

**RARE AND THREATENED FLORA SURVEY**

**MISSING LINK RAIL ALIGNMENT**

**GOONYELLA RIVERSIDE RAIL LOOP**

**TO NEWLANDS RAIL LOOP**



**Frontispiece: *Dichanthium queenslandicum* – a vulnerable grass found in remnant vegetation along several kilometres of the northern section of the proposed missing link rail alignment.**

## Introduction

GHD Pty Ltd and LAMR Pty Ltd undertook a field survey of potential habitats for rare and threatened flora along the alignment of the proposed “Missing Link” rail line between the existing rail loops at the BMA coal mine of Goonyella Riverside in the south and the Xstrata coal mine Newlands in the north.

The aim of this study was to:

- Survey the nature, extent, condition and values of habitats and ecosystems, and the known or likely occurrence of rare and threatened flora species, with particular focus on those of conservation concern at State and Commonwealth levels.

In addition, it rapidly became apparent that there was a need to review and revise existing Regional Ecosystem mapping along the alignment. The accompanying photo essay and map products clearly indicate a number of substantial differences between the current certified mapping, the results of the recently completed detailed flora and fauna study and the observations made for this study. Casual observations of fauna and the results of recent fauna studies indicate that the fauna studies may also require similar, additional, inputs to satisfy the assessment process for the proposed “Missing Link” rail connection.

The *study area* refers generally to the lands surrounding the proposed rail alignment. The *Brigalow Belt Bioregion* is defined as one of 13 biogeographical areas of Queensland, which extends from the Queensland-New South Wales border to Townsville. It encompasses approximately 3.6 million hectares of sub-humid and semi-arid environments (see Sattler and Williams 1999).

Within this report, the conservation status of a species may be described as *Endangered*, *Vulnerable* and/or *Rare*. These terms are used in accordance with the provisions of the *Nature Conservation Act 1992* and its regulations and amendments, and/or the *Environment Protection and Biodiversity Conservation Act 1999*. For the purposes of this report, relevant *Nature Conservation Act 1992* regulations and amendments refer to the *Nature Conservation (Wildlife) Regulation 1994* reprinted as in force on 17 December 2004 (includes commenced amendments up to 2004 SL No. 316). *Threatened* is a common term used to collectively describe endangered and vulnerable species.

## Regional Ecosystems

Under the *Vegetation Management Act 1999*, “*Remnant vegetation*, for an area of Queensland within a regional ecosystem map, means the vegetation mapped as remnant vegetation on the map”. For the purposes of this report, “the map” refers to a Regional Ecosystem map certified by the chief executive as a Regional Ecosystem map for an area. “*Remnant vegetation*, for an area of Queensland for which there is no regional ecosystem map, means the vegetation, part of which forms the predominant canopy of the vegetation: (a) covering more than 50% of the undisturbed predominant canopy; and (b) averaging more than 70% of the vegetation’s undisturbed height; and (c) composed of species characteristic of the vegetation’s undisturbed predominant canopy.”

Within this report, the definition of a *Regional Ecosystem* (RE) follows that provided by Sattler and Williams (1999), i.e. a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. This definition forms the basis of the *Vegetation Management Act 1999*, which also defines the “*pre-clearing extent*” of a regional ecosystem as the extent of the regional ecosystem before it was cleared.

Each *Regional Ecosystem* is assigned status under the VM Act as either *Endangered*, *Of Concern* or *Not Of Concern*. The status of all regional ecosystems mapped for Queensland is provided in the *Vegetation Management Act 1999 Vegetation Management Regulation 2000* (VMR), i.e.:

- *Vegetation Management Regulation* Schedule 1 - *Endangered* Remnant Regional Ecosystems.
- *Vegetation Management Regulation* Schedule 2 - *Of Concern* Remnant Regional Ecosystems.
- *Vegetation Management Regulation* Schedule 3 - *Not Of Concern* Remnant Regional Ecosystems.

For the purposes of this report, the status of RE's follows that of the Regional Ecosystem Description Database (REDD, Version 4.2) published by the Queensland Herbarium, EPA (2005). *Regrowth vegetation* means woody vegetation that is not remnant as defined under the *Vegetation Management Act 1999*.

### **Flora and Vegetation in General**

In this report, descriptions of vegetation types are based on the structural types described by Specht (1970). Standard references relevant to the *study site*, *study area* or region that have been employed for the taxa listed in this report are as follows: Queensland Herbarium (2002); Royal Botanic Gardens (1993); Sharpe (1986); Simon (1993); and Stanley & Ross (1983, 1986, 1989). Additional nomenclatural changes have been incorporated via regular, personal communication with staff at the Queensland Herbarium. As there is no standard or commonly and universally accepted reference work for plant common names, all taxa mentioned in this report will be referred simply by their currently published scientific names at the time of report preparation. Introduced and naturalised species, in accordance with Queensland Herbarium (2002), are denoted with an asterisk, i.e.\*. An *environmental weed* refers to any plant that survives in a natural area where its presence is undesirable, harmful or troublesome to native biodiversity.

For vegetation and flora, there is little available site-specific data published for this area. The current certified mapping data was reviewed (Version 4.2) to provide an indication of the bioregional analysis of regional ecosystems in the study area. Individual property level surveys frequently result in refinement of this mapping due to the finer scale of resolution of the vegetation patterns and land zones practicable at a property scale than is feasible for bioregional mapping studies.

### **Field Investigations**

Based on the integrated findings of desk-based assessments, the field investigation program was undertaken by a botanist and an ecologist. The field survey concentrated along the proposed rail alignment. The field investigation program was undertaken over four days, i.e. the 5<sup>th</sup> to the 8<sup>th</sup> September 2005.

### **Flora and Vegetation Assessment**

The primary objective of the vegetation assessment was to spatially identify vegetation types and regional ecosystems (REs) placing them into landscape types in order to identify those parts of the landscape with the highest potential of occurrence of the target rare and threatened flora and fauna. Existing RE mapping was reviewed and updated in the field to current *Vegetation Management Act 1999* descriptions and status. Random meander searches were made in likely habitats of rare and threatened taxa known from this region. Observations of species were recorded and an inventory was compiled during foot and vehicle based transects of the study area. Additional taxa observed in the nearby analogous

vegetation were also recorded for comparative purposes. The climatic variability of the region would normally dictate a number of seasons be monitored in order to detail natural variance in the assayed plant communities. The areas where there were observed or potential habitat of the target rare and threatened flora should be re-measured after the next effective rainfall event to maximise the recording of all individuals of the target taxa.

## Results

Queensland has been sub-divided into 13 biogeographical areas to identify biodiversity features at a regional level (Sattler & Williams 1999). This approach attempts to differentiate biodiversity characteristics at a broad and ecologically meaningful level, where differences are considered to be typically most apparent. This level of variation may be linked to a wide range of influences, and may be described within a hierarchical approach, i.e. within the context of landscape, ecosystem, species and genotype characteristics (Sattler 1993). The proposed alignment is embedded within the *Brigalow Belt Bioregion*, primarily within its northern section. It is characterised by flora and fauna species of open woodland, including the widespread leguminous tree Brigalow (*Acacia harpophylla*). Other vegetation communities include grassland, dry semi-evergreen vine thickets, eucalypt woodlands and forests, and riparian ecosystems.

### Flora and Vegetation

The floristic list of observed taxa recorded during site assessments are presented in Appendix A. Appendix B contains the data from Regional Ecosystem Digital Database (REDD, Version 4.2) defining the observed regional ecosystems along the proposed alignment. The patterning and distribution of the observed regional ecosystems is indicated on the accompanying map and GIS products. The following regional ecosystems were observed along or adjacent to the proposed alignment: 11.3.1, 11.3.10, 11.3.25, 11.4.3, 11.4.8, 11.4.9, 11.5.2, 11.5.3, 11.5.9, 11.5.16, 11.7.1, 11.7.2, 11.8.5, 11.8.11, 11.9.1, 11.9.4, 11.9.5 and 11.9.9. Descriptions of these regional ecosystems as contained in (REDD Version 4.2, 2005) are given in Appendix B. These descriptions conform to the original circumscription of the respective regional ecosystem by Young *et al.* (1999) in Sattler and Williams (1999).

Areas of the not of concern regional ecosystem 11.3.25 were restricted to Suttor Creek with other areas of land zone 3 found associated with smaller ephemeral waterways traversed by the proposed alignment. The endangered regional ecosystem 11.3.1 was found along some of these ephemeral waterways with a limited extent of the of concern regional ecosystem associated with the former riparian communities along Suttor Creek. Some of the vegetation on the rocky substrates conformed to the endangered RE 11.9.1 whilst the remaining endangered regional ecosystem s observed on the gilgaied clay plains (11.4.3, 11.4.8 and 11.4.9) were observed as an interwoven mosaic of clay plains that were embedded in the sand plains through which the aforementioned streams flowed. Small linear patches (some unmappable) of regional ecosystem 11.3.10 were found associated with the ephemeral waterways in the north, but regional ecosystem 11.5.3 dominated large areas of the *study site* across the sand plains through which the site's waterways flowed. Areas of rocky escarpment across the *study site* were covered with regional ecosystem 11.7.2 with only small areas of the endangered regional ecosystems 11.5.16, 11.9.1 and 11.9.4 are found scattered along the alignment. Black soil plains and undulating downs dominated the far northern sections of the alignment (regional ecosystems 11.8.5 and 11.8.11) and it was in this area that the vulnerable grass, *Dichanthium queenslandicum*, was located.

## Flora Representativeness and Diversity

The alignment represents an atypical Brigalow bioregion landscape in many respects as there are substantial tracts of remnant vegetation in some areas. Whilst land clearance has been minimal on land zone 7 and 9 substrates due to their rocky, infertile nature and the consequent poor water holding capacity of their thin veneer of soils, elsewhere land zones 3, 4, 5 and 8 have seen extensive removal of their native vegetative cover. This is particularly the case for the more fertile clay soils of land zones 4 and 8. Hence, many of the regional ecosystems on land zones 4 and 8 or those on other substrates with *Acacia harpophylla* (e.g. 11.5.16 and 11.9.1) within the Brigalow bioregion are classified as endangered under the Schedules of the VM Act as a consequence of high rates of land clearance for agriculture. Ironically, it is on land zones 7, 8 and 9 where the potential for rare and threatened flora is highest in the local province. The vine forest associations (none of which occur on the alignment, but are located close to it in the “gorge”) on these substrates contain the highest species richness and numbers of rare and threatened flora.

Close to these in terms of species richness, but less so with respect to probability of occurrence of rare and threatened taxa, are the grasslands on land zones 3, 4 and 8. A number of the rare and threatened flora species (including *Digitaria porrecta*, *Dichanthium queenslandicum* and *Dichanthium setosum*) recorded from this region occurs on these land zones. These species have some potential of occurrence in regional ecosystems 11.3.21, 11.8.5 and 11.8.11 which is restricted to the northern area. *Dichanthium queenslandicum* was located in this area.

## Threats to Biodiversity, Species and Communities of Significance

### Flora and Vegetation

The greatest threats to the flora of the region remain grazing by domestic animals, land clearance and the invasion of exotic weed taxa, particularly following fire or overly intensive grazing impacts. Australia’s most invasive exotic grass, *Cenchrus ciliaris* (Buffel Grass), dominates the ground layer of many areas of remnant native vegetation, as observed across the mine lease area. Riparian areas (land zone 3) also have dense invasive patches of the equally invasive grass, *Megathyrsus maximus* (Guinea Grass), where water availability and suitable soils enable it to dominate the ground layer in the same manner as *Cenchrus ciliaris* (Buffel Grass) on adjoining landscapes (especially land zones 4, 5 and 8).

*Cenchrus ciliaris* (Buffel Grass) is by far the most extensive invasive weed. It, like other environmental weeds such as *Lantana camara* and *Megathyrsus maximus* (Guinea Grass) will be part of the Australian landscape until such times as they collapse with some pathogen or other devastating impact. Their loss under such circumstances will wreak ecological havoc across the entire Australian landscape. Their ability to displace the native flora will result in huge tracts of land being totally denuded should their population collapse in areas they have colonised and dominated. The landscape scale erosion and instability that will result will have no equal in the geological history of the Australian landscape. It is to be hoped that they persist, even if it means they have permanently displaced numerous native taxa and reduced their spatial extent.

None of the weeds require active management other than the current control practices implemented effectively across the region, as they do not pose any greater threat to native vegetation in the local area under current management practices than extant populations of these same weed taxa in surrounding nature conservation or agricultural production or mining areas. It is feasible to reduce populations of most weeds in the immediate vicinity of the mine infrastructure and in nearby disturbed areas to minimise further propagule dispersal from these managed areas into contiguous remnant bushland. It is considered that the collateral damage associated with known control mechanisms if implemented across all

patches of remnant vegetation would outweigh any benefits that may accrue from spray programs in such areas.

### **Conclusions and Recommendations**

Numerous patches of unmapped endangered remnant regional ecosystems were observed along the alignment. Rare waterfowl (Jabiru and Cotton Pygmy Geese) are known or were observed on or adjacent to the proposed alignment as are extensive areas of known and potential Ornamental Snake habitat. The identification of *Dichanthium queenslandicum* on the black soil plains in the north further highlights the need for re-assessment of the environmental impact of the proposed rail corridor.

It is considered that another referral is required to the Commonwealth Department of Environment and Heritage as is referral to the Queensland Department of Natural Resources and Mines and Environment Protection Agency. These referrals should not proceed until further review and survey of fauna habitats (particularly that of the Ornamental Snake) and more detailed locational surveys of *Dichanthium queenslandicum* and other potential rare and threatened flora habitats in the northern area are completed following reasonable rainfall events.

## References

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## Appendix A – List of Taxa Observed. \* - Introduced Taxa. (Incomplete)

<i>Abelmoschus ficulneus</i>	<i>Brachiaria decumbens</i> *
<i>Abutilon auritum</i>	<i>Brachyachne convergens</i>
<i>Abutilon oxycarpum</i>	<i>Brachyscome basaltica</i>
<i>Acacia bancroftii</i>	<i>Breynia oblongifolia</i>
<i>Acacia bidwillii</i>	<i>Brunoniella australis</i>
<i>Acacia crassa</i>	<i>Bryophyllum daigremontianum</i> x <i>delagoense</i> *
<i>Acacia excelsa</i>	<i>Bursaria incana</i>
<i>Acacia farnesiana</i> *	<i>Calyptochloa gracillima</i>
<i>Acacia harpophylla</i>	<i>Canthium buxifolium</i>
<i>Acacia holosericea</i> *	<i>Canthium odoratum</i>
<i>Acacia leiocalyx</i>	<i>Canthium oleifolium</i>
<i>Acacia macradenia</i>	<i>Capillipedium spicigerum</i>
<i>Acacia rhodoxylon</i>	<i>Capparis lasiantha</i>
<i>Acacia salicina</i>	<i>Capparis sarmentosa</i>
<i>Acacia shirleyi</i>	<i>Carex rhytidocarpa</i>
<i>Acacia stenophylla</i>	<i>Carissa ovata</i>
<i>Acalypha nemorum</i>	<i>Cassia brewsteri</i>
<i>Acanthospermum hispidum</i> *	<i>Cassytha pubescens</i>
<i>Achyranthes aspera</i>	<i>Casuarina cristata</i>
<i>Alectryon diversifolius</i>	<i>Casuarina cunninghamiana</i>
<i>Alectryon oleifolius</i>	<i>Cenchrus ciliaris</i> *
<i>Allocasuarina luehmannii</i>	<i>Chamaecrista nomame</i>
<i>Alloteropsis cimicina</i>	<i>Chamaecrista rotundifolia</i> *
<i>Alphitonia excelsa</i>	<i>Chamaesyce drummondii</i>
<i>Alstonia constricta</i>	<i>Cheilanthes distans</i>
<i>Alternanthera nodiflora</i>	<i>Cheilanthes sieberi</i>
<i>Amaranthus spinosus</i> *	<i>Chenopodium carinatum</i>
<i>Ammannia multiflora</i>	<i>Chionachne cyathopoda</i>
<i>Amyema pendulum</i>	<i>Chloris divaricata</i>
<i>Ancistrachne uncinulata</i>	<i>Chloris gayana</i> *
<i>Apophyllum anomalum</i>	<i>Chloris truncata</i>
<i>Archidendropsis basaltica</i>	<i>Chloris virgata</i> *
<i>Aristida benthamii</i>	<i>Chrysopogon fallax</i>
<i>Aristida calycina</i>	<i>Cissus opaca</i>
<i>Aristida caput-medusae</i>	<i>Citrullus lanatus</i> *
<i>Aristida jerichoensis</i>	<i>Cleistochloa rigida</i>
<i>Aristida latifolia</i>	<i>Cleistochloa subjuncea</i>
<i>Aristida leptopoda</i>	<i>Cleome viscosa</i>
<i>Aristida ramosa</i>	<i>Clerodendrum floribundum</i>
<i>Aster subulatus</i> *	<i>Clitoria ternatea</i> *
<i>Astrebla elymoides</i>	<i>Commelina ensifolia</i>
<i>Astrebla squarrosa</i>	<i>Convolvulus erubescens</i>
<i>Atalaya hemiglauca</i>	<i>Corchorus olitorius</i>
<i>Atriplex muelleri</i>	<i>Corymbia clarksoniana</i>
<i>Atriplex semibaccata</i>	<i>Corymbia dallachyana</i>
<i>Austrostipa ramosissima</i>	<i>Corymbia erythrophloia</i>
<i>Boerhavia dominii</i>	<i>Corymbia leichhardtii</i>
<i>Bothriochloa decipiens</i>	<i>Corymbia tessellaris</i>
<i>Bothriochloa ewartiana</i>	<i>Crinum flaccidum</i>
<i>Bothriochloa piligera</i>	<i>Crotalaria dissitiflora</i>



Appendix A cont'd.

<i>Crotalaria montana</i>	<i>Eriochloa pseudoacrotricha</i>
<i>Crotalaria pallida</i> *	<i>Erythroxylum australe</i>
<i>Cryptostegia grandiflora</i> *	<i>Eucalyptus brownii</i>
<i>Cucumis myriocarpus</i> *	<i>Eucalyptus camaldulensis</i>
<i>Cyclophyllum coprosmoides</i>	<i>Eucalyptus cambageana</i>
<i>Cymbopogon bombycinus</i>	<i>Eucalyptus crebra</i>
<i>Cymbopogon refractus</i>	<i>Cyanthillium cinereum</i>
<i>Cynodon dactylon</i>	<i>Eucalyptus exserta</i>
<i>Cyperus bifax</i>	<i>Eucalyptus melanophloia</i>
<i>Cyperus difformis</i>	<i>Eucalyptus platyphylla</i>
<i>Cyperus fulvus</i>	<i>Eucalyptus populnea</i>
<i>Cyperus haspan</i>	<i>Eucalyptus tereticornis</i>
<i>Cyperus lucidus</i>	<i>Eucalyptus thozetiana</i>
<i>Cyperus nutans</i>	<i>Eulalia aurea</i>
<i>Cyperus polystachyos</i>	<i>Eustrephus latifolius</i>
<i>Cyperus rotundus</i> *	<i>Everistia vacciniifolia</i>
<i>Dactyloctenium radulans</i>	<i>Evolvulus alsinoides</i>
<i>Datura stramonium</i> *	<i>Ficus opposita</i>
<i>Denhamia oleaster</i>	<i>Fimbristylis dichotoma</i>
<i>Desmodium campylocaulon</i>	<i>Flemingia parviflora</i>
<i>Dianella longifolia</i>	<i>Flindersia dissosperma</i>
<i>Dichanthium sericeum</i>	<i>Flueggea leucopyrus</i>
<i>Digitaria bicornis</i>	<i>Galactia tenuiflora</i>
<i>Digitaria breviglumis</i>	<i>Geijera parviflora</i>
<i>Digitaria brownii</i>	<i>Geijera salicifolia</i>
<i>Digitaria ciliaris</i> *	<i>Glycine tomentella</i>
<i>Digitaria divaricatissima</i>	<i>Gomphrena celosioides</i> *
<i>Diplocyclos palmatus</i>	<i>Grevillea parallela</i>
<i>Dodonaea filifolia</i>	<i>Grevillea striata</i>
<i>Dodonaea viscosa</i>	<i>Grewia latifolia</i>
<i>Echinochloa colona</i> *	<i>Grewia retusifolia</i>
<i>Eclipta prostrata</i> *	<i>Grewia scabrella</i>
<i>Enchylaena tomentosa</i>	<i>Hakea lorea</i>
<i>Enneapogon intermedius</i>	<i>Harrisia martinii</i> *
<i>Enneapogon lindleyanus</i>	<i>Heteropogon contortus</i>
<i>Enneapogon truncatus</i>	<i>Hibiscus meraukensis</i>
<i>Enteropogon acicularis</i>	<i>Hibiscus trionum</i>
<i>Epaltes australis</i>	<i>Hovea longipes</i>
<i>Eragrostis brownii</i>	<i>Hybanthus enneaspermus</i>
<i>Eragrostis elongata</i>	<i>Hybanthus stellarioides</i>
<i>Eragrostis leptostachya</i>	<i>Indigofera linifolia</i>
<i>Eragrostis parviflora</i>	<i>Indigofera linnaei</i>
<i>Eragrostis spartinoides</i>	<i>Indigofera suffruticosa</i> *
<i>Eremocitrus glauca</i>	<i>Ipomoea lonchophylla</i>
<i>Eremophila bignoniiflora</i>	<i>Iseilema membranaceum</i>
<i>Eremophila debilis</i>	<i>Jasminum simplicifolium</i>
<i>Eremophila mitchellii</i>	<i>Jatropha gossypifolia</i> *
<i>Eriachne mucronata</i>	<i>Juncus aridicola</i>
<i>Eriochloa crebra</i>	<i>Lantana camara</i> *
<i>Eriochloa procera</i>	<i>Lantana montevidensis</i> *

**Appendix A cont'd.**

<i>Larsenaikia ochreatea</i>	<i>Phyllanthus fuernrohrrii</i>
<i>Lavatera plebeia</i>	<i>Phyllanthus maderaspatensis</i>
<i>Leptochloa digitata</i>	<i>Phyllanthus virgatus</i>
<i>Leptochloa fusca</i>	<i>Pittosporum spinescens</i>
<i>Leucaena leucocephala</i> *	<i>Pleiogynium timorense</i>
<i>Lomandra leucocephala</i>	<i>Pogonolobus reticulatus</i>
<i>Ludwigia peploides</i> *	<i>Polycarpha corymbosa</i>
<i>Lysiphyllum carronii</i>	<i>Polymeria calycina</i>
<i>Lysiphyllum hookeri</i>	<i>Polymeria longifolia</i>
<i>Macroptilium atropurpureum</i> *	<i>Portulaca australis</i>
<i>Maireana microphylla</i>	<i>Portulaca oleracea</i>
<i>Malvastrum americanum</i> *	<i>Potamogeton tricarlinatus</i>
<i>Malvastrum coromandelianum</i> *	<i>Pouteria cotinifolia</i>
<i>Marsdenia brevis</i>	<i>Pouteria pohlmiana</i>
<i>Marsdenia viridiflora</i>	<i>Pseuderanthemum variabile</i>
<i>Maytenus cunninghamii</i>	<i>Rhynchosia minima</i>
<i>Megathyrsus maximus</i> *	<i>Ricinus communis</i> *
<i>Melaleuca bracteata</i>	<i>Rostellularia adscendens</i>
<i>Melaleuca leucadendra</i>	<i>Salsola kali</i>
<i>Melaleuca nervosa</i>	<i>Santalum lanceolatum</i>
<i>Melaleuca tamarascina</i>	<i>Sarcostemma viminale</i>
<i>Melhania oblongifolia</i>	<i>Schoenoplectus litoralis</i>
<i>Melinis repens</i> *	<i>Sclerolaena bicornis</i>
<i>Murdannia graminea</i>	<i>Sclerolaena muricata</i>
<i>Myoporum acuminatum</i>	<i>Sehima nervosum</i>
<i>Neptunia gracilis</i>	<i>Senna artemisioides</i>
<i>Nicotiana glauca</i> *	<i>Sesbania cannabina</i>
<i>Nyssanthes diffusa</i>	<i>Setaria sphacelata</i> *
<i>Opuntia stricta</i> *	<i>Setaria surgens</i>
<i>Opuntia tomentosa</i> *	<i>Sida cordifolia</i>
<i>Owenia acidula</i>	<i>Sida rhombifolia</i> *
<i>Oxalis debilis</i> *	<i>Sida rohlenae</i>
<i>Pandorea pandorana</i>	<i>Sida subspicata</i>
<i>Panicum buncei</i>	<i>Sida trichopoda</i>
<i>Panicum decompositum</i>	<i>Solanum ellipticum</i>
<i>Panicum laevinode</i>	<i>Solanum esuriale</i>
<i>Panicum maximum</i> *	<i>Sporobolus actinocladus</i>
<i>Panicum queenslandicum</i>	<i>Sporobolus caroli</i>
<i>Panicum subxerophilum</i>	<i>Sporobolus mitchellii</i>
<i>Parsonsia eucalyptophylla</i>	<i>Stellaria angustifolia</i> *
<i>Parsonsia paulforsteri</i>	<i>Stylosanthes humilis</i> *
<i>Parthenium hysterophorus</i> *	<i>Stylosanthes scabra</i> *
<i>Paspalidium constrictum</i>	<i>Terminalia oblongata</i>
<i>Paspalidium distans</i>	<i>Themeda avenacea</i>
<i>Paspalidium globoideum</i>	<i>Themeda triandra</i>
<i>Paspalidium jubiflorum</i>	<i>Thysanotus tuberosus</i>
<i>Passiflora suberosa</i> *	<i>Tinospora smilacina</i>
<i>Passiflora foetida</i> *	<i>Tragus australianus</i>
<i>Perotis rara</i>	<i>Trianthema portulacastrum</i> *
<i>Petalostigma pubescens</i>	<i>Trianthema triquetra</i>

**Appendix A cont'd.**

<i>Tricoryne elatior</i>	
<i>Tripogon loliiformis</i>	
<i>Typha domingensis</i>	
<i>Urochloa mosambicensis</i> *	
<i>Urochloa panicoides</i> *	
<i>Ventilago viminalis</i>	
<i>Xanthium occidentale</i> *	
<i>Xylomelum cunninghamianum</i>	
<i>Zaleya galericulata</i>	

## Appendix B: Regional Ecosystem Descriptions for the Study Area

11.3.1 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* (particularly in southern parts), with or without scattered emergent *Eucalyptus* trees such as *E. coolabah*, *E. largiflorens*, *E. populnea*, *E. orgadophila*, and *E. pilligaensis*. A low tree layer dominated by *Geijera parviflora* and *Eremophila mitchellii* is usually present. The vegetation sometimes occurs as low open-forest or woodland. Tree height generally about 11-15m and the low tree (to tall shrub) understorey layer is between 2 and 8m high. Ground cover is generally sparse. Associated with Cainozoic alluvial plains which may be occasionally flooded. Landforms range from level to very gently sloping plains, alluvial flats, drainage floors, back-swamps and abandoned channels. Associated soils are predominantly deep to very deep cracking clays, sometimes with gilgai or texture contrast soils with sandy surface (particularly where *Eucalyptus populnea* is present). Major vegetation communities include: 11.3.1a: *E. orgadophila* woodland on alluvium with basaltic influence. Occurs on alluvium with basaltic influence.
- Habitat for rare and threatened flora species including painted honeyeater *Grantiella picta* particularly in sub region 35 (Oliver *et al.* 2003).
- Extensively cleared for cropping and pasture. Sometimes occurs as low open forest or woodland. Invades adjacent eucalypt woodland e.g. *Eucalyptus populnea* woodland.

11.3.2 – Of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus populnea* woodland to open-woodland. *E. melanophloia* may be present and locally dominant. There is sometimes a distinct low tree layer dominated by species such as *Geijera parviflora*, *Eremophila mitchellii*, *Acacia salicina*, *Acacia pendula*, *Lysiphyllum* spp., *Cassia brewsteri*, *Callitris glaucophylla* and *Acacia excelsa*. The ground layer is grassy dominated by a range of species depending on soil and management conditions. Species include *Bothriochloa decipiens*, *Chloris acicularis*, *Aristida ramosa*, and *Tripogon loliiformis*. Occurs on Cainozoic alluvial plains with variable soil types including texture contrast, deep uniform clays, massive earths and sometimes cracking clays. Major vegetation communities include: 11.3.2a: *Eucalyptus conica* woodland.
- Habitat for rare and threatened flora species including *Homopholis belsonii*.
- Extensively cleared or modified by grazing. There are unmapped patches of low *Acacia harpophylla* (11.3.1) or grassland (11.3.21) are associated with this regional ecosystem in some areas.

11.3.10 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus brownii* grassy woodland. This unit usually occurs as a woodland of *Eucalyptus brownii*. There is usually a grassy groundlayer of *Aristida* spp., *Chloris* spp., *Fimbristylis dichotoma*, *Eriachne* spp., *Eragrostis* spp. And *Chrysopogon fallax*. Areas subject to less intensive grazing or on better soils contain *Heteropogon contortus*, *Bothriochloa bladhii* and *Chrysopogon fallax*. Occurs on Cainozoic alluvial plains.
- Understorey modified by total grazing pressure. In some areas extensively invaded by Indian Couch (*Bothriochloa pertusa*).

11.3.21 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Grassland dominated by *Dichanthium sericeum* and/or *Astrebla* spp. (*A. lappacea*, *A. elymoides* and *A. squarrosa*). A wide range of other grass and forb species are usually present and may dominant depending on seasonal conditions and management regime. Frequently occurring species include the grasses *Aristida leptopoda*, *A. latifolia*, *Bothriochloa bladhii* var. *bladhii*, *Brachyachne convergens*, *Heteropogon contortus*, *Panicum decompositum*, *Eriochloa* spp., *Sporobolus mitchellii* and *Thellungia advena* and the forbs *Abelmoschus ficulneus*, *Corchorus trilocularis*, *Commelina ensifolia*, *Euphorbia coghlanii*, *Ipomoea lonchophylla*, *Neptunia gracilis*, *Phyllanthus maderaspatensis*, *Sida spinosa*, *S. trichopoda* and *Trichodesma zeylanica* var. *latisepalum*. Scattered trees and shrubs may occur including *Eucalyptus coolabah*, *E. populnea*, *E. tereticornis* or *Acacia* spp. Occurs on Cainozoic alluvial plains that are near level (slope <1%), i.e. on flats associated with rivers and creeks, including back-plains, terraces, low levees and back-swamps. Associated soils are usually cracking clays that lack gilgai, are often self mulching, usually deep and range in colour from dark grey-brown to grey or black.
- Habitat for rare and threatened flora species including *Thesium australe*, *Picris evae*, *Stemmacantha australis*, *Dichanthium queenslandicum*, *Bothriochloa biloba* and *Digitaria porrecta* and fauna species including grassland earless dragon *Tympanocryptis pinguicollis*, five-clawed work skink *Anomalopus mackayi* and grey snake *Hemiaspis damelii*.
- Many of the larger areas (sub regions 30, 32, 36) have been extensively cultivated for cropping and pasture. Extensive areas are subject to invasion by *Parthenium hysterophorus* in northern parts of the bioregion and to a lesser extent the exotic grass *Cenchrus ciliaris* (Fensham 1999) particularly after periods of heavy grazing or drought. Presence of the dominant grass species varies with grazing and seasonal conditions. In the south-western part of its occurrence, the ground layer of grasses and forbs may be 0.5–1 m high, with a projected foliage cover of 10-40% (Neldner 1984). Grazing may adversely impact on fauna values particularly during periods of drought (Hobson 2002). In some areas e.g. Nebo Shire, this RE occurs within larger areas of RE 11.3.4 along broad alluvial plains that are also associated with adjacent or upstream basaltic or andesitic landscapes.

11.3.25 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus camaldulensis* or *E. tereticornis* open-forest to woodland. Other tree species such as *Casuarina cunninghamiana*, *E. coolabah*, *Melaleuca bracteata*, *Callistemon viminalis*, and *Angophora floribunda* are commonly present and may be locally dominant. An open to sparse, tall shrub layer is frequently present dominated by species including *Acacia salicina*, *A. stenophylla* or *Lysiphillum carronii*. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs such as *Imperata cylindrica* var. *major*, *Bothriochloa bladhii*, *B. ewartiana*, *Chrysopogon fallax*, *Cyperus dactylotes*, *C. difformis*, *C. exaltatus*, *C. gracilis*, *C. iria*, *C. rigidellus*, *C. victoriensis*, *Dichanthium sericeum*, *Leptochloa digitata*, *Lomandra longifolia* or *Panicum* spp. Occurs fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast soils. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003). Major vegetation communities include: 11.3.25a: *Eucalyptus raveretiana* (sometimes emergent), *Melaleuca fluviatilis* woodland. A range of other species may be present including *Melaleuca leucadendra*, *Corymbia clarksoniana*, *Casuarina cunninghamiana*, *Callistemon viminalis* and *Nauclea orientalis*. There is often a dense low tree layer dominated by species such as *Melaleuca viminalis*, *Acacia salicina*, *Geijera salicina*, *Diospyros humilis*, *Mallotus philippensis* and *Grewia asiatica*. 11.3.25b: *Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest. A range of other tree species also occur including *Pandanus tectorius*, *Livistona*, *Eucalyptus tereticornis*, *Corymbia tessellaris*, *Casuarina cunninghamiana*, *Livistona decipiens*, *Lophostemon suaveolens* or *L. grandiflorus* and rainforest species. A groundlayer of tall grasses such as *Chionachne cyathopoda*, *Mnesithea rottboellioides* or *Heteropogon triticeus* may be present. Often occurs on coarse sand spits and levees within larger river channels. 11.3.25c: *E. camaldulensis* or *E. tereticornis* open-forest to woodland. Occurs fringing drainage lines derived from Serpentineite. 11.3.25d: *Melaleuca bracteata* woodland to open-forest. Occurs on fringing alluvial soils or near-channel levees on heavy wet clays. 11.3.25e: *Eucalyptus camaldulensis*, *E. tereticornis* woodland fringing larger, permanent water courses. A range of other tree species commonly occur including *Melaleuca trichostachya*, *Casuarina cunninghamiana*, and *Callistemon viminalis*. Ground layer is composed of grasses and forbs. Occurs fringing permanent water courses. 11.3.25f: River channels. Includes open water in channels, water holes and lagoons and exposed stream bed and bars. Usually devoid of emergent vegetation although scattered trees and shrubs such as *Callistemon viminalis* or *Melaleuca* spp. may be present and aquatic species may be abundant particularly in water holes and lagoons. River channels. 11.3.25g: Vegetation is seasonal and may consist of open water and/or a range of mainly aquatic species such as *Nymphoides crenata*, *Chara* sp, *Nitella* sp, or *Hydrilla verticillata*. Often with fringing woodland, commonly *E. camaldulensis* or *E. coolabah* and a ground layer that may include species such as *Pseudoraphis spinescens*, *Marsilea drummondii*, *M. mutica*, *Persicaria subsessilis* and *Eleocharis* spp. Waterholes in larger drainage lines
- Habitat for rare and threatened flora species including *Eucalyptus raveretiana*. Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the rare and threatened freshwater turtle *Rheodytes leukops*.
- Impact by total grazing pressure. Weeds particularly rubber vine *Cryptostegia grandiflora* (in the north of the bioregion) and buffel grass *Cenchrus ciliaris* have invaded many areas. Some areas have been modified by weir construction (Eberhard 1999). Often associated with regional ecosystems 11.3.2 and 11.3.4 which may occur on adjacent alluvial plains. In highly cleared sub regions a narrow fringe of riparian vegetation is often the only surviving woody vegetation. This regional ecosystem includes sandy or rocky banks and beds and water within channel which can be extensive in some of the larger coastal rivers. 11.3.25a: As the low tree layer becomes denser, this vegetation community grades into 11.3.11. 11.3.25b: Weeds particularly rubber vine *Cryptostegia grandiflora* (in the north of the bioregion) and buffel grass *Cenchrus ciliaris* have invaded many areas. Very frequently disturbed by natural flood events. 11.3.25g: Larger waterholes (> 5ha) are included here while smaller ones are included with river channels (11.3.25f).

11.4.3 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata*. *Acacia harpophylla* (10-16m high) predominates forming a fairly continuous canopy with varying densities of *Casuarina cristata* (14-18m high), forming part of the canopy or emerging above it. *Casuarina cristata* may be dominant or form pure stands particularly in the south of the bioregion (subregions 33, 36). *Eucalyptus* spp. such as *E. orgadophila*, *E. populnea*, *E. microcarpa*, *Eucalyptus pilligaensis*, *E. cambageana* and *E. thozetiana* (on shallower soils and upper slopes) may be scattered through the canopy or occur as emergents up to 22m high. *Brachychiton rupestris* may also be present in places. An open to dense, tall shrub layer is present, and is dominated by *Eremophila mitchellii* and/or *Geijera parviflora*. Low shrubs are often present, occasionally forming a distinct layer dominated by species such as *Carissa ovata* and *Alectryon diversifolius*. Tree/shrub height may range from 3-8 m. *Melaleuca bracteata* may be present in low-lying areas. The ground layer is sparse to open, and composed of grasses and forbs. Common grasses include *Ancistrachne uncinulata*, *Aristida armata*, *A. leptopoda*, *A. ramosa*, *Chloris ventricosa*, *Digitaria brownii*, *Enneapogon polyphyllus*, *Enteropogon acicularis*, *Eriochloa pseudoacrotricha*, *Leptochloa ciliata*, *Panicum decompositum* *Paspalidium caespitosum*, *P. constrictum*, *P. criniforme*, *P. gracile*, *P. radiatum*, *Sporobolus actinocladus* and *S. caroli*. Common species of forbs include *Abutilon oxycarpum*, *Atriplex muelleri*, *A. semibaccata*, *Brunoniella australis*, *Cheilanthes sieberi*, *Einadia nutans*, *Justicia procumbens*, *Malvastrum americanum*, *Rhagodia spinescens*, *Sclerolaena birchii*, *S. calcarata*, *S. diacantha*, *S. tetracuspis*, *Sida cunninghamii*, *Trianthema triquetra* and *Zygophyllum apiculatum*. Occurs on Cainozoic clay plains with cracking clay soils which are often gilgaied. The plains may be flat to gently undulating. Soils are often cracking clay which are usually deep to very deep, often self mulching, and sometimes with surface stone. Texture contrast soils and other clays may also be present in places. Major vegetation communities include: 11.4.3a: *Melaleuca bracteata* woodland associated with *Acacia harpophylla* communities. May include scattered occurrences of other tree species such as *Eucalyptus tereticornis*, *E. populnea*, *Acacia harpophylla* and *Casuarina cristata*. There may be an understorey of *Damasonium minus*, *Typha orientalis*, *Cyperus* spp., and other wetland plants associated with ephemeral wetlands. Associated with heavy dark clay soils with very broad and deep gilgai which is seasonally ponded and remain wet for long periods. 11.4.3b: *Eucalyptus argophloia*, *Acacia harpophylla* open-forest. Associated trees may include *Casuarina cristata*, *Eucalyptus populnea* or *Eucalyptus microcarpa*, with a shrub layer of *Geijera parviflora*. 11.4.3c: *Acacia omalophylla* low open-forest ± *A. harpophylla*.
- Specific habitat for rare and threatened flora species including *Eucalyptus argophloia* and *Xerothamnella herbacea*. 11.4.3a: Provides important wetland habitat.
- Extensively cleared for cropping and pasture. Areas of this regional ecosystem that occur on texture contrast and/or sodic soils often have lower (12 metres) canopy and sparse to absent mid layer. 11.4.3a: Occurs at Bellevue swamp and other scattered locations within a much larger area of *Acacia harpophylla* +/- *Casuarina cristata* (RE 11.4.3). 11.4.3b: This vegetation type has been almost completely cleared, and exists primarily as regrowth or isolated paddock trees of *Eucalyptus argophloia*.

11.4.8 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Woodland to open-forest dominated by *Eucalyptus cambageana* and *Acacia harpophylla* or, sometimes in the north, *A. argyrodendron*. *E. thozetiana* is sometimes present on shallower soils. There is a moderately dense low tree layer (5m high) layer dominated by species such as *Eremophila mitchellii* and a low shrub layer (2m high) dominated by species such as *Carissa ovata* and *Geijera parviflora*. Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoil's. Surface or subsurface gravel is common.
- Extensively cleared for pasture.

11.4.9 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Open-forest, occasionally woodland, dominated by *Acacia harpophylla* usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii*. *Casuarina cristata* sometimes replaces *Acacia harpophylla* in the overstorey and *Lysiphyllum cunninghamii* sometimes co-dominates. Other low tree or shrub species such as *Alectryon diversifolius*, *Carissa ovata*, *Pittosporum spinescens*, *Ehretia membranifolia*, *Geijera parviflora* and *Flindersia dissosperma* may occur in the mid-storey or low shrub layer. *Acacia harpophylla* trees have been recorded as 11- 17m high, the mid-storey layer 2- 8m high and the low shrub layer 1-2m high. Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas. Major vegetation communities include: 11.4.9a: *Acacia harpophylla*, *Lysiphyllum carronii* ± *Casuarina cristata* open-forest to woodland.
- Examples of this RE with seasonally ponded gilgai may contain the rare and threatened plant *Aponogeton queenslandicus*.
- Extensively cleared for cropping and pasture. The presence of *Terminalia oblongata* often distinguishes this regional ecosystem from *Acacia harpophylla* on clay plains in southern Queensland (11.4.3)

11.5.2 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus crebra* ± *Corymbia clarksoniana* ± *C. citriodora* ± *E. moluccana* woodland. Sparse ground layer and sparse to mid-dense shrub/low tree layer. On duplex soils, *Allocasuarina luehmannii* low tree layer is often present and can be the dominant layer in some areas. Other canopy or sub-canopy trees that may be present include *Lysicarpus angustifolius*, *Acacia rhodoxylon*, *Eucalyptus exserta*, *E. tenuipes* and *Corymbia tessellaris*. Occurs on Cainozoic sand plains which are often below hills and ranges. Major vegetation communities include: 11.5.2a: *Allocasuarina luehmannii* low tree layer with or without emergent woodland.
- Extensively cleared for pasture or modified by total grazing pressure.

11.5.3 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* ± *C. dallachiana* and occasionally *E. cambageana* dominate the tree layer (14m median height and 11-15m range) woodland. Localised areas may be dominated by *E. melanophloia*, occasionally *E. crebra* and other canopy species. There is generally a low tree layer (8, 6-11m high) dominated by species such as *Eremophila mitchellii*, *Geijera parviflora*, *Archidendropsis basaltica*, *Erythroxylum australe*, *Cassia brewsteri*, *Ventilago viminalis* and occasionally *Allocasuarina luehmannii* or *Callitris glaucophylla*. A low shrub layer (2-6m high) dominated by species such as *Carissa ovata*, *Erythroxylum australe*, *Capparis lasiantha* is also often present. Occurs on flat to gently undulating plains formed from Cainozoic sediments. Associated soils are generally deep texture contrast with thick sandy surface horizons with some deep red earths. Major vegetation communities include: 11.5.3a: *Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* ± *C. dallachiana* and occasionally *E. cambageana* dominate the tree layer (14m median height and 11-15m range) woodland. Localised areas may be dominated by *E. melanophloia* and occasionally *E. crebra*. There is generally a low tree layer (8, 6-11m high) dominated by species such as *Eremophila mitchellii*, *Geijera parviflora*, *Archidendropsis basaltica*, *Erythroxylum australe*, *Ventilago viminalis* and occasionally *Allocasuarina luehmannii* or *Callitris glaucophylla*. A low shrub layer (2-6m high) dominated by species such as *Carissa ovata*, *Erythroxylum australe*, *Capparis lasiantha* is also often present. Major vegetation communities include: 11.5.3a: *Eucalyptus populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* ± *C. dallachiana* and occasionally *E. cambageana* dominate the tree layer (14m median height and 11-15m range) woodland. Localised areas may be dominated by *E. melanophloia* and occasionally *E. crebra*. There is generally a low tree layer (8, 6-11m high) dominated by species such as *Eremophila mitchellii*, *Geijera parviflora*, *Archidendropsis basaltica*, *Erythroxylum australe*, *Ventilago viminalis* and occasionally *Allocasuarina luehmannii* or *Callitris glaucophylla*. A low shrub layer (2-6m high) dominated by species such as *Carissa ovata*, *Erythroxylum australe*, *Capparis lasiantha* is also often present.
- Extensively cleared for pasture or modified by total grazing pressure.



11.5.9 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus crebra* and/or *Eucalyptus melanophloia* woodland. Other tree species that may be present and locally dominant include *Corymbia citriodora* or *C. clarksoniana* sometimes in association with *C. intermedia*, *C. dallachiana*, *C. lamprophylla*, *E. tenuipes*, *E. exserta*, *E. cloeziana*, *E. acmenoides*. The mid layer ranges from absent to a sparse to dense shrubland typically dominated by *Acacia* spp. (such as *A. excelsa*, *A. leiocalyx*), *Petalostigma pubescens*, *Lysicarpus angustifolius*, *Alphitonia excelsa* and occasionally *Melaleuca nervosa* (on texture contrast soils). Occurs on plateaus and broad crests of hills and ranges which are formed by Cainozoic sand plains. Soils are generally deep red earths. Major vegetation communities include: 11.5.9a: *E. melanophloia* woodland. 11.5.9b: *E. crebra*, *E. tenuipes*, *Lysicarpus angustifolius* + *Corymbia* spp woodland. 11.5.9c: *Eucalyptus crebra* + *Corymbia intermedia* + *E. moluccana* + *C. dallachiana* woodland. 11.5.9d: *C. citriodora* and/or *E. crebra* woodland.
- Variation in structure and floristic composition of the understory may be associated with fire history. *Eucalyptus moluccana* is sometimes locally common especially on lower slopes where it merges into regional ecosystem 11.5.2. *Acacia shirleyi* may be present on rises where it merges into regional ecosystem 11.7.2.

11.5.16 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Acacia harpophylla* and/or *Casuarina cristata* open-forest. Occurs in depressions on Cainozoic sand plains. Major vegetation communities include: 11.5.16a: *Acacia harpophylla* open forest with softwood scrub species. Occurs on sandy loam outwash (apron / piedmont slope) from sandstone ranges, on Wheetalaba.
- Occurs as small patches in depressions, possibly of alluvial origin (land zone 3) across intact Tertiary surfaces.

11.7.1 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus thozetiana* predominates forming a distinct but discontinuous canopy (13-21m high). Occasionally scattered *E. microcarpa* or *Casuarina cristata* or *A. harpophylla* and sometimes *E. cambageana* (12-13m emergents) are present in the canopy. On the deeper soils of the lower slopes, there is a moderately dense low tree layer of *C. cristata* and/or *Acacia harpophylla*. *Acacia catenulata* and *A. microsperma* may be present towards crests. *Cadellia pentastylis* is sometimes present and may be locally dominant. A tall shrub layer of *Geijera parviflora* and less frequently, *Eremophila mitchellii* is usually developed, and a low shrub layer is often developed. The ground layer is sparse and usually dominated by forbs. Occurs on the slopes and scarps of rocky residual ranges with Cainozoic lateritic duricrust. The soils are shallow, gravelly, acidic loams and clays on the upper slopes, with deep (70-105 cm deep), uniform, brown clays with surface gravel on the lower slopes. Major vegetation communities include: 11.7.1x1: Semi-evergreen vine thicket. The following species are commonly present in the tree layer: *Flindersia australis*, *Flindersia collina*, *Alstonia constricta*, *Excoecaria dallachiana*, *Geijera parviflora*, *Notelaea* spp., *Pouteria cotinifolia* var. *pubescens*, *Diospyros humilis* and *Denhamia oleaster*, with emergent *Brachychiton rupestris* or *Flindersia australis*. A dense shrub layer of *Canthium odoratum* and *Acalypha eremorum* is often present. May contain emergent *Eucalyptus decorticans* or *Eucalyptus melanoleuca* in some southern locations.
- Habitat for rare and threatened flora species including *Cadellia pentastylis*.
- Lower slopes of this regional ecosystem, which are a natural saline discharge area, have often been heavily cleared. Upper slopes often merge into *Acacia catenulata* dominated regional ecosystems (11.7.2) while lower slopes may merge into *Acacia harpophylla* dominated regional ecosystems (11.9.1 or 11.9.5).

11.7.2 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Monospecific stands of *Acacia* forest/woodland on Cainozoic lateritic duricrusts. *Acacia shirleyi* and/or *Acacia catenulata* usually predominate the woodland to low woodland to low open-forest tree canopy (7-12m high). Other *Acacia* species that commonly occur and occasionally dominate the tree layer include *A. rhodoxylon*, *A. burrowii*, *A. sparsiflora*, *A. crassa* and *A. blakei*. Emergent eucalypt species such as *Eucalyptus thozetiana*, *E. crebra*, *E. decorticans* and *E. exserta* may be present. A low shrub layer is sometimes present and dominated by species such as *Acalypha eremorum*, *Croton phebalioides* and *Carissa ovata*. The ground layer is extremely sparse and dominated by grasses such as *Aristida caput-medusae*, *Paspalidium rarum*, *Brachiaria foliosa*. Forbs are usually rare although *Sida filiformis* may be conspicuous. Occurs on scarps and adjacent tops and slopes of dissected tablelands, mesas and buttes formed from chemically altered sediments and duricrusts. The soils are shallow to very shallow lithosols with surface stone and boulders. The vegetation is often growing in pockets of shallow lithosol soil between bare rock.
- Habitat for rare and threatened flora species including *Acacia wardellii*.
- Have been subject to clearing. This regional ecosystem may include adjacent areas which extend onto adjacent plateaus and plains with deeper soils (land zone 5).

11.8.5 – Not Of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus orgadophila* grassy open-woodland. *Eucalyptus orgadophila* predominates and forms a distinct but discontinuous canopy sometimes with other sub-dominant species such as *Corymbia erythrophloia*, *E. melanophloia* and occasionally *E. crebra*. Shrubs are usually scarce and scattered although a well defined shrubby layer does develop in some areas. On the lower slopes at better sites, softwood scrub species may form tall and low shrub layers under the canopy of *Eucalyptus orgadophila*. The ground layer is moderately dense to dense, and dominated by species that include the grasses *Aristida lazaridis*, *A. ramosa*, *Bothriochloa ewartiana*, *Dichanthium sericeum*, *Chrysopogon fallax*, *Heteropogon contortus*, *Enneapogon gracilis*, *Themeda triandra* and *Tragus australiensis* and the herbs *Brunoniella australis*, *Evolvulus alsinoides*, *Sida spinosa*, *Galactia tenuiflora* and *Indigofera linnaei*. Occurs on undulating plains, rises, low hills or sometimes flat tablelands on top of mountains, formed from basalt. Generally soils are shallow to moderately shallow, often rocky or stony clays. Major vegetation communities include: 11.8.5a: *Eucalyptus orgadophila* woodland with a dense understorey of low trees species including *Geijera parviflora*, *Callitris glaucophylla*, *Pittosporum angustifolium*, *Alectryon oleifolium*, *Canthium buxifolium* and *Notelaea microcarpa*.
- In southern part of bioregion, habitat for a number of rare and threatened flora species including *Bothriochloa biloba*, *Digitaria porrecta*, *Discaria pubescens*, *Indigofera baileyi*, *Picris evae*, *Stemmacantha australis* and *Thesium australe*.
- Extensively thinned, cleared or cultivated in many areas. Some areas in central Queensland are subject to invasion by *Parthenium hysterophorus* (Fensham 1999) associated with periods of low summer rainfall combined with high or moderate grazing pressure (Fensham *et al.* 1999). The occurrence of *Parthenium* may be reversible with appropriate management and season in the medium term (Fensham 1999). Areas of open-woodland to grassland that occur on foot slopes of basalt hills are included as 11.8.5 in situations where they represent a narrow (< 75m wide) ecotone adjacent to the alluvial land zone.

11.8.11 – Of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Grassland dominated by *Dichanthium sericeum*, *Aristida* spp., *Astrebla* spp. And *Panicum decompositum* with or without trees such as *Eucalyptus orgadophila*, *E. melanophloia*, *Corymbia erythrophloia* and *Acacia salicina*, (height 11±3 m). However, dominance and cover may vary with seasonal and other environmental conditions. Frequently occurring and sometimes locally dominant, species include the grasses *Aristida lazaridis*, *A. ramosa*, *Bothriochloa ewartiana*, *Dichanthium sericeum*, *Chrysopogon fallax*, *Heteropogon contortus*, *Enneapogon gracilis*, *Themeda triandra* and *Tragus australiensis* and the herbs *Brunoniella australis*, *Evolvulus alsinoides*, *Sida spinosa*, *Galactia tenuiflora* and *Indigofera linnaei*. Isolated emergent trees (tree height 12±4 m – species including *Eucalyptus orgadophila*, *E. melanophloia* and *Corymbia erythrophloia*) or small areas of open-woodland may also be present. Occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2–6%), although in places is occasionally present on lower slopes and flat areas (slopes 0–2%). Associated soils are moderately shallow to deep cracking clay soils, dark brown to reddish brown in colour, often self mulching, and with gravel, stone or linear gilgai sometimes present. Surface stone 10–15 cm diameter is present in the south-western remnants. Major vegetation communities include: 11.8.11a: *Melaleuca bracteata* woodland drainage depressions. Occurs in drainage depressions.
- Habitat for rare and threatened flora species including *Dichanthium queenslandicum* and *Trioncinia retroflexa* which is currently known from three small populations.
- Extensively utilised for cropping, and rapid decline is predicted on current trends. Large areas remaining have lost perennial grass cover which may be replaced by annuals including the exotic herb *Parthenium hysterophorus*. These changes may be associated with periods of low summer rainfall combined with high or moderate grazing pressure (Fensham et al. 1999). The occurrence of *Parthenium* may be reversible with appropriate management and season in the medium term (Fensham 1999). Species such as *Dichanthium sericeum* and *D. queenslandicum* are likely to have been more dominant in the absence of high or moderate grazing pressure (Fensham 1999). At the end of the wet season, the biomass of the vegetation may range from 5 to 10 t/ha, but may be negligible after the wet season under extreme grazing pressure (Fensham et al. 2002). Areas of woodland large enough to map (> 5 ha) are mapped as 11.8.5, while less extensive areas are treated as a component of 11.8.11

11.9.1 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Open-forest to woodland of *Eucalyptus cambageana* or *E. thozetiana* and *Acacia harpophylla*. *Eucalyptus cambageana* is commonly co dominant with *Acacia harpophylla* in the open-forest, or the open-forest may be dominated by *A. harpophylla* and have scattered emergent *Eucalyptus cambageana* or *E. thozetiana* trees. The *A. harpophylla* trees range from about 12m to 14m in height and the eucalypts 15-18m high. In central western areas the *Acacia harpophylla* may form tall shrubland c. 4m high with emergent *Eucalyptus cambageana* trees 10-12m high. The community has a moderately dense to dense lower tree/tall shrub layer dominated by *Eremophila mitchellii*, *Carissa ovata* and *Geijera parviflora*, with *Terminalia oblongata* often present in the north. The ground layer is frequently sparse. Associated with slopes and crests of undulating plains and below low ridges and escarpments formed from Cainozoic to Proterozoic consolidated, fine-grained sediments. Texture contrast soils predominate, often with surface stone or gravel in sub-surface horizons, but other soils such as clays, sandy clay loams and cracking clays may also be present.
- Extensively cleared for cropping and pasture.

11.9.4 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Semi-evergreen vine thicket or *Acacia harpophylla* with a semi-evergreen vine thicket understorey. Occurs on crests, mid-slopes, undulating plains and rises formed from Cainozoic to Proterozoic consolidated, fine-grained sediments. Major vegetation communities include: 11.9.4a: Semi-evergreen vine thicket, generally dominated by a low tree layer (5-10m high) which is floristically diverse and variable. Common co dominant species include *Croton insularis*, *Denhamia oleaster*. There is also a tall and low shrub layer (2-6m high) dominated by species such as *Ehretia membranifolia*, *Apophyllum anomalum*, *Geijera parviflora*, *Capparis* spp., *Croton phebaloides*, *Erythroxylum australe*, *Alectryon diversifolius* and *Carissa ovata*. Emergents (16-25m high) are usually present including species such as *Cadellia pentastylis* and *Brachychiton* spp. usually on better sites, and *Eucalyptus orgadophila* and *Casuarina cristata* on drier, poorer sites. Vines are frequent. The ground layer is very sparse, and is most frequently composed of *Ancistrachne uncinulata* and *Eragrostis megalosperma*. Occurs on steep upper and middle slopes where heavy clay soils have formed from sediments. It may grade into *Acacia harpophylla*, softwood spp. (11.9.4) on the lower slopes. It is prominent on the steep slopes of sandstone ranges, where shale has been exposed, and aspect, rainfall and runoff provide sufficient available water for its development. The soils are generally shallow, brown or grey-brown loams or light clays grading into medium or heavy clays. The soil reaction may become strongly acidic or alkaline at depth, depending on the acidity of parent material. May also occur on deep texture contrast soils, where a thin sandy colluvium overlies the clay subsoil. Loose fragments of sandstone may be present over the soil surface. 11.9.4b: *Acacia harpophylla* predominates and forms a fairly continuous canopy (10-18m high). Other tree species such as *Eucalyptus populnea*, *Casuarina cristata*, *Cadellia pentastylis* and *Brachychiton* spp. may also be present in some areas and form part of the canopy or emerge above it. Scattered *Eucalyptus orgadophila* may occur, especially on upper slopes and crests. A dense tall shrub layer dominated by a range of species is usually present, while a more open low shrub layer often occurs. Common species in these layers include *Croton insularis*, *Denhamia oleaster*, *Apophyllum anomalous*, *Croton phebaloides*, *Alectryon diversifolium* and *Carissa ovata*. The ground layer is sparse, most frequently composed of *Ancistrachne uncinulata* and *Eragrostis megalosperma* and varies with the density of the shrub layers. Occurs on undulating plains and rises formed mainly on shale's. The soils are predominantly cracking clay soils, which are strongly alkaline at or near the surface and acidic beneath, or dark brown and grey-brown gradational soils, with a coarse-textured surface grading into an alkaline, clayey subsoil. 11.9.4c: Semi-evergreen vine thicket with emergent *Eucalyptus crebra* on hill sides. *E. crebra* may occur as an open woodland in same areas. Common species include *Notelaea microcarpa*, *Geijera salicifolia*, *Bursaria spinosa* and *Pandorea pandorana*. Occurs on hillsides in the Warwick area.
- Habitat for rare and threatened flora species including *Cadellia pentastylis*.
- Extensively cleared for cropping and pasture. Distinguished from RE 11.9.8 by absence of *Macropteranthes leichhardtii*. 11.9.4b is distinguished from 11.9.5 by dense softwood scrub understorey. In places the vine thicket is associated with areas that have been subject to basalt enrichment.

11.9.5 – Endangered under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- Open-forest dominated by *Acacia harpophylla* and/or *Casuarina cristata*. Open-forest dominated by *C. cristata* is more common in southern parts of the bioregion. A prominent low tree or tall shrub layer dominated by species such as *Geijera parviflora* and *Eremophila mitchellii*, and often with semi-evergreen vine thicket species is often present. The latter include *Flindersia dissosperma*, *Brachychiton rupestris*, *Excoecaria dallachyana*, *Macropteranthes leichhardtii* and *Acalypha eremorum* in eastern areas, and species such as *Carissa ovata*, *Owenia acidula*, *Croton insularis*, *Denhamia oleaster* and *Notelaea microcarpa* in south-western areas. *Melaleuca bracteata* may be present along watercourses. Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments. The topography includes gently undulating plains, valley floors and undulating foot slopes and rarely on low hills. The soils are generally deep texture-contrast and cracking clays. The cracking clays are usually black or grey to brown or reddish-brown in colour, often self mulching and sometimes gilgaid in flatter areas. Some texture contrast soils are shallow to only moderately deep.
- Extensively cleared for cropping and pasture.

11.9.9 – Not of Concern under the *Vegetation Management Act 1999* (REDD, Version 4.2, 2005).

- *Eucalyptus crebra* grassy woodland. *Eucalyptus moluccana* sometimes conspicuous on lower slopes. Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments. Major vegetation communities include: 11.9.9a: *Eucalyptus albens* ± *E. crebra* ± *E. tereticornis* ± *Callitris baileyi* woodland. Occurs in southern part of bioregion. 11.9.9b: *Eucalyptus crebra* ± *E. exserta* ± *Corymbia* spp woodland.
- Extensively cleared or thinned for pasture.