bauhinia) and *Atalaya hemiglauca* (whitewood). The understorey is typically highly modified from grazing disturbance and is primarily dominated by *Pennisetum ciliare** (buffel grass).

Structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the tables below. Where a variation in floristics is seen in the dominant strata of the community further tables have been added to demonstrate the variation.

2005 - 2006 Survey

Vegetation Unit 1c (RE 11.3.3)	
Strata	Dominant species
Canopy 20-25 m **CSR: 20.4 / 4.6** **FPC: 2.8%**	*Eucalyptus coolabah*
	Lysiphyllum carronii
Mid-Storey 5-8 m **CSR: 20.4 / 4.6** **FPC: 2.8%**	*Atalaya hemiglauca*
	Cymbidium canaliculatum
Shrub Layer 1-2 m	*Alectryon diversifolius*
	Atalaya hemiglauca
	Flindersia dissosperma
	Salsola kali
	Santalum lanceolatum
Ground Layer <1 m **FPC: 60%** **Litter: 10%** **Bare: 30%**	*Acacia farnesiana* *
	Aristida leptopoda
	Astrebla lappacea
	Atalaya hemiglauca
	Capparis lasiantha
	*Pennisetum ciliare**
	Citrus glauca

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Vegetation Unit 1c (RE 11.3.3)	
	Eremophila debilis
	Eriocereus martinii *
	Neptunia gracilis
	Opuntia tomentosa *
	Sporobolus crebra

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

Vegetation Unit 1c (RE 11.3.3)	
Strata	Dominant species
Canopy 20-25 m **CSR: 10.4 / 3.6** **FPC: 5.3%**	*Eucalyptus coolabah*
	Eucalyptus camaldulensis
	Acacia salicina
Mid-Storey 15 m **CSR: 13.1 / 1.5** **FPC: 0.85%**	*Acacia salicina*
	Corymbia dallachiana
	Corymbia tessellaris
	Eucalyptus cambageana
	Eucalyptus coolabah
	Eucalyptus crebra
	Lysiphyllum hookeri
Shrub Layer 1-2 m	*Acacia salicina*
	Alectryon diversifolius
	Atalaya hemiglauca
	Capparis mitchellii
	Carissa ovata
	Cassia brewsteri
	Diospyros humilis
	Eremophila mitchellii
	Grewia retusifolia
	Lysiphyllum hookeri
	Pogonolobus reticulatus
Ground Layer <1 m **FPC: 50%** **Litter: 15%** **Bare: 35%**	*Acacia farnesiana* *
	Capparis lasiantha
	*Pennisetum ciliare**
	Corymbia dallachiana
	Eriocereus martinii *
	Jasminum didymum ssp. *didymium*
	Opuntia stricta var. *stricta* *
	Parsonsia lanceolata

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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A.1.4 Vegetation Unit 1d: *Eucalyptus tereticornis* and/or *Eucalyptus spp* woodland on alluvial plains (RE 11.3.4)

Description: This vegetation community was found on alluvial plains and terraces of the Isaac River and some of the smaller water courses of the survey area, including Goonyella Creek. This community is characterised by a tall open canopy cover dominated by *Eucalyptus tereticornis* (forest red gum) with a number of sub-dominants including *Eucalyptus crebra* (Narrow leaved Ironbark), *Eucalyptus camaldulensis* (river red gum), *Corymbia clarksoniana* (Clarkson's bloodwood) and *Corymbia dallachiana* (ghost gum). *Corymbia tessellaris* (Moreton Bay ash) and regenerating canopy species dominate the mid strata. The shrub layer is sparse but relatively diverse, dominated by canopy species and Acacia species. The groundcover is typically a low open grassland modified from grazing disturbance, primarily dominated by *Pennisetum ciliare** (buffel grass) and a number of other introduced species including a dense infestation of *Stylosanthes humilis* (Townsville stylo) in areas. This vegetation community occurs on alluvial plains and terraces as opposed to RE 11.3.25, which is solely restricted to stream banks (Sattler and Williams 1999).

Representative structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the tables below.

2005 - 2006 Survey

Vegetation Unit 1d (RE 11.3.4)	
Strata	Dominant species
Canopy 25-30 m **CSR: 7.15 / 11.75** **FPC: 31%**	*Corymbia clarksoniana*
	Corymbia dallachiana
	Eucalyptus camaldulensis
	Eucalyptus crebra
Mid-Storey 8-10 m **CSR: 6.5 / 4** **FPC: 11.7%**	*Corymbia clarksoniana*
	Corymbia tessellaris
	Cymbidium canaliculatum
	Eucalyptus camaldulensis
	Eucalyptus crebra
	Eucalyptus populnea
Shrub Layer 1-2 m	*Acacia cambagei*
	Acacia excelsa ssp. *excelsa*
	Acacia harpophylla
	Acacia salicina
	Atalaya hemiglauca
	Carissa ovata
	Cassia brewsteri
	Corymbia clarksoniana
	Corymbia tessellaris
	Eremophila mitchellii
	Eucalyptus camaldulensis
	Opuntia tomentosa *
	Stylosanthes scabra *

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Vegetation Unit 1d (RE 11.3.4)	
Ground Layer <1 m **FPC: 60%** **Bare: 40%**	*Capparis lasiantha*
	*Pennisetum ciliare**
	Citrus glauca
	Dianella revoluta v *minor*
	Eustrephus latifolius
	*Senna barclayana **
	*Stylosanthes humilis **

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 Survey

Photo 2: Example of Vegetation Unit 1d (RE 11.3.4) on Eureka Creek, at the west of the survey area.

Secondary Survey Site e9 (RE 11.3.4) **RED HILL Survey D: 20/05/09**	
Transect Start	595686mE; 7592040mN
Transect End (50m)	595639mE; 7592057mN
Bearing	51° W
Aspect	N
Slope	6°
Soil	Quaternary alluvium
Weeds	N/A
Erosion	Minimal, stable – limited to creek bank
Grazing impacts	Moderate - Heavy

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Secondary Survey Site e9 (RE 11.3.4) **RED HILL Survey D: 20/05/09**	
Fire history	> 10 years
Fauna habitat	Large *E. tereticornis* with hollows, low water level, dense grass
Notes	Community restricted to within creek and immediate banks
Strata	**Dominant Species**
Canopy (T1): 20-25 m **FPC: 51%**	*Eucalyptus tereticornis*
Mid-Storey (T2): 8-15m	*Eucalyptus tereticornis*
	Corymbia tessellaris
Shrub (S1): 1-5m **FPC: 5%**	*Acacia leiocalyx*
	Acacia salicina
	Cassia brewsteri
Ground (G): <1 m **FPC: 2%** **Litter: 33%** **Bare: 65%**	*Heteropogon contortus*
	*Megathyrsus maximus**
	Themeda triandra
Basal Count (Factor 1 cm)	
	Eucalyptus tereticornis: 7
	Lysiphyllum hookeri: 1
	Corymbia dallachiana: 1

FPC: Foliage Projection Cover

A.1.5 Vegetation Unit 1di: *Corymbia tessellaris* woodland on alluvial sand ridges to elevated levees and level terraces (RE 11.3.4a)

Description: This vegetation community was found to be restricted to alluvial plains and terraces of the Isaac River. This community is characterised by the dominance of *Corymbia tessellaris* (Moreton Bay ash) in the canopy layer. Sub-dominant canopy species include *Eucalyptus populnea* (poplar box) and *Corymbia clarksoniana* (Clarkson's bloodwood). The mid storey and shrub layer are characteristically sparse, dominated by both *Acacia salicina* (Sally wattle) and *Lysiphyllum hookeri* (white-flowered bauhinia). The groundcover is primarily dominated by *Pennisetum ciliare** (buffel grass) along with a number of introduced herb species.

Representative structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the table below.

2005 - 2006 Survey

Vegetation Unit 1di (11.3.4a)	
Strata	Dominant species
Canopy 20-25 m **CSR: 16 / 4.9** **FPC: 4.4%**	*Corymbia tessellaris*
	Corymbia clarksoniana
	Eucalyptus populnea

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Vegetation Unit 1di (11.3.4a)	
Mid-Storey 5-8 m	*Acacia salicina*
	Lysiphyllum hookeri
Shrub Layer 1-2 m	*Santalum lanceolatum*
Ground Layer <1 m **FPC: 65%** **Litter: 20%** **Bare: 15%**	*Pennisetum ciliare**
	Chrysocephalum apiculatum
	Crinum flaccidum
	Cyperus gracilis
	*Gomphrena celosioides **
	*Eriocereus martinii **
	*Opuntia tomentosa**
	*Oxalis corniculata **
	*Portulaca pilosa **
	Sida trichopoda
	*Stylosanthes scabra **
	Calyptochloa gracillima
	Wahlenbergia gracilis

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

A.1.6 Vegetation Unit 1e: *Acacia cambagei* woodland on alluvial plains (RE 11.3.5)

Description: This vegetation community was restricted to a small extent in one location on the west bank of the Isaac River, to the north-west of the survey area. This community was characterised by *Acacia cambagei* (gidgee) in a mid-dense to sparsely covered canopy at a height of 8 to 12 m. *Eucalyptus populnea* (poplar box) and *Acacia harpophylla* (brigalow) regrowth were also present in the canopy on the ecotonal boundary of this community. *Eremophila mitchellii* was present in the sparsely covered mid layer at two to four metres. The ground layer was dominated by *Pennisetum ciliare* * (buffel grass). No secondary transect data was recorded for the 7 ha extent of this community.

A.1.7 Vegetation Unit 1f: *Corymbia spp.* Woodland on alluvial plains (RE 11.3.7)

Description: This vegetation community was found to be distributed along the alluvial terraces along the north and south banks of the Isaac River to the south of the survey area, and the GRB mine complex. This community is characterised by *Corymbia tessellaris* (Moreton Bay ash) in the canopy with *Casuarina cunninghamiana* (river oak) co-dominating. *Eucalyptus populnea* (poplar box) is typically found interspersed with dominant and sub-dominant species in the canopy and mid layer. The understorey is dominated by *Pennisetum ciliare** (buffel grass) and showed signs of disturbance due to grazing.

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below.

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2005 - 2006 Survey

Vegetation Unit 1f (RE 11.3.7)	
Strata	Dominant species
Canopy 15-18 m **CSR: 22.3 / 18.4** **FPC: 14.3%**	*Corymbia erythrophloia*
	Corymbia tessellaris
	Eucalyptus populnea
Mid-Storey 15-18 m **CSR: 3.7 / 3.1** **FPC: 36.7%** **CSR: 22.3 / 18.4** **FPC: 14.3%**	*Acacia salicina*
	Eucalyptus populnea
Shrub Layer 1-2 m	*Atalaya hemiglauca*
	Cassia brewsteri
Ground Layer <1 m **FPC: 54%** **Bare: 39%**	*Aristida jerichoensis v jerichoensis*
	*Pennisetum ciliare**
	Chloris pectinata
	Chrysopogon fallax
	*Commelina ensifolia **
	Crinum flaccidum
	Cyperus gracilis
	Enchylaena tomentosa v glabra
	Eremophila deserti
	Heteropogon contortus
	*Melinis repens **
	Nyssanthes erecta
	*Opuntia stricta v stricta **
	*Oxalis corniculata **
	Panicum effusum v simile
	Parsonsia lanceolata
	*Sida cordifolia **
	Sida trichopoda
	*Urochloa mosambicensis **

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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A.1.8 Vegetation Unit 1g: *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines (RE 11.3.25e)

Description: This riparian vegetation community was found to be distributed along the flat river beds and associated river banks of the Isaac River. This community is characterised by *Eucalyptus camaldulensis* (River red gum) and *Eucalyptus tereticornis* (forest red gum) co-dominating the canopy layer. This community shows a distinct change in composition with increasing distance from the river edge. Along the lower river bank the canopy is typically dominated by *Eucalyptus camaldulensis* with the mid strata supporting *Casuarina cunninghamiana* (river oak). The ground cover along the lower river bank is characterised by dense stands of *Melaleuca bracteata* (black tea-tree). In contrast the higher river banks support a canopy dominated by *E. tereticornis*, with *Corymbia tessellaris* (Moreton Bay ash) and *Lysiphyllum* spp. dominating the mid strata.

Representative structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described in the table below. Where a significant variation in the floristic assemblage is seen in the dominant strata of the community, further tables have been added to demonstrate the variation.

2009 Survey

Photo 3: Example of Vegetation Unit 1g (RE 11.3.25e), taken at Fisher Creek in the south-west of the survey area. (2009 Survey photo)

2005 - 2006 Survey

Vegetation Unit 1g (RE 11.3.25e)	
Strata	Dominant species
Canopy 28-30 m **CSR: 12 / 9.8** **FPC: 16.2%**	*Eucalyptus camaldulensis*
	Eucalyptus tereticornis

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Vegetation Unit 1g (RE 11.3.25e)	
Mid-Storey 10-15 m **CSR: 5.5 / 2.5** **FPC: 7.9%**	*Acacia salicina*
	Casuarina cunninghamiana
	Corymbia tessellaris
	Eucalyptus tereticornis
	Lysiphyllum cunninghamii
	Lysiphyllum hookeri
	Melaleuca fluviatilis
Shrub Layer 1-3 m	*Acacia holosericea*
	Acacia salicina
	Casuarina cunninghamiana
	Eucalyptus tereticornis
	Lysiphyllum carronii
	Melaleuca bracteata
	Melaleuca linariifolia
	Melaleuca trichostachya
Ground Layer <1 m **FPC: 80%** **Bare: 20%**	*Argemone ochroleuca* *
	Austrostipa verticillata
	Bothriochloa ewartiana
	Callistemon viminalis
	*Pennisetum ciliare**
	Chloris virgata *
	Cucumis metuliferus *
	Cynodon dactylon *
	Cyperus dactylotes
	Cyperus exaltatus
	Cyperus gracilis
	Datura stramonium *
	Dichanthium sericeum
	Emilia sonchifolia v javanica *
	Eragrostis sp.
	Heliotropium tenuifolium
	Heteropogon contortus
	Leptochloa decipiens
	Megathyrus maximus v maximus *
	Portulaca oleracea
	Senna barclayana *
	Sida cordifolia *

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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Vegetation Unit 1g (RE 11.3.25e)	
Strata	Dominant species
Canopy 20-25 m **CSR: 8.7 / 5.8** **FPC: 12.9%**	*Eucalyptus camaldulensis*
	Casuarina cunninghamiana
	Eucalyptus populnea
	Eucalyptus tereticornis
Mid-Storey 8-10 m **CSR: 6.8 / 2.3** **FPC: 5.2%**	*Atalaya hemiglauca*
	Brachychiton australis
	Lysiphyllum hookeri
Shrub Layer 1-3 m	*Atalaya hemiglauca*
	Carissa ovata
	Melaleuca linariifolia
	Melaleuca trichostachya
Ground Layer <1 m **FPC: 55%** **Litter: 10%** **Bare: 35%**	*Argemone ochroleuca **
	*Pennisetum ciliare**
	*Datura stramonium **
	Eustrephus latifolius
	Lomandra longifolia
	*Megathyrus maximus v maximus **
	Portulaca oleracea
	*Sida cordifolia **
	*Yucca aloifolia **

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

Vegetation Unit 1g (RE 11.3.25e)	
Strata	Dominant species
Canopy 25-30 m **CSR: 17 / 7** **FPC: 6.9%**	*Eucalyptus tereticornis*
	Eucalyptus camaldulensis
	Casuarina cunninghamiana
	Eucalyptus coolabah
Mid-Storey 12-15 m **CSR: 19.8 / 2.8** **FPC: 1.2%**	*Acacia salicina*
	Corymbia polycarpa
	Corymbia tessellaris
	Eucalyptus populnea
	Casuarina cunninghamiana
	Melaleuca bracteata
	Owenia acidula

7 Appendices

Vegetation Unit 1g (RE 11.3.25e)	
Shrub Layer 2-3 m	*Acacia excelsa* ssp *excelsa*
	Acacia harpophylla
	Acacia holosericea
	Atalaya hemiglauca
	Ehretia saligna
	Melaleuca linariifolia
	Owenia acidula
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 60%** **Litter: 10%** **Bare: 30%**	*Acacia excelsa* ssp *excelsa*
	Acacia holosericea
	*Pennisetum ciliare**
	Crinum flaccidum
	Dichanthium sericeum
	Eustrephus latifolius
	Heliotropium tenuifolium
	Macroptilium atropurpureum
	Megathyrus maximus v maximus
	Parsonsia lanceolata
	Urochloa mosambicensis
	Xanthium occidentale

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

A.1.9 Vegetation Unit 1h: *Eucalyptus crebra* and/or *E. populnea* and/or *E. melanophloia* on alluvial plains (RE 11.3.36)

Description: This riparian vegetation community was restricted to the alluvial terrace to the south of the Isaac River, at the north of the Isaac River diversion survey area. This community is characterised by the dominance of *Eucalyptus crebra* (narrow-leaved ironbark) in the canopy. The mid storey and shrub layers are characteristically sparse, dominated by both *Acacia salicina* (sally wattle) and *Corymbia clarksoniana* (Clarkson's bloodwood). The groundcover is primarily dominated by *Pennisetum ciliare** (buffel grass) along with a number of introduced herb species.

Representative structural and floristic descriptions of the dominant species in each strata for secondary sites surveyed within this vegetation unit are described in the table below.

2005 - 2006 Survey

Vegetation Unit 1h: (RE 11.3.36)	
Strata	Dominant species
Canopy 20-25 m **CSR: 13 / 9** **FPC: 14%**	*Eucalyptus crebra*
Mid-Storey 12-15 m **CSR: 5.7 / 2**	*Acacia salicina*
	Corymbia clarksoniana

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Vegetation Unit 1h: (RE 11.3.36)	
FPC: 5.5%	*Eucalyptus crebra*
Shrub Layer 1-2 m	*Acacia salicina*
	Atalaya hemiglauca
	Cassia brewsteri
	Erythroxylum australe
	Eucalyptus crebra
Ground Layer <1 m **FPC: 43%** **Bare: 54%**	*Pennisetum ciliare**
	Cissus opaca
	*Commelina ensifolia **
	Enchylaena tomentosa v glabra
	Grewia retusifolia
	*Eriocereus martinii **
	Panicum decompositum
	Rostellularia adscendens var adscendens
	*Sida cordifolia **
	*Urochloa mosambicensis **

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

A.2 Clay Plains (Landzone 4) field survey results

A.2.1 Vegetation Unit 2a: *Eucalyptus populnea* / *brownii* woodland on Cainozoic clay plains (RE 11.4.2)

Description: This vegetation community was primarily found on the black soil clay plains to the south-east of the survey area and the west of the Isaac River Diversion area. This vegetation community is characterised by the dominance of *Eucalyptus populnea* (poplar box) in the canopy with occasional *Eucalyptus brownii* (Reid river box), *Corymbia erythrophloia* (red bloodwood), *Corymbia tessellaris* (Moreton Bay ash) and *Eucalyptus drepanophylla* also present in the canopy and mid-storey. Where the shrubby mid storey is present it is typically dominated by *Lysiphyllum carronii* (red bauhinia) and *Eremophila mitchellii* (false sandalwood) however the typical assemblage of mid-storey species associated with this community were often absent (most likely due to grazing), leaving an open mid storey and disturbed grassy understorey dominated by *Pennisetum ciliare** (buffel grass).

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below. Where a significant variation in floristics is seen in the dominant strata of the community further tables have been added to demonstrate the variation.

2005 - 2006 Survey

Vegetation Unit 2a: (RE 11.4.2)	
Strata	Dominant species
Canopy 12-15 m	*Eucalyptus brownii*

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Vegetation Unit 2a: (RE 11.4.2)	
CSR: 14.1 / 3.1 **FPC: 2.6%**	*Corymbia tessellaris*
	Corymbia erythrophloia
	Eucalyptus drepanophylla
Mid-Storey 8-10 m **CSR: 10 / 1.8** **FPC: 1.2%**	*Acacia salicina*
	Lysiphyllum carronii
Shrub Layer 1-2 m	*Acacia salicina*
	Archidendropsis basaltica
	Atalaya hemiglauca
	Carissa ovata
	Cassia brewsteri
	Lysiphyllum carronii
Ground Layer <1 m **FPC: 85%** **Bare: 15%**	*Capparis lasiantha*
	*Pennisetum ciliare**
	*Eriocereus martinii **
	Heteropogon contortus
	Ischaemum australe

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

Vegetation Unit 2a: (RE 11.4.2)	
Strata	Dominant species
Canopy 18-20 m **CSR: 8.8 / 3** **FPC: 5.2%**	*Eucalyptus populnea*
Mid-Storey 12-15 m	*Lysiphyllum carronii*
Shrub Layer 1-3 m	*Acacia excelsa* ssp *excelsa*
	Acacia harpophylla
	Alectryon diversifolius
	Alstonia constricta
	Capparis lasiantha
	Carissa ovata
	Citrus glauca
	Eremophila mitchellii
	Erythroxylum australe
	Geijera parviflora
	Lysiphyllum carronii
	Petalostigma pubescens

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Vegetation Unit 2a: (RE 11.4.2)	
	Pittosporum spinescens
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 60%** **Litter 5%** **Bare: 35%**	*Pennisetum ciliare**

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

Vegetation Unit 2a: (RE 11.4.2)	
Strata	Dominant species
Canopy 18-20 m **CSR: 12.9 / 3.1** **FPC: 3%**	*Eucalyptus populnea*
	Corymbia tessellaris
	Eucalyptus crebra
	Corymbia clarksoniana
Mid-Storey 12-15 m	*Amyema pendulum* ssp *longifolium*
	Cymbidium canaliculatum
	Geijera parviflora
Shrub Layer 1-3 m	*Acacia excelsa* ssp *excelsa*
	Acacia salicina
	Alstonia constricta
	Atalaya hemiglauca
	Carissa ovata
	Cassia brewsteri
	Flindersia dissosperma
	Lysiphyllum carronii
Ground Layer <1 m **FPC: 85%** **Litter 5%** **Bare: 30%**	*Aristida jerichoensis v jerichoensis*
	*Pennisetum ciliare**
	*Stylosanthes humilis **

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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2009 Survey

Photo 4: Example of Vegetation Unit 2a (RE 11.4.2) in the west of the survey area.

Secondary Survey Site d11 (RE 11.4.2) **RED HILL Survey D: 26/03/09**	
Transect Start	608299 mE; 7592071 mN
Transect End (50m)	608348 mE; 7592076 mN
Bearing	13° ENE
Aspect	N
Slope	4°
Soil	light brown/red fine Cainozoic clay with small coarse gravel
Weeds	*Eriocereus martinii* *
Erosion	nil
Grazing impacts	moderate – cattle tracks present
Fire history	> 10 years
Fauna habitat	Tall *E. populnea* and some timber on ground
Notes	-
Strata	**Dominant Species**
Canopy (T1): 12-15 m **FPC: 10%**	*Eucalyptus populnea*
Mid-Storey (T2): 6-10 m	*Eucalyptus populnea*
Shrub (S1): 1-4 m **FPC: < 5%**	*Acacia excelsa*
	Archidendropsis basaltica

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Secondary Survey Site d11 (RE 11.4.2) RED HILL Survey D: 26/03/09	
	Citrus glauca
	Cassia brewsteri
Ground (G): <1 m FPC: 54% Litter: 29% Bare: 17%	*Heteropogon contortus*
	Chloris divaricata
	Enneapogon lindleyanus
	Stylosanthes scabra
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 5

FPC: Foliage Projection Cover

Secondary Survey Site d14 (RE 11.4.2) RED HILL Survey D: 26/03/09	
Transect Start	608054mE; 7593442mN
Transect End (50m)	608008mE; 7593434mN
Bearing	43° WSW
Aspect	-
Slope	flat, undulating
Soil	light brown/orange clay with small sub-angular rocks
Weeds	*Eriocereus martinii* *, *Opuntia tomentosa**
Erosion	nil
Grazing impacts	moderate – cattle tracks present
Fire history	> 10 years
Fauna habitat	Large *E. populnea* stag trees with hollows and dense ground layer.
Notes	-
Strata	**Dominant Species**
Canopy (T1): 10-12 m FPC: 8%	*Eucalyptus populnea*
Mid-Storey (T2): 6-10 m	*Eucalyptus populnea*
Shrub (S1): 1-3 m FPC: 10%	*Carissa ovata*
	Archidendropsis basaltica
	Cassia brewsteri
Ground (G): <1 m FPC: 61% Litter: 25% Bare: 14%	*Heteropogon contortus*
	*Pennisetum ciliare**
	Glycine tabacina
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 7

FPC: Foliage Projection Cover

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Secondary Survey Site e4 (RE 11.4.2) **RED HILL Survey D: 19/05/09**	
Transect Start	592761mE; 7589441mN
Transect End (50m)	592722mE; 7589473mN
Bearing	52°W
Aspect	-
Slope	Flat
Soil	Brown/grey Cainozoic clay plains
Weeds	nil
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Dense native grass and large *E. populnea* with hollows
Notes	Near gas pipeline easement
Strata	**Dominant Species**
Canopy (T1): 14-18 m **FPC: 77%**	*Eucalyptus populnea*
Mid-Storey (T2): 4-10 m	*Eucalyptus populnea*
	Corymbia tessellaris
Shrub (S1): 1-3 m **FPC: 2%**	*Owenia acidula*
	Cassia brewsteri
	Archidendropsis basaltica
	Acacia leiocalyx
Ground (G): <1 m **FPC: 27%** **Litter: 31%** **Bare: 4%**	*Themeda triandra*
	Heteropogon contortus
	Panicum effusum
	*Pennisetum ciliare**
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 4
	Geijera parviflora: 1

FPC: Foliage Projection Cover

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2011 Survey

Site 25T

Tertiary Survey Site 25T (RE 11.4.2) **RED HILL Survey F: 19/5/2011**					
Survey start point	-21.887093, 147.939477				
Survey end point	-21.88753, 147.93948				
Aspect	flat				
Slope	flat				
Bearing of transect	160º (S)				
Soil	Clay plain – light brown- tan light sandy clay				
Declared Weeds	Harrisia cactus*				
Erosion	nil				
Grazing impacts	nil				
Fire history	> 10 years				
Fauna habitat	Trees, shrubs and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 90% Litter 5% Bare 5%	Veg 90% Litter 5% Bare 5%	Veg 90% Litter 10% Bare 0%	Veg 85% Litter 5% Bare 10%	Veg 85% Litter 5% Bare 10%
Canopy cover	16%				
Estimated shrub FPC	15%				
Strata	Dominant Species				
Canopy (T1): 4-8 m	*Eucalyptus populnea*				
Shrub (S1): 1-4 m	*Eremophila mitchellii*				
	Cassia brewsteri				

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Tertiary Survey Site 25T (RE 11.4.2) **RED HILL Survey F: 19/5/2011**	
Ground (G): <1 m	*Pennisetum ciliare**
	Carissa ovata
	Themeda triandra
Basal Count (Factor 1 cm)	
	Eucalyptus populnea - 1

A.2.2 Vegetation Unit 2b: *Eucalyptus populnea* with *Acacia harpophylla* (brigalow) and/or *Casuarina cristata* Open forest to woodland on Cainozoic clay plains (RE 11.4.7)

Description: This vegetation community was primarily found on the clay plains directly east of the mining area. The community is characterised by the dominance of *Eucalyptus populnea* in the relatively low, open canopy with *Acacia harpophylla* (brigalow) present in the mid-storey. *Lysiphyllum carronii* (red bauhinia) is also common in the canopy layer. The tall shrub layer typical of this vegetation community is generally absent (likely due to grazing). Where this is not the case, mid-storey species include *Acacia harpophylla, Citrus glauca* (lime bush) and *Flindersia dissosperma* (scrub leopardwood). The ground layer is typically sparse, dominated by *Pennisetum ciliare** (buffel grass), and includes large areas of bare ground and numerous fallen logs. Disturbance by pigs was also evident within this vegetation community.

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below. Where a significant variation in the floristic assemblage is seen in the dominant strata of the community, further tables have been added to demonstrate the variation.

2005 - 2006 Survey

Vegetation Unit 2b (RE 11.4.7)	
Strata	**Dominant species**
Canopy 12-15 m **CSR: 15 / 3.2** **FPC: 2.5%**	*Eucalyptus populnea*
	Lysiphyllum carronii
Mid-Storey 3-5 m **CSR: 17 / 2** **FPC: 0.9%**	*Acacia harpophylla*
	Citrus glauca
	Flindersia dissosperma
Shrub Layer 1-2 m	*Acacia cambagei*
	Acacia excelsa ssp *excelsa*
	Alectryon diversifolius
	Atalaya hemiglauca
	Carissa ovata
	Citrus glauca
	Flindersia dissosperma

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Vegetation Unit 2b (RE 11.4.7)	
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 50%** **Litter 5%** **Bare: 45%**	*Aristida contorta*
	Pennisetum ciliare *
	Digitaria divaricatissima
	Portulaca oleracea
	Sclerolaena muricata v muricata

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

Vegetation Unit 2b (RE 11.4.7)	
Strata	**Dominant species**
Canopy 12-15 m **CSR: 15 / 3.2** **FPC: 2.5%**	*Eucalyptus populnea*
	Lysiphyllum carronii
Mid-Storey 3-5 m **CSR: 17 / 2** **FPC: 0.9%**	*Acacia harpophylla*
	Citrus glauca
	Flindersia dissosperma
Shrub Layer 1-2 m	*Acacia cambagei*
	Acacia excelsa ssp *excelsa*
	Alectryon diversifolius
	Atalaya hemiglauca
	Carissa ovata
	Citrus glauca
	Flindersia dissosperma
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 50%** **Litter 5%** **Bare: 45%**	*Aristida contorta*
	Pennisetum ciliare *
	Digitaria divaricatissima
	Portulaca oleracea
	Sclerolaena muricata v muricata

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

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A.2.3 Vegetation Unit 2c: *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains (RE 11.4.8)

This vegetation community was found in limited extent on the clay plains to the far west of the survey area, and small areas directly east of the GRB mine complex and in the north-east of the survey area. This vegetation community is characterised by the dominance of *Eucalyptus cambageana* (Dawson gum) and *Eucalyptus populnea* (poplar box) in the relatively low, open canopy, with *Acacia harpophylla* (brigalow) present in the mid-storey. The tall shrub layer typical of this vegetation community was found to be absent (due to grazing impacts). The ground layer is typically sparse, dominated by *Pennisetum ciliare** (buffel grass), and includes large areas of bare ground and numerous fallen logs. Disturbance by pigs was also evident within this vegetation community.

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below.

2005 - 2006 Survey

Vegetation Unit 2c (RE 11.4.8)	
Strata	Dominant species
Canopy 15-20 m **CSR: 15.4 / 5.6** **FPC: 5.7%**	*Eucalyptus cambageana*
	Eucalyptus populnea
	Acacia harpophylla
Mid-Storey 10-12 m **CSR: 7.9 / 1.8** **FPC: 2.8%**	*Eucalyptus populnea*
	Acacia harpophylla
	*Opuntia tomentosa**
Shrub Layer 1-2 m	*Alectryon diversifolius*
	Alstonia constricta
	Carissa ovata
	Citrus glauca
	Denhamia oleaster
	Erythroxylum australe
	Flindersia dissosperma
	Lysiphyllum carronii
	*Opuntia tomentosa **
	Santalum lanceolatum
Ground Layer <1 m **FPC: 75%** **Litter: 5%** **Bare: 20%**	*Anacardium occidentale*
	Aristida jerichoensis v jerichoensis
	Aristida leptopoda
	Capparis lasiantha
	*Pennisetum ciliare **
	Chloris divaricata
	Dactyloctenium radulans
	Enteropogon acicularis

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Vegetation Unit 2c (RE 11.4.8)	
	Eriochloa crebra
	Opuntia tomentosa *
	Portulaca oleraceae
	Sarcostemma viminale ssp *brunonianum*
	Sporobolus australasicus
	Sporobolus creber

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 Survey

Photo 5: Example of Vegetation Unit 2c (RE 11.4.8), taken at the west of the survey area.

Secondary Survey Site e13 (RE 11.4.8) **RED HILL Survey D: 24/05/09**	
Transect Start	595169mE; 7598099 mN
Transect End (50m)	595196 mE; 7598138 mN
Bearing	42° N
Aspect	-
Slope	Flat
Soil	Cainozoic clay plains
Weeds	*Eriocereus martinii* *
Erosion	Minimal, stable
Grazing impacts	Moderate
Fire history	> 10 years
Fauna habitat	Vegetation community dominated by *E. cambageana*

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Secondary Survey Site e13 (RE 11.4.8) RED HILL Survey D: 24/05/09	
Notes	Shrubby understorey
Strata	**Dominant Species**
Canopy (T1): 16-20 m FPC: 36%	*Eucalyptus cambageana*
Mid-Storey (T2): 8-14m	*Eucalyptus cambageana*
Shrub (S1): 1-4m FPC: 20%	*Eremophila mitchellii*
	Flindersia dissosperma
	Terminalia oblongata
	Ehretia membranifolia
	Erythroxylum australe
Ground (G): <1 m FPC: 2% Litter: 33% Bare: 65%	*Portulaca oleraceae*
	*Pennisetum ciliare**
Basal Count (Factor 1 cm)	
	Eucalyptus cambageana: 2
	Eucalyptus exserta: 4

FPC: Foliage Projection Cover

Secondary Survey Site e14 (RE 11.4.8) RED HILL Survey D: 24/05/09	
Transect Start	591649 mE; 7597545 mN
Transect End (50m)	591693 mE; 7597570 mN
Bearing	6° NE
Aspect	SE
Slope	3°
Soil	Cainozoic clay plains
Weeds	nil
Erosion	Patches evident
Grazing impacts	Moderate
Fire history	> 10 years
Fauna habitat	Large *E. cambageana*, timber debris, stag trees
Notes	Woodland dominated by *E. cambageana*
Strata	**Dominant Species**
Canopy (T1): 16-20 m FPC: 28%	*Eucalyptus cambageana*
Mid-Storey (T2): 6-12m	*Eucalyptus cambageana*
Shrub (S1): 1-3m FPC: 30%	*Alectryon diversifolius*
Ground (G): <1 m	*Panicum effusum*

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Secondary Survey Site e14 (RE 11.4.8) RED HILL Survey D: 24/05/09	
FPC: 2% **Litter: 33%** **Bare: 65%**	*Pennisetum ciliare**
	*Urochloa mosambicensis**
	Carissa ovata
Basal Count (Factor 1 cm)	
	Eucalyptus cambageana: 5
	Eucalyptus populnea: 1

FPC: Foliage Projection Cover

2011 Survey

Site 23T

Tertiary Survey Site 23T (RE 11.4.8 HVR) RED HILL Survey F: 19/5/2011	
Survey start point	-21.84317, 147.996977
Survey end point	-21.842923, 147.996632
Aspect	flat
Slope	flat
Bearing of transect	295º (W)
Soil	Clay plain with ironstone gravel – tan clay
Declared Weeds	Harrisia cactus* parthenium*
Erosion	Gully erosion
Grazing impacts	Moderate
Fire history	> 10 years

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Tertiary Survey Site 23T (RE 11.4.8 HVR) RED HILL Survey F: 19/5/2011					
Fauna habitat	Regrowth trees, shrubs and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 40% Litter 50% Bare 10%	Veg 90% Litter 10% Bare 0%	Veg 30% Litter 60% Bare 10%	Veg 0% Litter40% Bare 60%	Veg 20% Litter 10% Bare 70%
Canopy cover	27%				
Estimated shrub FPC	10%				
Notes	Brigalow boarders gilgi				
Strata	Dominant Species				
Canopy (T1): 8-10 m	*Eucalyptus cambageana*				
Shrub (S1): 1-5 m	*Eremophila mitchellii*				
	Acacia harpophylla				
Ground (G): <1 m	*Pennisetum ciliare**				
	Carissa ovata				
	Leptochloa digitata				
Basal Count (Factor 1 cm)					
	Acacia harpophylla - 4				
	Eucalyptus cambageana - 1				

A.2.4 Vegetation Unit 2d: *Acacia harpophylla* (brigalow) shrubby open forest to woodland with *Terminalia oblongata* on Cainozoic clay plains (RE 11.4.9)

Description: This brigalow vegetation community was primarily found on the cracking clay soils scattered across the south-west and east of the survey area. The community was generally limited in extent and exhibited Gilgai characteristics. It is characterised by the dominance of *Acacia harpophylla* (brigalow) in the canopy. Both *Acacia harpophylla* and *Lysiphyllum* sp (bauhinia) co-dominate the mid strata. The understorey is typically a low open grassland modified from grazing disturbance, primarily dominated by *Pennisetum ciliare** (buffel grass) and a number of other introduced grass species. In some areas the understory is dominated by native bluegrass grassland species.

Representative structural and floristic descriptions of the dominant species in each strata for sites surveyed in 2005 - 2006, 2009 and 2011 within this vegetation unit are described in the tables below.

2005 to 2006 Survey

Vegetation Unit 2d: (RE 11.4.9)	
Strata	Dominant species
Canopy 10-12 m **CSR: 14 / 2.9** **FPC: 52%**	*Acacia harpophylla* *Eucalyptus cambageana*
Shrub Layer 2-4 m	*Eremophila mitchellii* *Lysiphyllum carronii* *Santalum lanceolatum*

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Vegetation Unit 2d: (RE 11.4.9)	
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 53%** **Bare: 45%**	*Alectryon diversifolius*
	Amyema quandang
	Bothriochloa pertusa *
	Carissa ovata
	Pennisetum ciliare *
	Cheilanthes sieberi
	Cissus opaca
	Commelina ensifolia *
	Dactyloctenium radulans
	Dichanthium sericeum
	Enchylaena tomentosa v glabra
	Enteropogon acicularis
	Grewia retusifolia
	Eriocereus martinii *
	Malvastrum americanum *
	Parsonsia lanceolata
	Paspalidium distans
	Phyllanthus maderaspatensis
	Portulaca oleracea
	Sporobolus caroli

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 Survey

Photo 6: Example of Vegetation Unit 2d (RE 11.4.9) showing density and height of the dominant *Acacia harpophylla*.

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Secondary Survey Site d8 (RE 11.4.9) RED HILL Survey D: 23/03/09	
Transect Start	607509 mE; 7586639 mN
Transect End (50m)	607518 mE; 7586597 mN
Bearing	28.5° SSE
Aspect	NE
Slope	3°
Soil	light brown/red fine Cainozoic clay/sand with subangular rocks
Weeds	*Opuntia tomentosa*, Parthenium hysterophorus**
Erosion	nil
Grazing impacts	moderate – cattle tracks present
Fire history	> 10 years
Fauna habitat	Dense grassy understorey – mixture of native and exotic species. Timber on ground; tight canopy layer.
Notes	*Acacia harpophylla* community adjacent to non-remnant grassland and 11.5.9.
Strata	**Dominant Species**
Canopy (T1): 12-15 m FPC: 29%	*Acacia harpophylla*
Mid-Storey (T2): 6-10 m	*Lysiphyllum hookeri*
	Acacia harpophylla
Shrub (S1): 1-4 m FPC: 30%	*Lysiphyllum hookeri*
	Carissa ovata
	Acalypha eremorum
Ground (G): <1 m FPC: 27% Litter: 41% Bare: 32%	*Ancistrachne uncinulata*
	Leptochloa decipiens subsp *decipiens*
	*Pennisetum ciliare**
Basal Count (Factor 1 cm)	
	Acacia harpophylla: 13
	Lysiphyllum hookeri: 1

FPC: Foliage Projection Cover

Secondary Survey Site e3 (RE 11.4.9) RED HILL Survey D: 15/05/09	
Transect Start	595344mE; 7587880mN
Transect End (50m)	595293mE; 7587866mN
Bearing	W
Aspect	N
Slope	1°
Soil	light brown Cainozoic clay/sand with subangular gravel

7 Appendices

Secondary Survey Site e3 (RE 11.4.9) RED HILL Survey D: 15/05/09	
Weeds	*Parthenium hysterophorus*, Eriocereus martinii **
Erosion	nil - good ground cover
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Long dense grasses abundance of dead wood on ground, brigalow community, crab holes in gilgai depressions
Notes	Gilgai /melon hole country, predominantly pure brigalow, mix of pasture and native species
Strata	**Dominant Species**
Canopy (T1): 8-15 m FPC: 87%	*Acacia harpophylla*
Mid-Storey (T2): 6-8 m	*Acacia harpophylla*
Shrub (S1): 1-4 m FPC: 5%	*Acacia harpophylla*
	Carissa ovata
	Santalum lanceolatum
	Terminalia oblongata
	Erythroxylum australe
Ground (G): <1 m FPC: 27% Litter: 41% Bare: 32%	*Sporobolus caroli*
	Salsola kali
	*Pennisetum ciliare**
	Bothriochloa bladhii
Basal Count (Factor 1 cm)	
	Acacia harpophylla: 10

FPC: Foliage Projection Cover

Secondary Survey Site e5 (RE 11.4.9) RED HILL Survey D: 19/05/09	
Transect Start	593137mE; 7588730mN
Transect End (50m)	593134mE; 7588675mN
Bearing	29°S
Aspect	W
Slope	4°
Soil	Cainozoic lateritic duricrust
Weeds	nil
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Fallen timber, leaf litter

7 Appendices

Secondary Survey Site e5 (RE 11.4.9) RED HILL Survey D: 19/05/09	
Notes	West from gas pipeline easement – large 11.7.2 patch
Strata	**Dominant Species**
Canopy (T1): 10-14 m FPC: 23.4%	*Eucalyptus cambageana*
Mid-Storey (T2): 6-8 m	*Acacia shirleyi*
Shrub (S1): 1-3 m FPC: 15%	*Erythroxylum australe*
Ground (G): <1 m FPC: 27% Litter: 62.4% Bare: 14.2%	*Aristida caput-medusae*
	Calotis cuneifolia
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 5

FPC: Foliage Projection Cover

Secondary Survey Site e6 (RE 11.4.9) RED HILL Survey D: 19/05/09	
Transect Start	593835mE; 7587840mN
Transect End (50m)	593831mE; 7587887mN
Bearing	064°N
Aspect	E
Slope	1°
Soil	Cainozoic clay plains
Weeds	*Eriocereus martinii* *
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Fallen timber, dense patches of grass
Notes	Brigalow in dense patches and more open patches
Strata	**Dominant Species**
Canopy (T1): 4-8 m FPC: 51%	*Acacia harpophylla*
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-3 m FPC: 5%	*Opuntia stricta**
	Eremophila mitchellii
Ground (G): <1 m FPC: 27%	*Pennisetum ciliare**
	Einadia nutans

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Secondary Survey Site e6 (RE 11.4.9) **RED HILL Survey D: 19/05/09**	
Litter: 31% **Bare: 18%**	*Sporobolus caroli*
Basal Count (Factor 1 cm)	
	Acacia harpophylla: 1

FPC: Foliage Projection Cover

2011 Survey

Site 24T

Tertiary Survey Site 24T (RE 11.4.9 HVR) **RED HILL Survey F: 19/5/2011**					
Survey start point	-21.885803, 147.938793				
Survey end point	- 21.886183, 147.938945				
Aspect	flat				
Slope	flat				
Bearing of transect	130º (SE)				
Soil	Clay plain with Gilgai – light brown medium clay				
Declared Weeds	Harrisia cactus*				
Erosion	nil				
Grazing impacts	Moderate				
Fire history	> 10 years				
Fauna habitat	Regrowth trees, gilgi and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)

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Tertiary Survey Site 24T (RE 11.4.9 HVR) **RED HILL Survey F: 19/5/2011**					
	Veg 10% Litter 20% Bare 70%	Veg 50% Litter 30% Bare 20%	Veg 40% Litter 20% Bare 40%	Veg 40% Litter20% Bare 40%	Veg 90% Litter 5% Bare 5%
Canopy cover	10%				
Estimated shrub FPC	<1%				
Notes	Brigalow borders gilgai				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Acacia harpophylla*				
	Eremophila mitchellii				
Ground (G): <1 m	*Pennisetum ciliare**				
	Capparis lasiantha				
	Sclerolaena muricata v muricata				
Basal Count (Factor 1 cm)					
	Acacia harpophylla - 3				

A.3 Sand Plains (Landzone 5) Field Survey Results

A.3.1 Vegetation Unit 3a: *Eucalyptus populnea* and/or *Corymbia clarksoniana* woodland on Cainozoic sand plains/remnant surfaces (RE 11.5.3)

Description: This vegetation community was found on sandy soils throughout the survey area. The community is characterised by the dominance of *Eucalyptus populnea* (poplar box) with occasional patches of *Eucalyptus brownii* (Reid river box) in the canopy. Where the shrubby mid storey is present, it is typically dominated by *Atalaya hemiglauca, Bursaria spinosa* and *Cassia brewsteri.* However, the typical assemblage of mid-storey species associated with this community were often absent (most likely due to grazing), leaving an open mid storey and grassy understorey dominated by either introduced pasture *Pennisetum ciliare** (buffel grass) or native grasses such as *Aristida jerichoensis* var. *jerichoensis* depending on the adjacent vegetation at each survey site.

Structural and floristic descriptions of the dominant species in each strata for the sites surveyed in 2005 - 2006, 2009 and 2011 found within this vegetation community are described below.

2005 - 2006 Survey

Vegetation Unit 3a: (RE 11.5.3)	
Strata	Dominant species
Canopy 18-20 m **CSR: 9 / 7** **FPC: 12.3%**	*Eucalyptus populnea*
Mid-Storey 10-12 m	*Eucalyptus populnea*
Shrub Layer 2-5 m	*Alstonia constricta*
	Atalaya hemiglauca
	Bursaria spinosa

7 Appendices

Vegetation Unit 3a: (RE 11.5.3)	
	Cassia brewsteri
Ground Layer <1 m **FPC: 49%** **Bare: 48%**	*Aristida jerichoensis v jerichoensis*
	Bursaria spinosa
	Pennisetum ciliare *
	Chloris pectinata
	Cyperus gracilis
	Ehretia membranifolia
	Enneapogon lindleyanus
	Enteropogon acicularis
	Grewia retusifolia
	Malvastrum americanum *
	Panicum decompositum
	Sida cordifolia *
	Urochloa mosambicensis *

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 survey

Photo 7: Example of Vegetation Unit 3a (RE 11.5.3) showing large *Eucalyptus populnea* (poplar box) with some evidence of dieback.

Secondary Survey Site d2 (RE 11.5.3) **RED HILL Survey D: 21/03/09**	
Transect Start	605769 mE; 7586311 mN
Transect End (50m)	605735 mE; 7586351 mN
Bearing	56° NW

7 Appendices

Secondary Survey Site d2 (RE 11.5.3) RED HILL Survey D: 21/03/09	
Aspect	S
Slope	4°
Soil	light brown/reddish orange consolidated fine sandy clay with fine gravel
Weeds	nil
Erosion	minimal
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Tall ground layer (exotic), several small stag trees
Notes	Middle of large *Eucalyptus populnea* woodland patch; invasion of buffel grass; few localised *E. crebra*.
Strata	**Dominant Species**
Canopy (T1): 12-14 m FPC: 18%	*Eucalyptus populnea*
Mid-Storey (T2): 6-10 m	*Eucalyptus populnea*
Shrub (S1): 1-5 m FPC: 20%	*Erythroxylum australe*
	Pittosporum spinescens
	Cassia brewsteri
Ground (G): <1 m FPC: 56% Litter: 24% Bare: 20%	*Pennisetum ciliare**
	Carissa ovata
	Ehretia membranifolia
	Ancistrachne uncinulata
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 7
	Eremophila mitchellii: 1
	Acacia excelsa: 1

FPC: Foliage Projection Cover

Secondary Survey Site e2 (RE 11.5.3) RED HILL Survey D: 14/05/09	
Transect Start	595958mE; 7588348mN
Transect End (50m)	596011mE; 7588360mN
Bearing	NNE
Aspect	E
Slope	0.5° E
Soil	Fine red/brown clay/silt
Weeds	*Eriocereus martinii* *
Erosion	Some on occasional cattle track

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Secondary Survey Site e2 (RE 11.5.3) **RED HILL Survey D: 14/05/09**	
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Long dense grass mix of native and introduced tall poplar box, some timber on ground
Notes	A few brigalow trees present
Strata	**Dominant Species**
Canopy (T1): 15-20 m **FPC: 54%**	*Eucalyptus populnea*
	Eucalyptus crebra
Mid-Storey (T2): 10-12 m	*Eucalyptus populnea*
	Acacia harpophylla
Shrub (S1): 1-6 m **FPC: 25%**	*Atalaya hemiglauca*
	Carissa ovata
	Bursaria incana
	Erythroxylum australe
Ground (G): <1 m **FPC: 27%** **Litter: 31%** **Bare: 18%**	*Themeda triandra*
	Aristida calycina
	Bothriochloa decipiens
	*Pennisetum ciliare**
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 6

FPC: Foliage Projection Cover

7 Appendices

2011 Survey

Site 1T

Tertiary Survey Site 1T (RE 11.5.3) **RED HILL Survey F: 17/5/2011**					
Survey start point	-21.691047, 147.926112				
Survey end point	- 21.691423, 147.926285				
Aspect	flat				
Slope	flat				
Bearing of transect	130º (SE)				
Soil	Sand plain – red fine sand				
Declared Weeds	nil				
Erosion	nil				
Grazing impacts	Occasional				
Fire history	> 10 years				
Fauna habitat	Tall trees, shrubs and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 100% Litter 0% Bare 0%	Veg 40% Litter 50% Bare 10%	Veg 80% Litter 20% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 90% Litter 10% Bare 0%
Canopy cover	29%				
Estimated shrub FPC	15-20%				
Notes	Buffel understorey				
Strata	Dominant Species				
Canopy (T1): 12-16 m	*Eucalyptus crebra*				

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Tertiary Survey Site 1T (RE 11.5.3) RED HILL Survey F: 17/5/2011	
Mid-Storey (T2): 6-10 m	*Eucalyptus crebra*
Shrub (S1): 1-3 m	*Alphitonia excelsa*
	Bursaria incana
Ground (G): <1 m	*Pennisetum ciliare**
	Carissa ovata
	Heteropogon contortus
Basal Count (Factor 1 cm)	
	Eucalyptus crebra - 6

Site 7T

Tertiary Surv3y Site 7T (RE 11.5.3) RED HILL Survey F: 17/5/2011	
Survey start point	-21.819165, 147.91076
Survey end point	- 21.818757, 147.910623
Aspect	flat
Slope	flat
Bearing of transect	120º (SE)
Soil	Sand plain – Tan sand
Declared Weeds	nil
Erosion	nil
Grazing impacts	nil

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Tertiary Surv3y Site 7T (RE 11.5.3) RED HILL Survey F: 17/5/2011					
Fire history	> 10 years				
Fauna habitat	Dead standing trees with hollows, native grass understorey				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 90% Litter 10% Bare 0%	Veg 40% Litter 10% Bare 50%	Veg 60% Litter 30% Bare 10%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%
Canopy cover	18%				
Estimated shrub FPC	5%				
Notes					
Strata	Dominant Species				
Canopy (T1): 6-10 m	*Eucalyptus populnea*				
Mid-Storey (T2): 3-5 m	*Eucalyptus populnea*				
	Eucalyptus crebra				
Shrub (S1): 1-3 m	*Acacia excelsa* ssp *excelsa*				
	Erythroxylum australe				
Ground (G): <1 m	*Panicum decompositum*				
	Panicum effusum v simile				
	Heteropogon contortus				
Basal Count (Factor 1 cm)					
	Eucalyptus populnea - 1				

Site 12Q

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Quaternary Survey Site 12Q (RE 11.5.3) **RED HILL Survey F: 18/05/11**	
Survey point	21.767825, 148.051903
Aspect	Gentle undulation NW facing
Slope	<1%
Soil	Tan-red sand
Weeds	Parthenium, harrisia cactus
Erosion	nil
Grazing impacts	occasional
Fire history	5- 10 years
Fauna habitat	large habitat *E. populnea* with hollows, dead standing trees, logs and grass
Notes	
Strata	**Dominant Species**
Canopy (T1): 6-12 m	*Eucalyptus populnea*
Shrub (S1): 1-3 m	*Alectryon diversifolius*
	Cassia brewsteri
	Archidendropsis basaltica
	Acalypha eremorum
Ground (G): <1 m	*Urochloa mosambicensis* *
	Heteropogon contortus
	Panicum decompositum
	*Pennisetum ciliare**

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Site 13Q

Quaternary Survey Site 13Q (RE 11.5.3) RED HILL Survey F: 18/05/11	
Survey point	-21.758487, 148.035783
Aspect	Gentle undulation
Slope	<1%
Soil	Tan-orange claey sand
Weeds	nil
Erosion	nil
Grazing impacts	occasional
Fire history	5- 10 years
Fauna habitat	large habitat *E. populnea* with hollows, shrubs and grass
Notes	
Strata	**Dominant Species**
Canopy (T1): 8-14 m	*Eucalyptus populnea*
Mid-Storey (T2): 4-8 m	*Eucalyptus populnea*
Shrub (S1): 1-3 m	*Eremophila mitchellii*
	Cassia brewsteri
	Erythroxylum australe
	Ehretia membranifolia

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Quaternary Survey Site 13Q (RE 11.5.3) **RED HILL Survey F: 18/05/11**	
Ground (G): <1 m	*Themeda triandra*
	Heteropogon contortus
	Pennisetum ciliare *

A.3.2 Vegetation Unit 3b: *Eucalyptus crebra* and other *Eucalyptus spp.* and *Corymbia spp.* woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests (RE 11.5.9)

Description: This vegetation community was found on the lower slopes of lateritic crests to the south-east of the survey area. This vegetation community is characterised by the dominance of *Eucalyptus crebra* (narrow-leaved ironbark) in the canopy with instances of *Corymbia clarksoniana, Corymbia dallachiana* and *Corymbia intermedia* (pink bloodwood) also present in the canopy and mid-storey. The shrub layer is typically dominated by acacia species and *Bursaria incana* with a disturbed grassy understorey dominated by *Pennisetum ciliare** (buffel grass). Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below.

2005 - 2006 Survey

Vegetation Unit 3b: (RE 11.5.9)	
Strata	Dominant species
Canopy 20-25 m **CSR: 10.4 / 6.8** **FPC: 12.6%**	*Eucalyptus crebra*
Mid-Storey 12-15 m **CSR: 12.3 / 3.4** **FPC: 3.8%**	*Corymbia intermedia*
	Eucalyptus crebra
Shrub Layer 2-5 m	*Acacia leiocalyx* ssp *leiocalyx*
	Alphitonia excelsa
	Clerodendrum floribundum
	Ehretia membranifolia
	Melaleuca nervosa
Ground Layer <1 m **FPC: 34%** **Bare: 57%**	*Calotis cuneifolia*
	Pennisetum ciliare *
	Chrysopogon fallax
	Enneapogon nigricans
	Grewia retusifolia
	Hibiscus meraukensis
	Iphigenia indica
	Parsonsia lanceolata
	Phyllanthus maderaspatensis

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Vegetation Unit 3b: (RE 11.5.9)	
	Portulaca oleracea
	Sida cordifolia *

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

2009 Survey

Photo 8: Example of Vegetation Unit 3b (RE 11.5.9) with *Eucalyptus crebra* (narrow-leaved ironbark) in the foreground. Photo taken at survey site in the east of the survey area.

Secondary Survey Site d3 (RE 11.5.9) **RED HILL Survey D: 21/03/09**	
Transect Start	605010 mE; 7585325 mN
Transect End (50m)	605057 mE; 7585312 mN
Bearing	19° E
Aspect	-
Slope	flat, undulating
Soil	light brown/reddish orange consolidated fine sandy clay with fine gravel
Weeds	nil
Erosion	minimal
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Tall ground layer, several stag trees, timber on ground.
Notes	*Eucalyptus crebra* community adjacent to 11.5.3.

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Secondary Survey Site d3 (RE 11.5.9) RED HILL Survey D: 21/03/09	
Strata	**Dominant Species**
Canopy (T1): 10-12 m FPC: 12%	*Eucalyptus crebra*
Mid-Storey (T2): 6-10 m	*Eucalyptus crebra*
Shrub (S1): 1-4 m FPC: 15%	*Bursaria incana*
	Erythroxylum australe
	Petalostigma pubescens
Ground (G): <1 m FPC: 62% Litter: 17% Bare: 21%	*Pennisetum ciliare**
	Heteropogon contortus
	*Urochloa mosambicensis**
	Aristida psammophila
Basal Count (Factor 1 cm)	
	Eucalyptus populnea: 1
	Eucalyptus crebra: 1
	Corymbia clarksoniana: 2

FPC: Foliage Projection Cover

Secondary Survey Site d4 (RE 11.5.9) RED HILL Survey D: 22/03/09	
Transect Start	606552 mE; 7586578 mN
Transect End (50m)	606562 mE; 7586625 mN
Bearing	1° N
Aspect	W
Slope	1°
Soil	light brown/reddish orange consolidated fine sandy clay with fine gravel
Weeds	nil
Erosion	minimal
Grazing impacts	occasional – cattle tracks
Fire history	> 10 years
Fauna habitat	Tall, dense ground layer. Several stag trees, timber on ground.
Notes	Continuation of 11.5.9 polygon. Adjacent to cleared grassland (to the east). Some Eucalypt regrowth.
Strata	**Dominant Species**
Canopy (T1): 10-14 m FPC: 6%	*Eucalyptus crebra*
	Corymbia dallachiana
Mid-Storey (T2): 6-8 m	*Eucalyptus crebra*

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Secondary Survey Site d4 (RE 11.5.9) RED HILL Survey D: 22/03/09	
	Corymbia dallachiana
Shrub (S1): 1-3 m FPC: 5%	*Alphitonia excelsa*
	Alstonia constricta
Ground (G): <1 m FPC: 51% Litter: 29% Bare: 20%	*Sida hackettiana*
	Aristida psammophila
Basal Count (Factor 1 cm)	
	Corymbia dallachiana: 3
	Corymbia clarksoniana: 1

FPC: Foliage Projection Cover

Secondary Survey Site d6 (RE 11.5.9) RED HILL Survey D: 22/03/09	
Transect Start	607473 mE; 7587686 mN
Transect End (50m)	607525 mE; 7587680 mN
Bearing	15° E
Aspect	SSW
Slope	3°
Soil	light brown/reddish orange consolidated fine sandy clay with coarse gravel
Weeds	nil
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Tall ground layer, several stag trees, timber on ground.
Notes	*Eucalyptus crebra* community adjacent to 11.5.3.
Strata	**Dominant Species**
Canopy (T1): 8-10 m FPC: 12%	*Eucalyptus crebra*
	Corymbia clarksoniana
Mid-Storey (T2): 4-8 m	*Eucalyptus crebra*
Shrub (S1): 1-4 m FPC: 15%	*Acacia excelsa*
	Flindersia dissosperma
	Petalostigma pubescens
Ground (G): <1 m FPC: 73% Litter: 19% Bare: 8%	*Pennisetum ciliare**
	Melinis repens
	Enneapogon nigricans
	Aristida psammophila

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Secondary Survey Site d6 (RE 11.5.9) RED HILL Survey D: 22/03/09	
Basal Count (Factor 1 cm)	
	Eucalyptus crebra: 1
	Corymbia clarksoniana: 1

FPC: Foliage Projection Cover

A.3.3 Vegetation Unit 3c: *Acacia harpophylla* (brigalow) and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains/remnant surfaces (RE 11.5.16)

Description: This brigalow vegetation community was primarily found on the weathered substrates directly east of the GRB mine complex inside the current mining lease. Located between the Red Hill coal handling and processing plant (CHPP) and the Wiep Dam. This area will be impacted by the new Train Load Out facility. This community is characterised by the dominance of *Acacia harpophylla* (brigalow) at a height of 10 to 12 m with occasional scattered emergent Eucalyptus thozetiana (Thozet's box) in the canopy. *Acacia harpophylla* was dominant in the mid strata. The understorey is typically a low open grassland modified from grazing disturbance, primarily dominated by *Pennisetum ciliare** (buffel grass) and a number of other introduced grass species. No secondary transect data was recorded for this community.

A.4 Ironstone jump-ups (Landzone 7) field survey results

A.4.1 Vegetation Unit 4a: *Acacia harpophylla* (brigalow) and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust (RE 11.7.1)

Description: This vegetation community was found in two locations with a very limited extent on the lateritic duricrust in the south-east and the north-west of the survey area. This vegetation community is characterised by the dominance of *Eucalyptus thozetiana* (Thozet's box) in the relatively tall, open canopy with *Acacia harpophylla* (brigalow) present in the mid-storey. The shrub layer was dominated by both *Eremophila mitchellii* (false sandalwood) and *Erythroxylum australe* and the ground layer is dominated by *Pennisetum ciliare** (buffel grass).

Structural and floristic descriptions of the dominant species in each strata for the sites surveyed in 2009 and 2011, found within this vegetation community are described below.

7 Appendices

2009 Survey

Photo 9: Example of Vegetation Unit 4a (RE 11.7.1) with *Eucalyptus thozetiana* (Thozet's box) as the dominant canopy species. Photo taken from survey site d10 in the south-east of the survey area.

Secondary Survey Site d10 (RE 11.7.1) **RED HILL Survey D: 25/03/09**	
Transect Start	607878 mE; 7586076 mN
Transect End (50m)	607922 mE; 7586080 mN
Bearing	17° E
Aspect	S
Slope	6°
Soil	Cainozoic clay – light brown/grey/orange + coarse metamorphic rocks
Weeds	*Opuntia tomentosa**
Erosion	minimal
Grazing impacts	occasional – cattle tracks
Fire history	> 10 years
Fauna habitat	Tall, dense native ground layer. Timber on ground, small stag trees.
Notes	Continues North to South from 11.7.2.
Strata	**Dominant Species**
Canopy (T1): 14-18 m **FPC: 22%**	*Eucalyptus thozetiana*
Mid-Storey (T2): 6-10 m	*Eucalyptus thozetiana*
	Acacia harpophylla
Shrub (S1): 1-4 m	*Eremophila mitchellii*

7 Appendices

Secondary Survey Site d10 (RE 11.7.1) **RED HILL Survey D: 25/03/09**	
FPC: 25%	*Erythroxylum australe*
Ground (G): <1 m **FPC: 53%** **Litter: 32%** **Bare: 15%**	*Pennisetum ciliare**
	Carissa ovata
	Cleistochloa subjuncea
Basal Count (Factor 1 cm)	
	Eucalyptus thozetiana: 7

FPC: Foliage Projection Cover

2011 Survey

Site 5Q

Quaternary Survey Site 5Q (RE 11.7.1) **RED HILL Survey F: 17/05/11**	
Survey point	-21.697171, 147.923572
Aspect	flat
Slope	flat
Soil	Pale tan sandy earth
Weeds	*Opuntia tormentosa*
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Tall trees, shrubs and grass
Notes	*Casuarina cristata* and *Eucalyptus thozetiana* woodland

7 Appendices

Quaternary Survey Site 5Q (RE 11.7.1) RED HILL Survey F: 17/05/11	
Strata	**Dominant Species**
Canopy (T1): 8-14 m	*Eucalyptus thozetiana*
Shrub (S1): 1-4 m	*Alectryon diversifolius*
	Casuarina cristata
	Eremophila mitchellii
	Flindersia dissosperma
Ground (G): <1 m	*Apophyllum anomalum*
	Leptochloa decipiens
	Sclerolaena muricata v muricata
	*Pennisetum ciliare**

A.4.2 Vegetation Unit 4b: *Acacia spp.* woodland on lateritic duricrust. (RE 11.7.2)

Description: This vegetation community was primarily found on the ironstone jump-ups found in the south-east and the central west of the survey area. This community is characterised by the dominance of *Acacia shirleyi* (lancewood) at a height of 6 to 12 m. *Erythroxylum australe* was dominant in the mid strata. The understorey is typically a sparse grass layer, primarily dominated by *Aristida caput-medusae, Cleistochloa subjuncea* and *Calyptochloa gracillima.*

2005 - 2006 Survey

Vegetation Unit 4b: (RE 11.7.2)	
Strata	Dominant species
Canopy 10-15 m **CSR: 14 / 2.9** **FPC: 2.3%**	*Acacia shirleyi*
	Eucalyptus crebra
	Eucalyptus persistens
Mid-Storey 5-8 m	*Acacia catenulata*
	Brachychiton australis
	Croton phebalioides
	Cymbidium canaliculatum
Shrub Layer 1-2 m	*Alphitonia excelsa*
	Carissa ovata
	Erythroxylum australe
	Cyclophyllum attenuatum
Ground Layer <1 m **FPC: 70%** **Bare: 20%**	*Aristida caput-medusae*
	*Pennisetum ciliare **
	Ipomoea muelleri
	Parsonsia lanceolata

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

7 Appendices

2009 Survey

Photo 10: Example of Vegetation Unit 4b (RE 11.7.2) showing *Acacia shirleyi* (lancewood) as the dominant canopy species.

Secondary Survey Site d7 (RE 11.7.2) **RED HILL Survey D: 23/03/09**	
Transect Start	607399 mE; 7587386 mN
Transect End (50m)	607413 mE; 7587333 mN
Bearing	27.5° SSE
Aspect	W
Slope	5°
Soil	Ironstone jump-up: light brown/orange coarse fines and sub-angular ironstone rocks.
Weeds	nil
Erosion	minor
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Abundant timber and litter on ground; reasonably closed canopy.
Notes	*Acacia shirleyi* patch just beyond *E. crebra/E. populnea* boundary. Very dense.
Strata	**Dominant Species**
Canopy (T1): 6-8 m **FPC: 21%**	*Acacia shirleyi*
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-4 m **FPC: 10%**	*Acacia shirleyi*
	Erythroxylum australe

7 Appendices

Secondary Survey Site d7 (RE 11.7.2) **RED HILL Survey D: 23/03/09**	
Ground (G): <1 m **FPC: 26%** **Litter: 57%** **Bare: 17%**	*Calyptochloa gracillima*
	Calotis cuneifolia
	Aristida caput-medusae
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 11

FPC: Foliage Projection Cover

Secondary Survey Site d9 (RE 11.7.2) **RED HILL Survey D: 25/03/09**	
Transect Start	608348 mE; 7586266 mN
Transect End (50m)	608367 mE; 7586313 mN
Bearing	3° N
Aspect	E
Slope	4°
Soil	Ironstone jump-up: light brown/orange coarse fines and sub-angular ironstone rocks.
Weeds	nil
Erosion	minor – cattle tracks
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Abundant timber on ground.
Notes	
Strata	**Dominant Species**
Canopy (T1): 8-10 m **FPC: 6%**	*Acacia shirleyi*
Mid-Storey (T2): 6-8 m	*Acacia shirleyi*
Shrub (S1): 1-3 m **FPC: 20%**	*Erythroxylum australe*
	Everistia vaccinifolia
	Acacia shirleyi
Ground (G): <1 m **FPC: 16%** **Litter: 44%** **Bare: 40%**	*Calyptochloa gracillima*
	Calotis cuneifolia
	Aristida caput-medusae
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 10

FPC: Foliage Projection Cover

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Secondary Survey Site e8 (RE 11.7.2) **RED HILL Survey D: 20/05/09**	
Transect Start	595377mE; 7590903mN
Transect End (50m)	595419mE; 7590882mN
Bearing	19° E
Aspect	N
Slope	3°
Soil	Fine red/brown ironstone jump up with small ironstone rocks
Weeds	-
Erosion	-
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Abundant timber on ground
Notes	Very patchy community – several areas of bare ground and surrounding *Acacia shirleyi* stands
Strata	**Dominant Species**
Canopy (T1): 6-8 m **FPC: 17%**	*Acacia shirleyi*
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-2 m **FPC: 10%**	*Erythroxylum australe*
Ground (G): <1 m **FPC: 26%** **Litter: 37%** **Bare: 46%**	*Pennisetum ciliare**
	Maireana villosa
	Aristida caput-medusae
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 6

FPC: Foliage Projection Cover

Secondary Survey Site e10 (RE 11.7.2) **RED HILL Survey D: 20/05/09**	
Transect Start	591022mE; 7591381mN
Transect End (50m)	591001mE; 7591424mN
Bearing	59° NNW
Aspect	E
Slope	2°
Soil	Consolidated fine deep red/brown ironstone jump up with large ironstone rocks
Weeds	-
Erosion	-
Grazing impacts	occasional

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Secondary Survey Site e10 (RE 11.7.2) **RED HILL Survey D: 20/05/09**	
Fire history	> 10 years
Fauna habitat	Dense native grass (patches), leaf litter and timber
Notes	Patch of 11.7.2 with elements of 11.5.3
Strata	**Dominant Species**
Canopy (T1): 6-10 m **FPC: 61%**	*Acacia shirleyi*
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-4 m **FPC: 2%**	*Erythroxylum australe*
	Alphitonia excelsa
	Acacia bancroftiorum
Ground (G): <1 m **FPC: 26%** **Litter: 24%** **Bare: 15%**	*Melinis repens*
	Maireana villosa
	Aristida caput-medusae
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 5

FPC: Foliage Projection Cover

Secondary Survey Site e11 (RE 11.7.2) **RED HILL Survey D: 22/05/09**	
Transect Start	595109mE; 7592868mN
Transect End (50m)	595068mE; 7592876mN
Bearing	50° W
Aspect	S
Slope	4°
Soil	Mixed coarse/fine brown/grey ironstone jump up with large ironstone rocks
Weeds	nil
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Lots of timber on ground
Notes	Relatively integral; however several dead trees present
Strata	**Dominant Species**
Canopy (T1): 8-12 m **FPC: 40%**	*Acacia shirleyi*
Mid-Storey (T2): N/A	N/A

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Secondary Survey Site e11 (RE 11.7.2) **RED HILL Survey D: 22/05/09**	
Shrub (S1): 1-3 m **FPC: 15%**	*Erythroxylum australe*
	Acacia shirleyi
	Alstonia constricta
Ground (G): <1 m **FPC: 26%** **Litter: 24%** **Bare: 15%**	*Melinis repens*
	Maireana villosa
	Aristida caput-medusae
Basal Count (Factor 1 cm)	
	Acacia shirleyi: 5

FPC: Foliage Projection Cover

2011 Survey

Site 3Q

7 Appendices

Quaternary Survey Site 3Q (RE 11.7.2) RED HILL Survey F: 17/05/11	
Survey point	-21.697433, 147.917992
Aspect	Gentle undulation, low jump up S facing
Slope	5%
Soil	Tan-grey sand with ironstone gravel
Weeds	Opuntia tormentosa
Erosion	nil
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Trees, dead standing trees, logs
Notes	No ground cover
Strata	**Dominant Species**
Canopy (T1): 6-8 m	*Acacia shirleyi*
Mid-Storey (T2): 2-4 m	*Acacia shirleyi*
Shrub (S1): 1-2 m	*Erythroxylum australe*
	Petalostigma pubescens
Ground (G): <1 m	*Eragrostis* sp.
	Megathyrsus maximum *
	Melinis repens *

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Site 4T

Tertiary Survey Site 4T (RE 11.7.2) RED HILL Survey F: 17/5/2011					
Survey start point	-21.697243, 147.921967				
Survey end point	-21.697223, 147.922485				
Aspect	Top of rise				
Slope	Flat				
Bearing of transect	75º (E)				
Soil	Low Ironstone jump up / sand plain – Tan sand with ironstone gravel				
Declared Weeds	nil				
Erosion	Gully erosion				
Grazing impacts	Occasional				
Fire history	> 10 years				
Fauna habitat	Dead standing trees, hollows, logs, trees, shrubs, grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 40% Litter 20% Bare 40%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 80% Litter 20% Bare 0%	Veg 30% Litter 30% Bare 40%
Canopy cover	30%				
Estimated shrub FPC	10%				
Notes	All species a match for 11.7.2 however A. shirleyi not present				
Strata	Dominant Species				
Canopy (T1): 8-12 m	*Eucalyptus exserta*				
Shrub (S1): 1-4 m	*Eremophila mitchellii*				

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Tertiary Survey Site 4T (RE 11.7.2) RED HILL Survey F: 17/5/2011	
	Terminalia oblongata ssp *voluvris*
Ground (G): <1 m	*Pennisetum ciliare**
	Themeda triandra
	Glycine tabacina
Basal Count (Factor 1 cm)	
	Eucalyptus exserta - 4

Site 6T

Tertiary Survey Site 6T (RE 11.7.2) RED HILL Survey F: 17/5/2011	
Survey start point	-21.699615, 147.92455
Survey end point	-21.69946, 147.924092
Aspect	Mid slope
Slope	5%
Bearing of transect	265º (W)
Soil	Ironstone jump up – Pale brown sandy earth with ironstone gravel

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Tertiary Survey Site 6T (RE 11.7.2) RED HILL Survey F: 17/5/2011					
Declared Weeds	*Opuntia tormentosa*				
Erosion	nil				
Grazing impacts	nil				
Fire history	> 10 years				
Fauna habitat	Dead standing trees, logs, native understorey				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 50% Litter 50% Bare 0%	Veg 50% Litter 50% Bare 0%	Veg 40% Litter 50% Bare 10%	Veg 40% Litter 60% Bare 0%	Veg 90% Litter 10% Bare 0%
Canopy cover	28%				
Estimated shrub FPC	60%				
Notes					
Strata	Dominant Species				
Canopy (T1): 6-10 m	*Acacia shirleyi*				
Shrub (S1): 1-4 m	*Everistia vacciniifolia*				
	Erythroxylum australe				
Ground (G): <1 m	*Aristida caput-medusae*				
	Jasminum didymum ssp *didymum*				
	Cleistochloa subjuncea				
Basal Count (Factor 1 cm)					
	Acacia shirleyi - 4				

7 Appendices

Site 10T

Tertiary Survey Site 10T (RE 11.7.2) RED HILL Survey F: 17/5/2011					
Survey start point	-21.80742, 148.05122				
Survey end point	-21.807433, 148.050738				
Aspect	Mid slope S facing				
Slope	2%				
Bearing of transect	255º (W)				
Soil	Ironstone jump up – Tan sandy earth				
Declared Weeds	nil				
Erosion	nil				
Grazing impacts	nil				
Fire history	> 10 years				
Fauna habitat	Dead standing trees with hollows, logs, native grass understorey				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 40% Litter 50% Bare 10%	Veg 50% Litter 50% Bare 0%	Veg 90% Litter 10% Bare 0%	Veg 80% Litter 20% Bare 0%	Veg 90% Litter 10% Bare 0%
Canopy cover	52%				
Estimated shrub FPC	20%				
Notes					
Strata	Dominant Species				
Canopy (T1): 6-8 m	*Acacia shirleyi*				

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Tertiary Survey Site 10T (RE 11.7.2) RED HILL Survey F: 17/5/2011	
Shrub (S1): 1-3 m	*Everistia vacciniifolia*
	Erythroxylum australe
Ground (G): <1 m	*Aristida caput-medusae*
	Panicum decompositum
	Cleistochloa subjuncea
Basal Count (Factor 1 cm)	
	Acacia shirleyi - 7

A.5 Fine grained sedimentary undulating country (Landzone 9) field survey results

A.5.1 Vegetation Unit 5a: *Eucalyptus thozetiana* with *Acacia harpophylla* open woodland. (RE 11.9.1)

Description: This community was primarily found in two locations on weathered lateritic rises at the north-east of the Isaac river diversion survey area and the western edge of the GRB mine complex survey area. This community is characterised by the dominance of Eucalyptus thozetiana (Thozet's box) in the canopy. *Acacia harpophylla* (brigalow) was locally dominant in the mid strata. The understorey was typically a low open grassland modified from grazing disturbance, primarily dominated by Pennisetum ciliare* (buffel grass) and a number of other introduced grass species.

2005 - 2006 Survey

Vegetation Unit 6a: (RE 11.9.1)	
Strata	Dominant species
Canopy 18-20 m **CSR: 7.2 / 11.8** **FPC: 31%**	*Eucalyptus thozetiana*
Shrub Layer 1-2 m	*Acacia excelsa* ssp *excelsa*
	Acacia harpophylla
	Alectryon diversifolius
	Alphitonia excelsa
	Eremophila deserti
	Flindersia dissosperma
	Geijera parviflora
	Salsola kali
Ground Layer <1 m **FPC: 70%** **Bare: 20%**	*Achyranthes aspera* *
	Pennisetum ciliare *
	Enchylaena tomentosa v glabra
	Paspalidium caespitosum

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

7 Appendices

2009 Survey

Photo 11: Example of Vegetation Unit 5a (RE 11.9.1) showing *Eucalyptus thozetiana* (Thozet's box) as the dominant canopy species.

Secondary Survey Site d5 (RE 11.9.1) **RED HILL Survey D: 22/03/09**	
Transect Start	605597 mE; 7587422 mN
Transect End (50m)	605559 mE; 7587444 mN
Bearing	53° NW
Aspect	NE
Slope	5°
Soil	Light brown/red sandy clay with small coarse gravel.
Weeds	*Eriocereus martinii* *
Erosion	minimal
Grazing impacts	occasional – cattle tracks
Fire history	> 10 years
Fauna habitat	Tall, dense ground layer. Large *Eucalyptus thozetiana* with hollows.
Notes	~15 large old *Eucalyptus thozetiana*
Strata	**Dominant Species**
Canopy (T1): 12-16 m **FPC: 10%**	*Eucalyptus thozetiana*
Mid-Storey (T2): N/A	N/A
Shrub (S1): N/A **FPC: N/A**	N/A

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Secondary Survey Site d5 (RE 11.9.1) **RED HILL Survey D: 22/03/09**	
Ground (G): <1 m **FPC: 68%** **Litter: 10%** **Bare: 12%**	*Pennisetum ciliare**
	Portulaca pilosa
	Parsonsia lanceolata
Basal Count (Factor 1 cm)	
	Eucalyptus thozetiana: 5

FPC: Foliage Projection Cover

A.6 Basalt plains and hills (Landzone 8) field survey results

A.6.1 Vegetation Unit 6a: *Dichanthium sericeum* grassland on Cainozoic igneous rocks. (RE 11.8.11)

Description: This community was located on black cracking clays north-east of the Isaac River along natural drainage lines on the eastern edge of the GRB mine complex and in the north-east portion of the survey area. This community is characterised by the dominance of *Dichanthium sericeum* (bluegrass). RE 11.8.11 is part of the EPBC Act-listed 'Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin'. Remnant grasslands were assessed using a target grassland survey (methodology in **Section 2.2.3**). All remnant sites were considered in 'Good' condition.

2011 Survey

Site 14T

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Tertiary Survey Site 14T (RE 11.8.11) **RED HILL Survey F: 18/5/2011**					
Survey start point	-21.66357, 148.014085				
Survey end point	- 21.663777, 148.013622				
Aspect	flat				
Slope	flat				
Bearing of transect	225º (SW)				
Soil	Black cracking clay plain – dark brown heavy clay				
Declared Weeds	Parthenium*				
Erosion	nil				
Grazing impacts	nil				
Fire history	> 10 years				
Fauna habitat	Grassland				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 90% Litter 10% Bare 0%	Veg 100% Litter 0% Bare 0%
Grassland survey					**Quality**
Patch size	44 ha				
Grasses	3 indicator species				
Tussocks / 0.1ha	16200				Good
Estimated shrub FPC	15%				
Introduced species	<5%				
Strata	Dominant Species				
Shrub (S1): 1-5 m	*Owenia acidula*				
	Acacia salicina				
Ground (G): <1 m	*Dichanthium sericeum*				
	Aristida leptopoda				
	Panicum decompositum				
Basal Count (Factor 1 cm)					
	n/a				

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Site15T

Tertiary Survey Site 15T (RE 11.8.11) RED HILL Survey F: 18/5/2011					
Survey start point	-21.66012, 148.010333				
Survey end point	-21.660097, 148.009873				
Aspect	flat				
Slope	flat				
Bearing of transect	245º (SW)				
Soil	Black cracking clay plain – black heavy clay				
Declared Weeds	Parthenium*				
Erosion	nil				
Grazing impacts	nil				
Fire history	> 10 years				
Fauna habitat	Grassland				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 80% Litter 10% Bare 10%	Veg 85% Litter 10% Bare 5%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%
Grassland survey					**Quality**
Patch size	38 ha				Good
Grasses	4 indicator species				
Tussocks / 0.1ha	10400				
Estimated shrub FPC	10%				
Introduced species	15%				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Atalaya hemiglauca*				

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Tertiary Survey Site 15T (RE 11.8.11) RED HILL Survey F: 18/5/2011	
	Acacia salicina
Ground (G): <1 m	*Dichanthium sericeum*
	Aristida leptopoda
	Panicum decompositum
Basal Count (Factor 1 cm)	
	n/a

Site 16Q

Quaternary Survey Site 16Q (RE 11.8.11) RED HILL Survey F: 17/05/11	
Survey point	-21.649555, 148.017207
Aspect	flat
Slope	flat
Soil	Black cracking clay
Weeds	Parthenium
Erosion	nil
Grazing impacts	nil
Fire history	> 10 years
Fauna habitat	Grassland
Notes	'Good' condition but only 2 indicator species
Strata	**Dominant Species**
Shrub (S1): 1-3 m	*Acacia salicina*
Ground (G): <1 m	*Dichanthium sericeum*
	Aristida leptopoda
	Panicum decompositum
	Iseilema membranaceum
Basal Count (Factor 1 cm)	
	n/a

7 Appendices

Site 17Q

Quaternary Survey Site 17Q (RE 11.8.11) RED HILL Survey F: 17/05/11	
Survey point	-21.644867, 148007142
Aspect	flat
Slope	flat
Soil	Black cracking clay
Weeds	Parthenium
Erosion	Occasional
Grazing impacts	nil
Fire history	> 10 years
Fauna habitat	Grassland
Notes	'Good' condition 4 indicator species
Strata	**Dominant Species**
Shrub (S1): 1-3 m	*Acacia harpophylla*
Ground (G): <1 m	*Dichanthium sericeum*
	Aristida leptopoda
	Panicum decompositum
	Iseilema membranaceum
Basal Count (Factor 1 cm)	
	n/a

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Site 18T

Tertiary Survey Site 18T (RE 11.8.11) RED HILL Survey F: 19/5/2011					
Survey start point	-21.743002, 148.007852				
Survey end point					
Aspect	Mid slope SW facing				
Slope	1%				
Bearing of transect	285º (W)				
Soil	Black cracking clay plain – dark brown med-heavy clay				
Declared Weeds	Parthenium*				
Erosion	Track erosion In stock walking tracks				
Grazing impacts	moderate				
Fire history	> 10 years				
Fauna habitat	Grassland				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 90% Litter 0% Bare 10%	Veg 90% Litter 0% Bare 10%	Veg 100% Litter 0% Bare 0%
Grassland survey					**Quality**
Patch size	83 ha				Good
Grasses	3 indicator species				
Tussocks / 0.1ha	15400				
Estimated shrub FPC	<1%				
Introduced species	<5%				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Atalaya hemiglauca*				

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Tertiary Survey Site 18T (RE 11.8.11) RED HILL Survey F: 19/5/2011	
	Acacia salicina
Ground (G): <1 m	*Dichanthium sericeum*
	Aristida leptopoda
	Panicum decompositum
Basal Count (Factor 1 cm)	
	n/a

Site 19T

Tertiary Survey Site 19T (RE 11.8.11) RED HILL Survey F: 19/5/2011					
Survey start point	-21.740118, 148.004193				
Survey end point	-21.739995, 148.003717				
Aspect	Lower slope SW facing				
Slope	2%				
Bearing of transect	270º (W)				
Soil	Black cracking clay plain – black heavy clay				
Declared Weeds	Parthenium*				
Erosion	Track erosion In stock walking tracks				
Grazing impacts	Moderate				
Fire history	> 10 years				
Fauna habitat	Grassland				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)

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Tertiary Survey Site 19T (RE 11.8.11) **RED HILL Survey F: 19/5/2011**					
	Veg 100% Litter 0% Bare 0%	Veg 80% Litter 20% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 100% Litter 0% Bare 0%	Veg 90% Litter 10% Bare 0%
Grassland survey					**Quality**
Patch size	83 ha				
Grasses	3 indicator species				
Tussocks / 0.1ha	11600				Good
Estimated shrub FPC	<1%				
Introduced species	<5%				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Atalaya hemiglauca*				
	Acacia salicina				
Ground (G): <1 m	*Dichanthium sericeum*				
	Aristida leptopoda				
	Panicum decompositum				
Basal Count (Factor 1 cm)					
	n/a				

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Site 22T

Tertiary Survey Site 22T (RE 11.8.11) RED HILL Survey F: 19/5/2011					
Survey start point	-21.73195, 148.007603				
Survey end point	-21.731818, 148.00714				
Aspect	Flat				
Slope	Flat				
Bearing of transect	280º (W)				
Soil	Black cracking clay plain – chocolate med-heavy clay				
Declared Weeds					
Erosion	nil				
Grazing impacts	Occasional cattle trampling				
Fire history	> 10 years				
Fauna habitat	Grassland				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 90% Litter 5% Bare 5%	Veg 90% Litter 5% Bare 5%	Veg 95% Litter 0% Bare 5%	Veg 90% Litter 5% Bare 5%	Veg 90% Litter 5% Bare 5%
Grassland survey					**Quality**
Patch size	83 ha				Good
Grasses	3 indicator species				
Tussocks / 0.1ha	14200				
Estimated shrub FPC	<1%				
Introduced species	<5%				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Acacia salicina*				

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Tertiary Survey Site 22T (RE 11.8.11) RED HILL Survey F: 19/5/2011	
Ground (G): <1 m	*Dichanthium sericeum*
	Aristida leptopoda
	Panicum decompositum
Basal Count (Factor 1 cm)	
	n/a

A.6.2 Vegetation Unit 6b: Heterogeneous *Dichanthium sericeum* grassland (RE 11.8.11) / non-remnant grassland

Description: This community borders communities of RE 11.8.11, which are located on black cracking clays north-west of the Isaac river on the eastern edge of the GRB mine complex and along natural drainage lines in the north-east portion of the survey area. This community is characterised by the shared dominance of *Dichanthium sericeum* (bluegrass) interspaced with Pennisetum ciliare* (buffel grass, an introduced pasture grass). RE 11.8.11 is part of the EPBC Act-listed 'Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin'. However, due to the heterogeneous nature of this community, it does not qualify as an EPBC Act-listed community. With careful management these areas could be returned to remnant grasslands.

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2011 Survey

Site 20Q

Quaternary Survey Site 20Q (RE 11.8.11/ non-rem grassland) **RED HILL Survey F: 19/05/11**	
Survey point	-21.741342, 148.007288
Aspect	Top of slope
Slope	<1%
Soil	Black cracking clay plain – dark brown med clay
Weeds	Parthenium
Erosion	nil
Grazing impacts	Occasional
Fire history	> 10 years
Fauna habitat	Grassland
Notes	1 grassland survey indicator species
Strata	**Dominant Species**
Shrub (S1): 1-2 m	*Acacia salicina*
Ground (G): <1 m	*Dichanthium sericeum*
	Heteropogon contortus
	Pennisetum ciliare *
Basal Count (Factor 1 cm)	
	n/a

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Site 21Q

Quaternary Survey Site 21Q (RE 11.8.11/ non-rem grassland) RED HILL Survey F: 19/05/11	
Survey point	-21.733872, 148.009745
Aspect	flat
Slope	flat
Soil	Black cracking clay plain – dark brown med clay
Weeds	nil
Erosion	nil
Grazing impacts	Moderate
Fire history	> 10 years
Fauna habitat	Grassland
Notes	1 grassland survey indicator species
Strata	**Dominant Species**
Shrub (S1): 1-4 m	*Corymbia dallachiana*
Ground (G): <1 m	*Dichanthium sericeum*
	Heteropogon contortus
	Pennisetum ciliare *
Basal Count (Factor 1 cm)	
	n/a

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A.7 Non remnant vegetation on assorted landzones field survey results

A.7.1 Vegetation Unit 7a: Non remnant modified open grassland

Description: This community is the dominant vegetation type for the survey area, covering the majority of the north-east and north-west of the area. The community is comprised of a modified grasslands for grazing, dominated by Pennisetum ciliare* (buffel grass) and other introduced pasture species. Stocking of these pastures has been managed in a sustainable manner, and incidences of weed species are relatively low.

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below. Where a significant variation in the floristic assemblage is seen in the dominant strata of the community further tables have been added to demonstrate the variation.

2005 - 2006 Survey

Vegetation Unit 7a: Non remnant modified open grassland	
Strata	**Dominant species**
Shrub Layer 1-2 m	*Eremophila mitchellii*
	Acacia harpophylla
	Atalaya hemiglauca
	Citrus glauca
Ground Layer <1 m **FPC: 70%** **Bare: 20%**	*Acacia leiocalyx* ssp *leiocalyx*
	Astrebla lappacea
	Atriplex muelleri
	Capparis lasiantha
	Carissa ovata
	*Pennisetum ciliare**
	Einadia nutans subsp. linifolia
	Enchylaena tomentosa v glabra
	Hibiscus brachysiphonus
	Iseilema membranaceum
	*Opuntia tomentosa**
	Panicum decompositum
	Phyllanthus maderaspatensis
	Phyllanthus virgatus
	Salsola kali
	Sclerolaena muricata v muricata
	*Sida cordifolia**
	Sida rohlenae
	Sporobolus caroli
	Sporobolus creber

CSR: Crown Separation Ratio
FPC: Foliage Projection Cover

7 Appendices

Vegetation Unit 7a: **Non remnant modified open grassland**	
Strata	**Dominant species**
Shrub Layer 1-2 m	*Acacia harpophylla*
	Acacia salicina
	Atalaya hemiglauca
	Lysiphyllum carronii
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 70%** **Bare: 20%**	*Aristida leptopoda*
	Atriplex muelleri
	*Pennisetum ciliare**
	Citrus glauca
	*Hibiscus trionum**
	Iseilema membranaceum
	Neptunia gracilis
	Parsonsia lanceolata
	Phyllanthus maderaspatensis
	Portulaca oleracea
	Sarcostemma viminale
	Sida rohlenae
	Sporobolus creber
	Ventilago viminalis

FPC: Foliage Projection Cover

2009 Survey

Photo 12: Example of Vegetation Unit 6a (non-remnant grassland) showing *Pennisetum ciliare** (buffel grass) as the dominant ground cover species.

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Secondary Survey Site d1 (Vegetation Unit 7a) **RED HILL Survey D: 20/03/09**	
Transect Start	607730 mE; 7595287 mN
Transect End (50m)	607780 mE; 7595280 mN
Bearing	13° ENE
Aspect	undulating plain
Slope	7°
Soil	light yellowish/brown fine clay sediment
Weeds	-
Erosion	Minimal
Grazing impacts	occasional
Fire history	> 10 years
Fauna habitat	Tall, dense ground layer ideal for insectivorous birds, reptiles, snakes.
Notes	Exotic grassland with some shrubby regrowth; site adjacent to creek (~250 m away).
Strata	**Dominant Species**
Canopy (T1): N/A **FPC: N/A**	N/A
Mid-Storey (T2): N/A	N/A
Shrub (S1): N/A **FPC: N/A**	N/A
Ground (G): <1 m **FPC: 66%** **Litter: 28%** **Bare: 6%**	*Pennisetum ciliare**
	Evolvulus alsinoides
	Glycine tabacina
Basal Count (Factor 1 cm)	
	N/A

FPC: Foliage Projection Cover

2011 Survey

Quaternary Survey Site 2Q (non-remnant grassland) **RED HILL Survey F: 17/05/11**	
Survey point	-21.686221, 147.933799
Aspect	Mid slope
Slope	2%
Soil	Clay plain – pale red clay
Weeds	nil
Erosion	nil
Grazing impacts	Moderate
Fire history	> 10 years
Fauna habitat	Grassland

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Quaternary Survey Site 2Q (non-remnant grassland) RED HILL Survey F: 17/05/11	
Notes	
Strata	**Dominant Species**
Shrub (S1): 1-2 m	*Carissa ovata*
	Acacia harpophylla
Ground (G): <1 m	*Pennisetum ciliare**

A.7.2 Vegetation Unit 7b: Non remnant mixed shrubby regrowth

Description: This community is found distributed across the survey area, typically found in association with Vegetation Unit 7a non remnant open grasslands when on Landzone 5. It was also found in areas of previously grazed open pasture that has been excluded from grazing pressure and now exhibits a low shrubby layer of regrowth species. The species assemblage of the dominant regrowth layer was generally found to be analogous with previously cleared REs. Where a dominance of *Acacia harpophylla* was encountered, this community was considered to be Vegetation Unit 7c.

Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below.

2011 Survey
Site 8T

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Tertiary Survey Site 8T (non-remnant shrubby regrowth analogous to RE 11.5.3) RED HILL Survey F: 17/5/2011					
Survey start point	-21.822513, 147.914027				
Survey end point	-21.722507, 147.914473				
Aspect	Flat				
Slope	Flat				
Bearing of transect	95º (E)				
Soil	Sand plain – red fine sand				
Declared Weeds	nil				
Erosion	nil				
Grazing impacts	Moderate				
Fire history	> 10 years				
Fauna habitat	Regrowth, shrubs and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 50% Litter 20% Bare 30%	Veg 85% Litter 5% Bare 10%	Veg 90% Litter 5% Bare 5%	Veg 75% Litter 20% Bare 5%	Veg 30% Litter 20% Bare 50%
Canopy cover	N/A				
Estimated shrub FPC	10-15%				
Notes	*E. populnea* and *C. clarksoniana* dom spp.				
Strata	Dominant Species				
Shrub (S1): 1-4 m	*Eucalyptus populnea*				
Ground (G): <1 m	*Pennisetum ciliare**				
	Themeda triandra				
	Urochloa mosambicensis *				
Basal Count (Factor 1 cm)					
	n/a				

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Site 11T

Tertiary Survey Site 11T (non-remnant shrubby regrowth analogous to RE 11.5.3) RED HILL Survey F: 18/5/2011					
Survey start point	-21.804785, 148.046422				
Survey end point	-21.804434, 148.046428				
Aspect	Gentle undulation				
Slope	2%				
Bearing of transect	340º (N)				
Soil	Sand plain – Tan sandy earth				
Declared Weeds	nil				
Erosion	nil				
Grazing impacts	Occasional				
Fire history	> 10 years				
Fauna habitat	Regrowth and grass				
Ground cover	Q1(0m)	Q2(12.5m)	Q3(25m)	Q4(37.5m)	Q5(50m)
	Veg 80% Litter 10% Bare 10%	Veg 90% Litter 5% Bare 5%	Veg 70% Litter 20% Bare 10%	Veg 100% Litter 0% Bare 0%	Veg 75% Litter 20% Bare 5%
Canopy cover	N/A				
Estimated shrub FPC	20-30%				
Notes	*E. populnea* and *E. crebra* dom spp.				
Strata	Dominant Species				
Shrub (S1): 1-3 m	*Eucalyptus populnea*				
	Eucalyptus crebra				
Ground (G): <1 m	*Pennisetum ciliare**				

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Tertiary Survey Site 11T (non-remnant shrubby regrowth analogous to RE 11.5.3) RED HILL Survey F: 18/5/2011	
	Melinis repens *
	Heteropogon contortus
Basal Count (Factor 1 cm)	
	n/a

A.7.3 Vegetation Unit 7c: Non remnant shrubby *Acacia harpophylla* regrowth

This community is found distributed across the survey area, typically found in association with Vegetation Unit 6a non remnant open grasslands on Landzone 4. It is found in areas of previously grazed open pasture that has been excluded from grazing pressure. These communities now exhibit a low shrubby layer dominated by *Acacia harpophylla* (brigalow) and were located in several discrete locations across the survey area. Structural and floristic descriptions of the dominant species in each strata for the survey sites found within this vegetation community are described below.

2005 - 2006 Survey

Vegetation Unit 7c (Non remnant shrubby *Acacia harpophylla* regrowth)	
Strata	**Dominant species**
Shrub Layer 1-2 m	*Acacia harpophylla*
	Acacia salicina
	Atalaya hemiglauca
	Lysiphyllum carronii
	Terminalia oblongata ssp *voluvris*
Ground Layer <1 m **FPC: 90%** **Bare: 10%**	*Aristida leptopoda*
	Atriplex muelleri
	*Pennisetum ciliare**
	Citrus glauca
	*Hibiscus trionum**
	Iseilema membranaceum
	Neptunia gracilis
	Parsonsia lanceolata
	Phyllanthus maderaspatensis
	Portulaca oleracea
	Sarcostemma viminale
	Sida rohlenae
	Sporobolus creber
	Ventilago viminalis

FPC: Foliage Projection Cover

7 Appendices

2009 Survey

Photo 13: Example of Vegetation Unit 6b (non-remnant shrubby *Acacia harpophylla* regrowth) showing *Pennisetum ciliare** (buffel grass) as the dominant ground cover species and *Acacia harpophylla* (brigalow) as the dominant shrub species.

Secondary Survey Site d13 Non-remnant shrubby *Acacia harpophylla* regrowth (Vegetation Unit 7c) **RED HILL Survey D: 26/03/09**	
Transect Start	608194mE; 7593766mN
Transect End (50m)	608151mE; 7593786mN
Bearing	-
Aspect	-
Slope	undulating plain
Soil	Light brown fine clay sediment with coarse angular metamorphic rocks.
Weeds	*Eriocereus martinii* *, *Parthenium hysterophorus**
Erosion	nil
Grazing impacts	moderate
Fire history	> 10 years
Fauna habitat	Dense ground layer of buffel grass.
Notes	Exotic grassland with *Acacia harpophylla* shrubby regrowth 1-2 m high. Minor gilgai effects.
Strata	**Dominant Species**
Canopy (T1): N/A **FPC: N/A**	N/A

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Secondary Survey Site d13 Non-remnant shrubby *Acacia harpophylla* regrowth (Vegetation Unit 7c) **RED HILL Survey D: 26/03/09**	
Mid-Storey (T2): N/A	N/A
Shrub (S1): 1-3 m **FPC: 30%**	*Acacia harpophylla* *Lysiphyllum carronii*
Ground (G): <1 m **FPC: 48%** **Litter: 28%** **Bare: 24%**	*Pennisetum ciliare**
	Salsola kali
	Sporobolus caroli
Basal Count (Factor 1 cm)	
	N/A

FPC: Foliage Projection Cover

B

Appendix B - Species List

Scientific Name	Common Name	Family	Life form
Desmodium filiforme	narrow necklace pea	Fabaceae	Creeper
Evolvulus alsinoides v decumbens	tropical speedwell	Convolvulaceae	Creeper
Glycine latifolia	glycine	Fabaceae	Creeper
Glycine tabacina	variable glycine	Fabaceae	Creeper
Indigofera linnaei	birdsville indigo	Fabaceae	Creeper
Neptunia gracilis	native sensitive plant	Mimosaceae	Creeper
Pandorea pandorana	wonga vine	Bignoniaceae	Creeper
Rhynchosia minima	smallest rhynchosia	Fabaceae	Creeper
Alloteropsis cimicina		Poaceae	Grass
Alloteropsis semialata	cockatoo grass	Poaceae	Grass
Ancistrachne uncinulata	hooky grass	Poaceae	Grass
Aristida acuta	wire-grass	Poaceae	Grass
Aristida benthamii v benthamii	three-awned speargrass	Poaceae	Grass
Aristida calycina	dark wiregrass	Poaceae	Grass
Aristida calycina v calycina	dark wiregrass	Poaceae	Grass
Aristida calycina v praealta	dark wiregrass	Poaceae	Grass
Aristida caput-medusae	many headed wire-grass	Poaceae	Grass
Aristida contorta	bunched kerosene grass	Poaceae	Grass
Aristida ingrata		Poaceae	Grass
Aristida jerichoensis v jerichoensis	jericho wire-grass	Poaceae	Grass
Aristida jerichoensis v subspinulifera	jericho wire-grass	Poaceae	Grass
Aristida latifolia	feathertop wire-grass	Poaceae	Grass
Aristida leptopoda	white spear-grass	Poaceae	Grass
Aristida psammophila		Poaceae	Grass
Astrebla lappacea	curly mitchell grass	Poaceae	Grass
Astrebla squarrosa	bull mitchell grass	Poaceae	Grass
Austrostipa verticillata	slender bamboo-grass	Poaceae	Grass
Bothriochloa bladhii subsp. bladhii	forest blue grass	Poaceae	Grass
Bothriochloa decipiens subsp cloncurrensis	pitted bluegrass	Poaceae	Grass
Bothriochloa decipiens v decipiens	pitted bluegrass	Poaceae	Grass
Bothriochloa erianthoides	satin top	Poaceae	Grass
Bothriochloa ewartiana	bluegrass	Poaceae	Grass
Calyptochloa gracillima		Poaceae	Grass
Capillipedium spicigerum	scentedtop	Poaceae	Grass
Chionachne hubbardiana	summer grass	Poaceae	Grass
Chloris divaricata	slender finger-grass	Poaceae	Grass
Chloris pectinata	comb chloris	Poaceae	Grass
Chloris truncata	windmill grass	Poaceae	Grass
Chrysopogon fallax	golden beard grass	Poaceae	Grass
Cleistochloa subjuncea		Poaceae	Grass
Cymbopogon obtectus	silkyheads	Poaceae	Grass
Cymbopogon refractus	barbwire grass	Poaceae	Grass
Dactyloctenium radulans	button grass	Poaceae	Grass
*Dichanthium aristatum**	Angleton grass	Poaceae	Grass
Dichanthium fecundum		Poaceae	Grass
Dichanthium sericeum	qld or silky blue-grass	Poaceae	Grass
Dichanthium setosum		Poaceae	Grass
Digitaria ammophila	silky umbrella grass	Poaceae	Grass
Digitaria brownii	cotton panic grass	Poaceae	Grass
Digitaria divaricatissima	umbrella grass	Poaceae	Grass
Enneapogon avanaceus	common bottlewashers	Poaceae	Grass
Enneapogon gracilis	slender nineawn	Poaceae	Grass
Enneapogon lindleyanus	conetop nineawn	Poaceae	Grass
Enneapogon nigricans	niggerheads	Poaceae	Grass
Enneapogon robustissimus		Poaceae	Grass
Enteropogon acicularis	curly windmill grass	Poaceae	Grass
Enteropogon paucispiceus		Poaceae	Grass
Enteropogon ramosus	twirly windmill grass	Poaceae	Grass

Eragrostis basedowii	neat lovegrass	Poaceae	Grass
Eragrostis brownii	Brown's lovegrass	Poaceae	Grass
Eragrostis lacunaria	purple lovegrass	Poaceae	Grass
Eragrostis parviflora	weeping lovegrass	Poaceae	Grass
Eragrostis pilosa	soft lovegrass	Poaceae	Grass
Eragrostis speciosus		Poaceae	Grass
Eragrostis tenellula	delicate lovegrass	Poaceae	Grass
Eremophila debilis	winter apple	Myoporaceae	Grass
Eriachne obtusa	northern wanderrie grass	Poaceae	Grass
Eriochloa crebra	cup grass	Poaceae	Grass
Heteropogon contortus	bunched spear grass	Poaceae	Grass
Heteropogon triticeus	tall spear grass	Poaceae	Grass
Ischaemum australe	large bluegrass	Poaceae	Grass
Iseilema membranaceum	flinders grass	Poaceae	Grass
Leersia hexandra	swamp ricegrass	Poaceae	Grass
Leptochloa decipiens	slender cane grass	Poaceae	Grass
Leptochloa decipiens subsp decipiens	slender canegrass	Poaceae	Grass
Leptochloa digitata	umbrella cane grass	Poaceae	Grass
Leptochloa fusca subsp. fusca		Poaceae	Grass
Panicum decompositum	native millet	Poaceae	Grass
Panicum effusum v simile	hairy panicum	Poaceae	Grass
Paspalidium caespitosum	briglow grass	Poaceae	Grass
Paspalidium constrictum	knottybutt grass	Poaceae	Grass
Paspalidium distans		Poaceae	Grass
Paspalidium globoideum	shot grass	Poaceae	Grass
Paspalidium rarum		Poaceae	Grass
Perotis rara	comet grass	Poaceae	Grass
Setaria oplismenoides		Poaceae	Grass
Setaria surgens	annual pigeon grass	Poaceae	Grass
Sporobolus actinocladus	katoora ray grass	Poaceae	Grass
Sporobolus australasicus	australian dropseed	Poaceae	Grass
Sporobolus caroli	fairy grass	Poaceae	Grass
Sporobolus creber	sporobolus	Poaceae	Grass
Sporobolus disjunctus		Poaceae	Grass
Sporobolus scabridus		Poaceae	Grass
Themeda triandra	kangaroo grass	Poaceae	Grass
Thyridolepis xerophila		Poaceae	Grass
Tragus australianus	small burrgrass	Poaceae	Grass
Triraphis mollis		Poaceae	Grass
Urochloa pubigera		Poaceae	Grass
Adriana urticoides var. urticoides		Euphorbiaceae	Herb
Alternanthera denticulata	lesser joyweed	Amaranthaceae	Herb
Alternanthera nodiflora	common joyweed	Amaranthaceae	Herb
Alysicarpus rugosus	chain pea	Fabaceae	Herb
Atriplex muelleri	annual saltbush	Chenopodiaceae	Herb
Atriplex semibaccata	saltbush	Chenopodiaceae	Herb
Brunoniella acaulis ssp acaulis	blue trumpet	Acanthaceae	Herb
Calotis cuneifolia	purple burr-daisy	Asteraceae	Herb
Chrysocephalum apiculatum	yellow buttons	Asteraceae	Herb
Corchorus pascuorum	jute	Tiliaceae	Herb
Corchorus trilocularis		Tiliaceae	Herb
Crinum flaccidum	inland river lily	Amaryllidaceae	Herb
Cyanthillium cinereum	fleabane	Asteraceae	Herb
Dianella revoluta v minor	black-anther flax lily	Phormiaceae	Herb
Einadia nutans subsp. linifolia	climbing saltbush	Chenopodiaceae	Herb
Emex australis	cape spinach	Polygalaceae	Herb
Enchylaena tomentosa	ruby saltbush	Chenopodiaceae	Herb
Enchylaena tomentosa v glabra	ruby saltbush	Chenopodiaceae	Herb
Epaltesaustralis	spreading nut-heads	Asteraceae	Herb

Erodium crinitum	corkscrew	Geraniaceae	Herb
Euphorbia tannensis subsp. eremophila		Euphorbiaceae	Herb
Grewia retusifolia	emu berry	Tiliaceae	Herb
Heliotropium peninsulare		Asteraceae	Herb
Heliotropium tenuifolium	heliotrope	Asteraceae	Herb
Hybanthus enneaspermus		Violaceae	Herb
Hypericum gramineum	small St John's wort	Clusiaceae	Herb
Indigofera colutea		Fabaceae	Herb
Indigofera linifolia	narrow-leaved indigo	Fabaceae	Herb
Indigofera pratensis		Fabaceae	Herb
Iphigenia indica		Colchicaceae	Herb
Ixiolaena brevicompta	flat billybuttons	Asteraceae	Herb
Jacquemontia paniculata		Convolvulaceae	Herb
Lavatera plebeia	Australian hollyhock	Malvaceae	Herb
Lomandra longifolia	mat rush	Xanthorrhoeaceae	Herb
Murdannia graminea	blue murdannia	Commelinaceae	Herb
Nyssanthes erecta		Amaranthaceae	Herb
Peripleura hispidula		Asteraceae	Herb
Phyllanthus maderaspatensis	phyllanthus	Euphorbiaceae	Herb
Phyllanthus virgatus	phyllanthus	Euphorbiaceae	Herb
Pimelea haematostachya	red rice-flower	Thymelaeaceae	Herb
Polycarpaea corymbosa		Polycarpaea	Herb
Polymeria calycina		Convolvulaceae	Herb
Pseuderanthemum variable		Acanthaceae	Herb
Pterocaulon sphacelatum	grey mulla	Asteraceae	Herb
Ptilotus exaltatus v semilanatus	lambs tails	Amaranthaceae	Herb
Rostellularia adscendens var adscendens		Acanthaceae	Herb
Rutidosis lanata		Asteraceae	Herb
Sida corrugata	corrugated sida	Malvaceae	Herb
Sida fibulifera	silver sida	Malvaceae	Herb
Sida rohlenae	shrub sida	Malvaceae	Herb
Sida subspicata	qld hemp	Malvaceae	Herb
Sida trichopoda		Malvaceae	Herb
Sida trichopoda	high sida	Malvaceae	Herb
Spermacoce brachystema		Rubiaceae	Herb
Tephrosia filipes	tephrosa	Fabaceae	Herb
Tephrosia leptoclada		Fabaceae	Herb
Trianthema triquetra	Red spinach	Aizoaceae	Herb
Vigna lanceolata v lanceolata	maloga bean	Fabaceae	Herb
Wahlenbergia gracilis	bluebells	Campanulaceae	Herb
Wedelia spilanthoides		Asteraceae	Herb
Zornia muriculata		Fabaceae	Herb
Cyperus dactylotes	sedge	Cyperaceae	Sedge
Cyperus difformis	sedge	Cyperaceae	Sedge
Cyperus exaltatus	tall sedge	Cyperaceae	Sedge
Cyperus fulvus		Cyperaceae	Sedge
Cyperus gilesii	giles sedge	Cyperaceae	Sedge
Cyperus gracilis	whisker grass	Cyperaceae	Sedge
Cyperus iria		Cyperaceae	Sedge
Fimbristylis dichotoma	common fringe-sedge	Cyperaceae	Sedge

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URS Australia Pty Ltd
Level 17, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

www.ap.urscorp.com