

## 17. TERRESTRIAL ECOLOGY

This chapter provides a summary of the environmental values of the terrestrial ecology within the project development area and an assessment of the potential for these values to be affected by direct and indirect impacts associated with the construction, operations and decommissioning phases of the project.

A detailed assessment of the potential impacts on the terrestrial ecology environmental values in the project development area is provided in Appendix K, Terrestrial Ecology Impact Assessment. Environmental protection objectives have been developed, and the mitigation and management measures to achieve these objectives have been identified. The residual impact assessment assumes that the proposed mitigation and management measures have been applied.

The assessment of aquatic flora and fauna associated with watercourses and waterbodies within the project development area is provided in Chapter 16, Aquatic Ecology. Any matters of national environmental significance identified through the terrestrial ecology impact assessment have also been presented in Attachment 3, Matters of National Environmental Significance.

### 17.1 Legislative Context

The following legislation and policy, guideline and guidance documents are relevant to identifying values and to provide guidance for avoidance, mitigation and management measures.

***Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act)***. This Commonwealth act provides for the protection of matters of national environmental significance, including listed threatened terrestrial species and communities and listed migratory species. Threatened flora and fauna species are listed as 'extinct', 'extinct in the wild', 'critically endangered', 'vulnerable' or 'conservation dependent'. Threatened communities are listed as 'critically endangered', 'endangered' or 'vulnerable'.

***Environmental Protection Act 1994 (Qld) (EP Act)***. The main objective of this act is to protect the Queensland environment by promoting ecologically sustainable development. The Environmental Protection Regulation 2008 provides a mechanism to enforce the EP Act and allows for an assessment of the risk that an environmentally relevant activity poses to environmentally sensitive areas (ESAs). The classification of Category A, Category B and Category C ESAs is based on a ranking of environmental sensitivity:

- **Category A ESAs.** Regarded as being of extremely high ecological sensitivity relevant to their terrestrial ecology values, Category A environmentally sensitive areas include the following:
  - All areas designated as national park under the *Nature Conservation Act 1992 (QLD)*.
  - Conservation parks.
  - Forest reserves.
  - Wet Tropics World Heritage areas.
- **Category B ESAs.** Category B ESAs relevant to natural terrestrial ecology values include the following:
  - Areas designated under the Nature Conservation Act as coordinated conservation areas, wilderness areas, world heritage management areas, areas of critical habitat under a conservation plan or areas subject to interim conservation orders.

- Areas designated under conventions to which Australia is signatory, including the Ramsar Convention, Convention on the Conservation of Migratory Species of Wild Animals and the Convention on Wetlands of International Importance.
- Feature protection areas
- Regional ecosystems scheduled as ‘endangered’ (biodiversity status) by the Queensland Department of Environment and Resource Management (DERM).
- **Category C ESAs.** Category C ESAs are not listed under the schedules of the Environmental Protection Regulation although they are provided in the Draft Code of Environmental Compliance for Level 2 Petroleum Activities (EPA, 2008) forming part of the environmental compliance and conditioning framework. Category C ESAs include state forests and regional ecosystems with an ‘of-concern’ biodiversity status.

Authority for level 1 petroleum activities with the potential to impact Category A or Category B ESAs may be granted in association with an approved environmental management plan or an approved environmental impact statement (EIS).

**Nature Conservation Act 1992 (QLD).** This act contains a number of associated regulations and plans intended to protect native wildlife, including individual species of plants and animals, as well as habitats and ecosystems. The Nature Conservation (Wildlife) Regulation 2006 provides species lists for the defined seven classes of wildlife, five of which are used to classify native plant and animal species (‘extinct in the wild’, ‘endangered’, ‘vulnerable’, ‘near threatened’, and ‘least concern’). The Nature Conservation (Protected Plants) Conservation Plan 2000 also relates to this act; and it outlines how clearing permits, licenses and exemptions can be issued to take native plants that are protected. This plan will be considered for vegetation clearance activities.

**Vegetation Management Act 1999 (Qld).** This act is the planning initiative underlying regional management of vegetation in Queensland, including clearing of vegetation types, termed regional ecosystems. The regional ecosystem classification is a hierarchical system formed by a three-part code with the primary subdivision being bioregion, followed by land zone, and then vegetation type. The biogeographic region, or bioregion, is the primary level of classification for biodiversity values in Queensland, describing where the regional ecosystem is found on a statewide basis. Land zones are geological and geomorphic categories that describe the major geologies and landforms of Queensland. The land-form system is based primarily on geology, with geologic age considered an important determinant. The status of regional ecosystems is based on their preclearing and remnant extent under the act and is assigned a Vegetation Management Class (VM class).

The act aims to conserve remnant ‘endangered’ and ‘of concern’ regional ecosystems, prevent land degradation and further loss of biodiversity, manage the environmental impacts of clearing vegetation and reduce greenhouse emissions. Petroleum activities under the *Petroleum and Gas (Production and Safety) Act 2004* (Qld) are exempt from the requirement to obtain approval to clear native vegetation under the Vegetation Management Act. The VM class of a regional ecosystem is described in line with the following:

- **‘Endangered’.** A regional ecosystem that is prescribed under the regulation and has either of the following attributes:
  - Less than 10% of its preclearing extent remaining.

- From 10% to 30% of its preclearing extent remaining and the extent remaining is less than 10,000 ha.
- **‘Of concern’**. A regional ecosystem that is prescribed under the regulation and has either of the following attributes:
  - From 10% to 30% of its preclearing extent remaining.
  - More than 30% of its preclearing extent remaining and the extent remaining is less than 10,000 ha.
- **‘Least concern’**. A regional ecosystem that is prescribed under a regulation and has the following attributes:
  - More than 30% of its preclearing extent remaining; and
  - The extent remaining is more than 10,000 ha.

The biodiversity status of a regional ecosystem is based on the VM class with an additional assessment of the condition of the remnant vegetation.

- **‘Endangered’**. A regional ecosystem is classified as ‘endangered’ if, in addition to the VM Class criteria for ‘endangered’, it fulfils one of the following three criteria:
  - Less than 10% of the pre-clearing extent remains unaffected by severe degradation or biodiversity loss;
  - 10 to 30% of the pre-clearing extent remains unaffected by severe degradation or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
  - It is a rare ecosystem subject to a threatening process
- **‘Of concern’**. A regional ecosystem is classified as ‘of concern’ if, in addition to the VM Class criteria for ‘of concern’, 10 to 30% of its pre-clearing extent remains unaffected by moderate degradation or biodiversity loss.
- **‘No concern at present’**. A regional ecosystem is classified as ‘no concern at present’ if it includes ecosystems that meet the VM class criteria for ‘least concern’, and the degradation criteria listed above for ‘endangered’ or ‘of concern’ regional ecosystems are not met.

DERM maintains the ‘Regional Ecosystem Description Database’ (REDD) which includes both the VM Class and biodiversity status of regional ecosystems.

The Vegetation Management Act also has provision for the regulation of essential habitat for species of state significance. Essential habitat (mapped by DERM) is vegetation in which a listed species has been known to occur. Clearing or disturbance to areas of essential habitat will require compensatory habitat measures e.g., habitat offsets to be developed. For the project development area, the term ‘core habitat’ has been used to describe the combination of critical or essential habitat for both national and state-listed significant species.

***Land Protection (Pest and Stock Route Management) Act 2002 (Qld)***. This act lists declared plants and provides a framework for the management of pest animals and plants. The species targeted for control by the act are those with the potential to cause serious economic, environmental or social impacts. Three categories are defined in the act:

- Class 1 Pest (fauna or flora species that has the potential to become a very serious pest in Queensland in the future).

- Class 2 Pest (fauna or flora species that has already spread over substantial areas of Queensland, but its impact is considered sufficiently serious to warrant control).
- Class 3 Pest (fauna or flora species that is commonly established in parts of Queensland, but its control by landholders is not warranted unless the plant is impacting or has the potential to impact on a nearby ESA).

**State Planning Policy 2/10: Koala Conservation in South East Queensland.** This policy aims to ensure that koala habitat conservation is taken into account in planning processes within the South East Queensland Koala Protection Area, contributing to a net increase in koala habitat, and to assist in the long-term retention of viable koala populations.

**Biodiversity Assessment and Mapping Methodology (BAMM) (DERM, 2011e).** This is an approach developed by DERM to provide for a consistent statewide approach for the assessment of biodiversity values at the landscape scale in Queensland. The assessment is based largely on vegetation mapping data generated or approved by the Queensland Herbarium, and BAMM has been used to generate Biodiversity Planning Assessments for each Queensland bioregion. BAMM is used to identify areas of significance solely for biodiversity reasons, including threatened ecosystems or species, large tracts of habitat in good condition and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes.

**Weeds of National Significance (AWC, 2011).** This is a list containing 20 species regarded as posing the greatest threat to a range of Australia's natural values and primary industries. Identifying these weeds within the project development area supplements the broader assessment of vegetation community biocondition.

**Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions.** The code has been prepared in accordance with provisions set out in the Vegetation Management Act and applies to significant projects under the *State Development and Public Works Association Act 1971* (Qld). Although petroleum activities are exempt from the requirement to obtain approval to clear native vegetation under the Vegetation Management Act and the project has not been declared a significant project, the guidance of the code has been used to ensure best-practice techniques are undertaken to maintain terrestrial ecological processes.

**Queensland Regrowth Vegetation Code 2011.** The code allows for regulation of the clearing of high-value regrowth vegetation (defined as regrowth vegetation that has not been cleared since 31 December 1989). Exemptions to the code apply to clearing of regrowth vegetation for the extractive industry within key resource areas, clearing for a number of prescribed land management practices (e.g., fencing or firebreaks) or clearing for significant community projects. The code applies three levels of protection for regrowth vegetation derived from 'endangered', 'of concern' and 'least concern' regional ecosystems. The code also applies protection to regrowth watercourse vegetation.

**Draft Policy Statement 2007: Use of Environmental Offsets under the Environment Protection and Biodiversity Conservation Act (1999).** The offset policy under the EPBC Act is used to maintain or enhance environmental health, diversity and productivity as they relate to matters of national environmental significance. The policy statement contains a set of principles that directs the use of environmental offsets under the EPBC Act.

**Queensland Government Environmental Offsets Policy 2008.** The policy provides a framework for preparation of offsets in Queensland and when they should be applied. It outlines principles that direct the way offsets can be used to contribute to sustainable development.

**Policy for Vegetation Management Offsets 2011.** The requirements for offsets under state legislation fall under the subordinate policies (Regional Vegetation Management Code, Policy for Vegetation Management Offsets, Nature Conservation (Koala) Conservation Plan) of the Nature Conservation Act and Vegetation Management Act. Offsets will be based on the residual impact after measures to avoid impacts have been implemented. Offset requirements must be sufficient to 'maintain existing extent' for regional ecosystems, essential habitat and conservation status thresholds under the Regional Vegetation Management Code for the Brigalow Belt and New England Tablelands bioregions. Due to uncertainty in the location of project impacts, the requirement for environmental offsets will be determined prior to construction activities in consultation with DERM.

**Queensland Biodiversity Offset Policy 2011.** This policy aims to ensure an equivalent or better biodiversity outcome on a statewide basis, where biodiversity values are lost as a result of development or other activities. The offset policy is triggered because the project is a level 1 petroleum activity under the EP Act. The offsets required under the policy will be determined prior to construction activities in consultation with DERM.

## 17.2 Assessment Methods

The terrestrial ecology impact assessment comprised a desktop study, a habitat suitability assessment and field surveys to describe the existing environment of the project development area, followed by a significance assessment to determine the scale of the potential impacts that could result from project activities.

### 17.2.1 Desktop Study

The desktop study involved a detailed review of relevant literature, including books, scientific journals, and unpublished technical and planning reports, as well as personal communications with local experts.

Aerial photography of recent and historical imagery was also assessed to assist with the verification of remnant vegetation and EPBC-listed vegetation communities. The imagery also served to correlate past land management practices to current vegetation conditions.

Searches of the following databases were also conducted as part of the desktop study:

- Protected Matters Search Tool (EPBC Act), including a 5-km additional search buffer.
- Regional ecosystem mapping and high-value regrowth vegetation mapping (Queensland Government).
- DERM's Regional Ecosystem Description Database.
- Queensland Herbarium's records system (HERBRECS).
- Queensland Herbarium's site-based floristic database (CORVEG).
- DERM's WildNet, including a 10-km additional search buffer.
- Queensland Museum's fauna collections database, including a 10-km additional search buffer.
- Birds Australia Atlas, including a 10-km additional search buffer.
- Internal flora and fauna databases held by 3D Environmental and Osmotic Ecology.

- BAMB Biodiversity Planning Assessment for the Brigalow Belt South bioregion to provide information on biodiversity significance, essential habitat and regional wildlife corridors.

### **17.2.2 Habitat Suitability Assessment**

An assessment of habitat suitability was undertaken to identify areas likely to support 'general' habitat and 'core' habitat.

Core habitat within the project development area is defined as a combination of critical and essential habitat (as mapped by DERM) for national- or state-listed significant species (however, there are other important habitat areas for EPBC Act-listed species that do not fall within the essential habitat classification). Core habitat areas comprise regional ecosystems that are likely to be regularly inhabited by or are of high importance to the listed species. Areas of known occupancy are identified as "core habitat known", while areas identified as having a high likelihood of species occurrence are identified as "core habitat possible".

Where fauna species are known to select habitats based on specific habitat factors that cannot be assigned to individual regional ecosystems (such as rock outcrops, the presence of water or mistletoe), regional ecosystems that regularly contained these features were included as possible core habitat. Where habitat data for species was not readily available, i.e., those recorded infrequently within the project development area, habitat types were determined by carrying out the following:

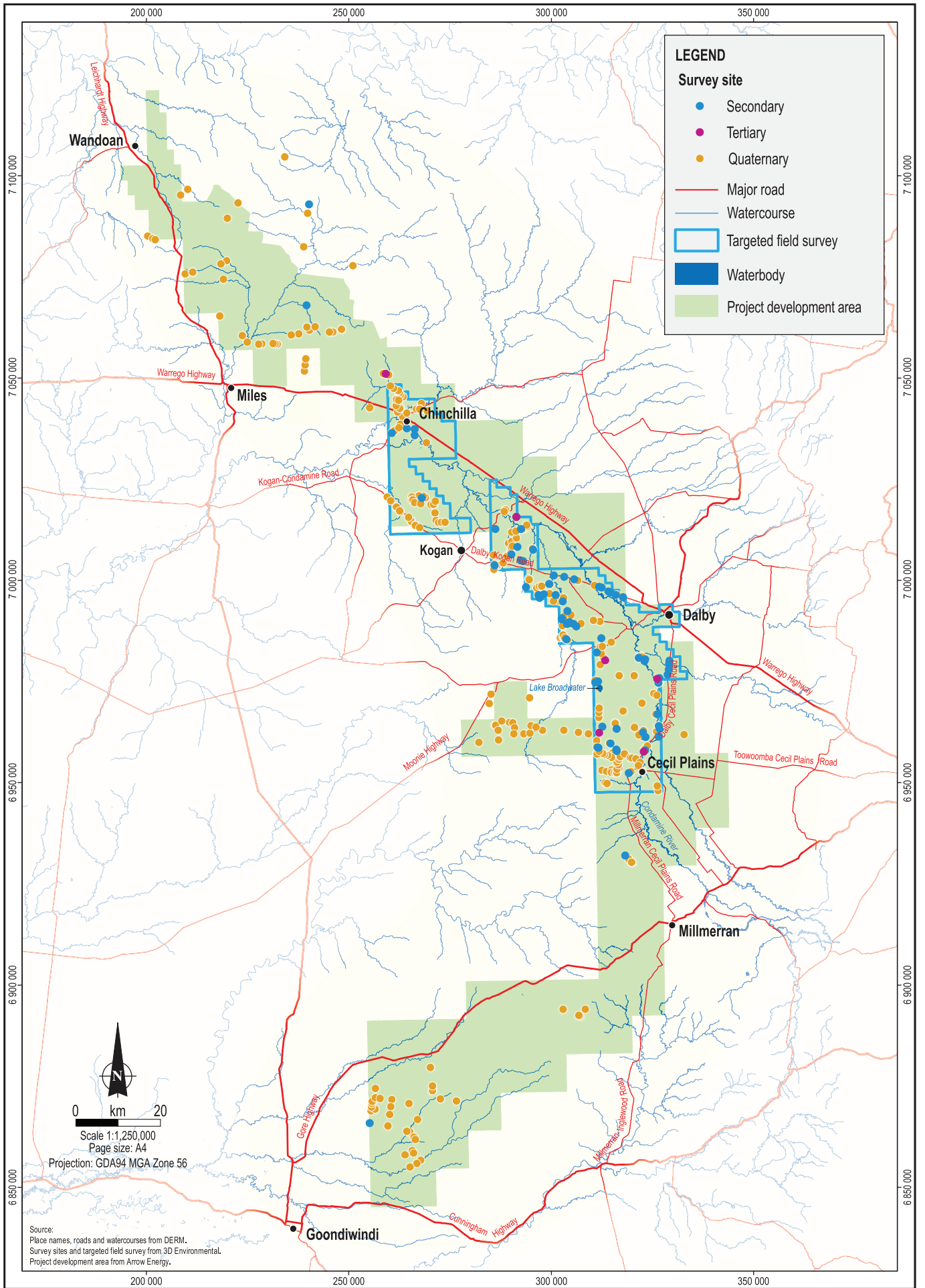
- Compiling a list of regional ecosystems from the essential habitat factors provided by DERM under the Vegetation Management Act.
- Compiling a list of regional ecosystems based on cross-referencing regional ecosystem maps and known location data.
- Vetting resultant lists of regional ecosystems for each species, based on known habitat requirements, to remove erroneous regional ecosystems.
- Segregating the regional ecosystems into core and supplementary habitats by comparing the Regional Ecosystem Description Database with habitat requirements known for each species.
- Testing the validity of the resultant list of regional ecosystems for each species in field surveys.
- Modifying the resultant maps to account for factors that cannot be included in descriptions of regional ecosystems, e.g., species distributions, proximity to highly valuable habitat, patch size, etc.

General habitats containing regional ecosystems that may be used less regularly by fauna are described further in Appendix K, Terrestrial Ecology Impact Assessment.

### **17.2.3 Field Surveys**

Field surveys were undertaken at 399 sites (Figure 17.1) over 2 seasons comprising 29 days between October and December 2009 (a period when chances of detecting most fauna species were relatively high) and an additional 6 days in May 2010.

The initial field survey specifically targeted petroleum leases associated with the Dalby Expansion Project, an extension of Arrow's existing operations permitted under a separate approvals process. This was a more intensive survey, required to verify the suitability of potential development sites. The results of the survey carried out for the Dalby Expansion Project were included in the impact assessment undertaken for the EIS to provide a more comprehensive



record of terrestrial ecosystems in the project development area, which encompasses the Dalby Expansion Project area. Consequently, a proportionally higher number of survey sites are located within this area.

The subsequent survey was designed to sample and validate ecosystems in the project development area to identify sensitive vegetation communities and habitat, a key input to the constraints analysis and mapping that has been designed to inform site and route selection. Weather conditions during the field surveys were seasonally typical.

### **Field Survey Site Selection**

As the precise location of project activities will not be known until the field development plan and project design have progressed, field survey sites were selected based on their representativeness of the range of environmental values that exist across the project development area. Areas targeted for field surveys were selected primarily based on information collected from local stakeholder groups, the results of the desktop study and a habitat suitability assessment. The areas were selected based on an initial assessment of habitat sensitivity and likelihood of exposure to threatening processes, with survey sites located within:

- Ecosystems where limited information on the condition or structure of vegetation in the project development area was available.
- Areas identified as possessing, or potentially possessing significant or sensitive plant and animal species.
- Areas with representative examples of remnant vegetation which provide a reference condition for a number of sensitive regional ecosystems.

Initially regional ecosystem mapping was used to identify sites representative of ecosystems present in the project development area. Aerial photography was then used to verify the accuracy of the regional ecosystem mapping and to ensure that a minimum of three sample sites per regional ecosystem were surveyed, except where regional ecosystems were limited in their extent.

Ground truthing of mapped regional ecosystems was also undertaken to verify the appropriateness of using the existing, certified mapping for a broader impact and biodiversity assessment i.e., across the project development area. Additional survey locations were added opportunistically during the field survey to provide complete data coverage and mapping verification. Field surveys clarified that many of the 399 sites were representative in terms of biophysical attributes of regional ecosystems identified within the project development area, with regard to vegetation composition, presence of animals and soil types. The targeted survey approach allowed for a comprehensive assessment to be conducted at each of the survey sites representative of all identified ecosystems across the project development area. Appendix K, Terrestrial Ecology Impact Assessment provides further details on site selection.

### **Vegetation Communities**

Survey methods for vegetation communities and flora species followed the Queensland Herbarium standards, which recommend using a combination of formalised secondary-, tertiary- and quaternary-level sampling procedures whereby:

- Secondary vegetation survey sites are used for classification and detailed descriptions of regional ecosystems and vegetation communities. Secondary sites consisted of 50-m by 10-m plots positioned to avoid sampling across vegetation community boundaries.



- Tertiary vegetation survey sites are used for classification and descriptions of regional ecosystems and vegetation communities. Generally, only the dominant or conspicuous species in the ground layer are recorded.
- Quaternary vegetation survey sites are used primarily as a record of field traverses and to verify regional ecosystem or vegetation mapping.

Secondary and tertiary vegetation survey sites were assessed concurrently for flora and fauna attributes, while an 'as needed' approach was adopted for fauna assessment within quaternary sites where further assessment was determined to be beneficial.

When a vegetation community with the potential to provide critical habitat for national- or state-listed species was identified, the search area was broadened and a more extensive species list was assembled. Trees that were identified as important food sources for various fauna species, such as eucalypts for koalas (*Eucalyptus tereticornis* and *Eucalyptus populnea*) and flowering trees for honeyeaters and gliders, were also recorded, together with important habitat attributes, such as hollow-bearing trees, rocky outcrops, ground structure (e.g., fallen logs and soil cracks) and exfoliating bark. Habitat modifications, such as invasive weed species, thinning of timber and clearing of understorey, were also recorded.

Reference sites established in undisturbed or lightly disturbed vegetation communities within the project development area formed the basis from which an assessment of the remnant or non-remnant status of a specific vegetation community could be made. These sites also provided a benchmark for the assessment of the vegetation community condition and biodiversity values.

## Flora

Flora species were recorded on walking traverses, with particular reference to known and potential habitats of national- or state-listed significant species, as well as declared weeds and locally significant taxa (non-listed species).

The relative abundance and species present at each site was assessed, while species not identifiable in the field were submitted to the Queensland Herbarium for identification.

Weeds were assessed by their invasiveness, potential for impact and spread, and potential for social and economic impacts.

## Fauna

Fauna and habitat surveys involved log and rock rolling and the inspection of exfoliating bark to search for sheltering terrestrial vertebrates, such as amphibians and reptiles. Birds were also identified and recorded, either by direct observation or by their calls. Mammals, such as foxes and wallabies, were likewise identified and recorded, as were animal traces, including droppings and claw marks on trees.

Additional detail of the field survey method is provided in Appendix K, Terrestrial Ecology Impact Assessment.

### 17.2.4 Impact Assessment Method

The potential impacts of the project on terrestrial ecology values were assessed using the significance assessment method defined in Chapter 7, Impact Assessment Method. This assessment method was tailored to consider the sensitivity of environmental values and the magnitude and significance of potential impacts on the existing environment and associated values.

## Sensitivity of the Environmental Value

The sensitivity of an environmental value is determined from its susceptibility or vulnerability to threatening processes.

Applying the representative attributes that define sensitivity (e.g., legislative status, intactness, rarity, resilience to cope with change, ability to recover from an impact and the replacement potential), enables the sensitivity of an environmental value to be ranked as extremely high, high, moderate, low or not sensitive as per Table 17.1.

**Table 17.1 Criteria for sensitivity of terrestrial ecology environmental values**

Sensitivity	Description
Extremely high	<ul style="list-style-type: none"> <li>• The environmental value is listed as 'endangered' or 'critically endangered' under state or national legislation and has low resilience to disturbance.</li> <li>• The environmental value typically demonstrates a high degree of intactness and may represent benchmark conditions in reference to examples across its broader range.</li> <li>• Natural recruitment or colonisation would not replace or restore the environmental value within several generations.</li> <li>• Impacts may or are likely to lead to the long-term extinction of the environmental value at a local scale.</li> </ul>
High	<ul style="list-style-type: none"> <li>• The environmental value is listed on a recognised or statutory state, national or international register as being of conservation significance.</li> <li>• The environmental value is intact and retains its intrinsic value.</li> <li>• The environmental value is unique to the environment in which it occurs. It is isolated to the affected system or area, which is poorly represented in the region, territory, country or world.</li> <li>• It has not been exposed to threatening processes, or they have not had a noticeable impact on the integrity of the environmental value. Project activities would have an adverse effect on the value.</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>• The environmental value is recorded as being important at a regional level and may have been nominated for listing on recognised or statutory registers.</li> <li>• The environmental value is in a moderate to good condition despite being exposed to threatening processes. It retains many of its intrinsic characteristics and structural elements.</li> <li>• It is relatively well represented in the systems or areas in which it occurs, but its abundance and distribution are limited by threatening processes.</li> <li>• Threatening processes have reduced its resilience to change. Consequently, changes resulting from project activities may lead to degradation of the prescribed value.</li> <li>• Replacement of unavoidable losses is possible due to its abundance and distribution.</li> </ul>
Low	<ul style="list-style-type: none"> <li>• The environmental value is not listed on any recognised or statutory register. It might be recognised locally by relevant suitably qualified experts or organisations, e.g., historical societies.</li> <li>• It is in a poor to moderate condition as a result of threatening processes that have degraded its intrinsic value.</li> <li>• It is not unique or rare, and numerous representative examples exist throughout the system or area.</li> <li>• It is abundant and widely distributed throughout the host systems or areas.</li> <li>• There is no detectable response to change, or change does not result in further degradation of the environmental value.</li> <li>• The abundance and wide distribution of the environmental value ensure replacement of unavoidable losses is achievable.</li> </ul>

**Table 17.1 Criteria for sensitivity of terrestrial ecology environmental values (cont'd)**

<b>Sensitivity</b>	<b>Description</b>
Not sensitive	<ul style="list-style-type: none"> <li>• The environmental value is not considered threatened under state or national legislation. Impacted habitats may have a low degree of intactness due to previous disturbance regimes.</li> <li>• No short-term or long-term project impacts are likely to affect the environmental value adversely.</li> <li>• The environmental value may benefit from the project (e.g., coloniser species) and is resilient to changes in habitat structure or condition.</li> </ul>

### **Magnitude of Impact**

The magnitude of an impact on an environmental value is an assessment of the geographical extent, duration and severity of the impact. Applying these attributes enables the magnitude of an impact to be ranked as major, high, moderate, low or negligible as shown in Table 17.2.

**Table 17.2 Criteria for magnitude of impact on terrestrial ecology environmental values**

<b>Magnitude</b>	<b>Description</b>
Major	An impact that is widespread, long lasting and results in substantial and possibly irreversible change to the environmental value whether this be at a national, regional or local level. Impact management procedures have not been tested or provide limited impact amelioration, and there is limited potential for the environmental value to recover once the disturbance has been removed.
High	An impact that is widespread, long lasting and results in substantial and possibly irreversible change to the environmental value. Avoidance through appropriate design responses or the implementation of site-specific environmental management controls is required to address the impact.
Moderate	An impact that extends beyond the area of disturbance to the surrounding area but is contained within the region where the project is being developed. The impacts are short term and result in changes that can be ameliorated with specific environmental management controls.
Low	A localised impact that is temporary or short term and either unlikely to be detectable or could be mitigated effectively through standard environmental management controls.
Negligible	The impact on the environmental value is restricted to a local scale, and impacts do not extend beyond the direct impact footprint. The impact will be difficult to detect when the source of impact is removed.

### **Significance of Potential Impacts**

The significance of the potential impacts on the environmental value was determined based on the sensitivity of the value and the magnitude of the potential impact. The significance assessment matrix (Table 17.3) shows how, using the criteria above, the significance of an impact on environmental value was determined.

**Table 17.3 Significance assessment matrix for terrestrial ecology**

Magnitude of Impact	Sensitivity of the Environmental Value				
	Extremely High	High	Moderate	Low	Not Sensitive
Major	Major	Major	High	Moderate	Moderate
High	Major	High	Moderate	Moderate	Low
Moderate	High	Moderate	Moderate	Low	Low
Low	Moderate	Moderate	Low	Low	Insignificant
Negligible	Moderate	Low	Low	Insignificant	Insignificant

The classifications for determining the significance of an impact are as follows:

- **Major.** An impact occurs that causes major, long-term and widespread harm to a habitat or environmental value that is irreplaceable because of its uniqueness or restricted occurrence. The impact is largely irreversible, no mitigation measures have been proven to ameliorate the impact, and avoidance is considered the only effective mitigation.
- **High.** A high magnitude impact occurs when proposed activities exacerbate or accelerate the degradation of a unique or rare environmental value. While management actions are known to ameliorate impacts, a full recovery of the value to pre-impact condition is a long-term process (decades) that will require rigorous active management. In these cases, avoidance is the preferred primary mitigation measure.
- **Moderate.** Although resilient to change, further degradation of an environmental value will occur due to the impact scale, or the activity has the potential to increase the susceptibility of the environmental value to further change. Although important in the local ecological context, the value is widespread outside the area of impact and a range of management measures are known to facilitate recovery or replacement of the environmental value.
- **Low.** An environmental value is of local importance only, and impacts will be of a transient nature that will not affect the long-term viability of a local population. A range of mitigation and management measures is known to ameliorate or reverse the process of degradation.
- **Insignificant.** An impact occurs on an environmental value that is of limited importance on a local or regional basis. The impact is largely reversible, with degradation controlled by a range of standard mitigation and management measures that have been proven to be extremely effective.

## 17.3 Existing Environment and Environmental Values

This section provides an overview of the existing terrestrial ecology environment as compiled from the desktop study, habitat suitability assessment and field surveys. Both regional and local descriptions have been identified, including regional ecosystems, environmentally sensitive areas, vegetation communities, flora and fauna species and core habitats. Environmental values requiring protection are also described.

### 17.3.1 Regional Context

Queensland is divided into 13 bioregions based on broad landscape patterns that reflect the major underlying geology, climate patterns and ecology. The project development area lies within the Brigalow Belt South bioregion.

Generally, the Brigalow Belt South bioregion is characterised by the brigalow tree (*Acacia harpophylla*), a wattle tree with silvery foliage that grows as forests or woodlands on clay soils. Other vegetation types that occur include eucalypt and cypress pine forests and woodlands, vine thickets and grasslands.

The Brigalow Belt South bioregion is a major pastoral and agricultural area, with much of the natural vegetation heavily cleared as a result of land development. The resulting landscape is one of isolated patches of remnant, disturbed and regrowth vegetation that vary in size, shape and isolation. This is evident in the network of linear vegetation (both remnant and regrowth) along road verges and fence lines and by the few larger stands of vegetation containing unbroken habitat preserved in areas that either are unsuitable for agriculture or have been preserved through alternative use.

### 17.3.2 Environmentally Sensitive Areas

Three Category A ESAs were recognised within the project development area:

- **Wondul Range National Park** (Plate 17.1). This park is located within the southern portion of the project development area. Extensive tracts of remnant vegetation buffer this area, with no evidence of logging, weed invasion or associated land degradation. This site is known to provide core habitat for many listed species, including the EPBC Act listed *Macrozamia machinii* which is largely restricted to this area.
- **Bendidee National Park** (Plate 17.2). This park is abutted by Bendidee State Forest and contains one of three known populations of the Bull oak jewel butterfly (*Hypochrysops piceatus*) (the only known population to occur within the project development area). The largest population is found more than 30 km east of Millmerran, over an area of approximately 8 km by 1.5 km (Sands & New, 2002). The third identified population (recorded at Mount Emlyn, 10 km southwest of the project development area) is now thought to be extinct (Lundie-Jenkins & Payne, 2000). Anecdotal sightings have also been recorded within the project development area; however, none have been verified (Sands & New, 2002; Sands, 2003).
- **Lake Broadwater Conservation Park** (Plate 17.3). Located within the central portion of the project development area, the conservation park receives water from large catchments. The area has been identified as an important wildlife refuge containing special biodiversity values. The wetland within this conservation park is an important migratory bird habitat with migratory species commonly observed within its vicinity.

Category B and C ESAs are also present in the project development area, and are discussed in the following sections.

Category A, B and C ESAs are shown in Figure 17.2.



Source: 3D.

**Plate 17.01**  
Wondul Range National Park



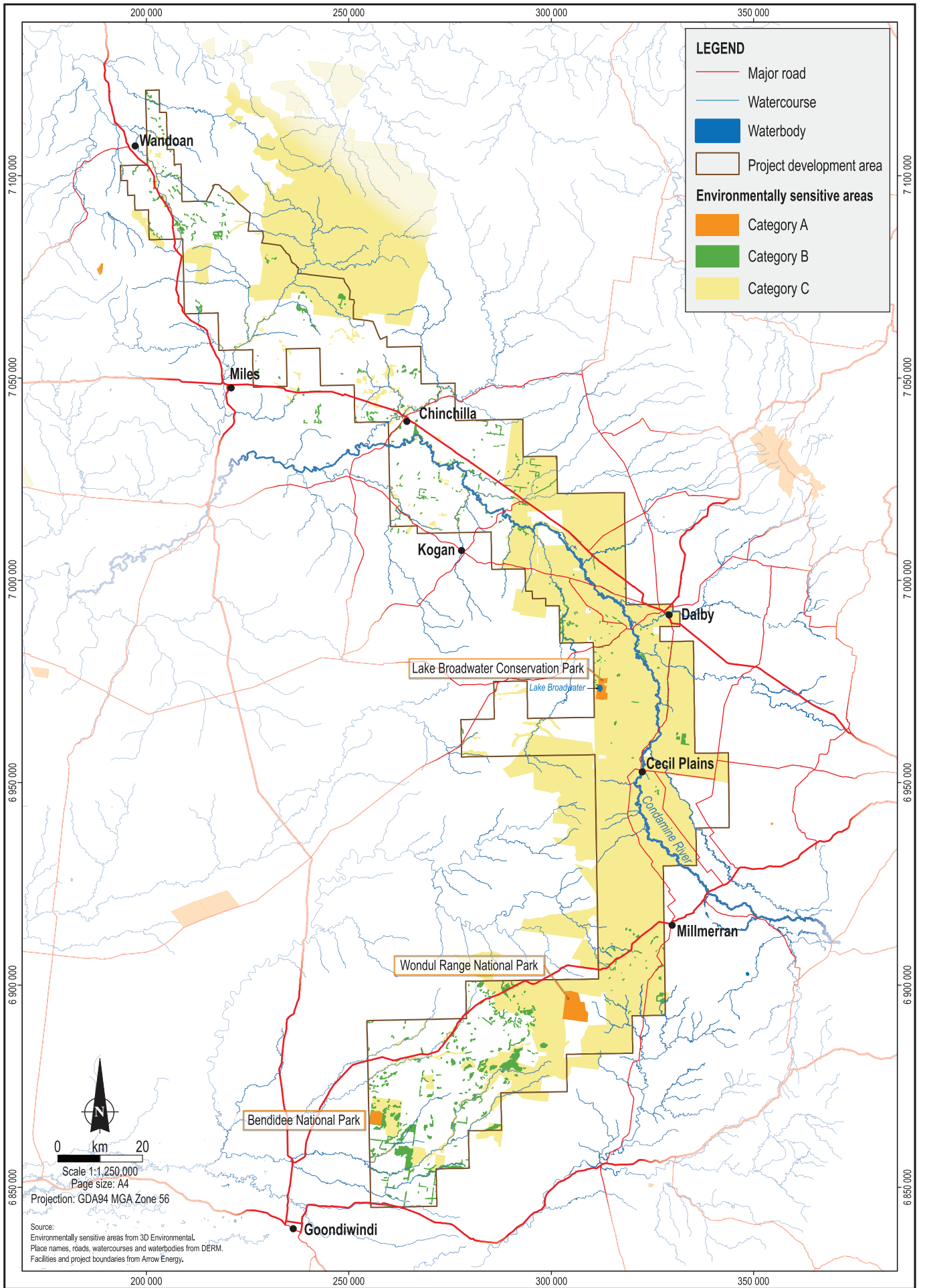
Source: 3D.

**Plate 17.02**  
Bendidee National Park



Source: 3D.

**Plate 17.03**  
Lake Broadwater Conservation Park



### 17.3.3 Terrestrial Flora

Terrestrial flora within the project development area is regarded as highly diverse, with numerous vegetation communities identified through the desktop study habitat suitability assessment and field surveys.

#### Vegetation Communities

Remnant vegetation comprises approximately 263,202 ha (30% of the project development area) with a balance of 586,178 ha of non-remnant vegetation, comprising mostly cleared pastoral and grazing land.

#### **Nationally Classified Vegetation Communities**

Nationally threatened vegetation communities are identified under the EPBC Act as 'critically endangered', 'endangered' or 'vulnerable' relative to their risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.

Two nationally significant, threatened ecological communities were identified within the project development area during the field surveys and an additional four communities are considered as 'possible' or 'likely' occurrences:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) ('endangered') (Plate 17.4): field observations and regional ecosystem mapping suggest that *A. harpophylla* dominant and co-dominant communities are a common, although highly fragmented, ecosystem. These communities were recorded throughout the project development area as regional ecosystems (REs) 11.3.1, 11.4.3, 11.4.10, 11.9.5 and 11.9.6 and also as advanced brigalow regrowth communities.
- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland ('critically endangered'): this community was identified during field surveys as narrow strips in road verges and stock routes (Plate 17.5). Represented as REs 11.3.21 and 11.3.24, this community occupies 990 ha within the project development area.
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions ('endangered'): field surveys did not identify this community; however, vegetation mapping shows this community as occurring over 31 ha of the project development area. Occurrences within the project development area are limited to severely degraded, small (less than 1.7 ha), isolated remnants within REs 11.9.4a and 11.8.3.
- Weeping Myall Woodlands ('endangered'): this community is often associated with RE 11.3.2, which occurs extensively through the project development area. Field surveys did not locate any examples of this community, although scattered weeping myall trees were observed to be associated with RE 11.4.12 and its presence is therefore considered possible.
- White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grassland ('critically endangered'): this community was not identified during field surveys, however it possibly exists within the project development area within RE 11.8.2a, in the Captains Mountain area approximately 9 to 10 km southwest of Millmerran.





Source: 3D.

**Plate 17.04**  
Brigalow (*Acacia harpophylla*  
dominant and co-dominant)



Source: 3D.

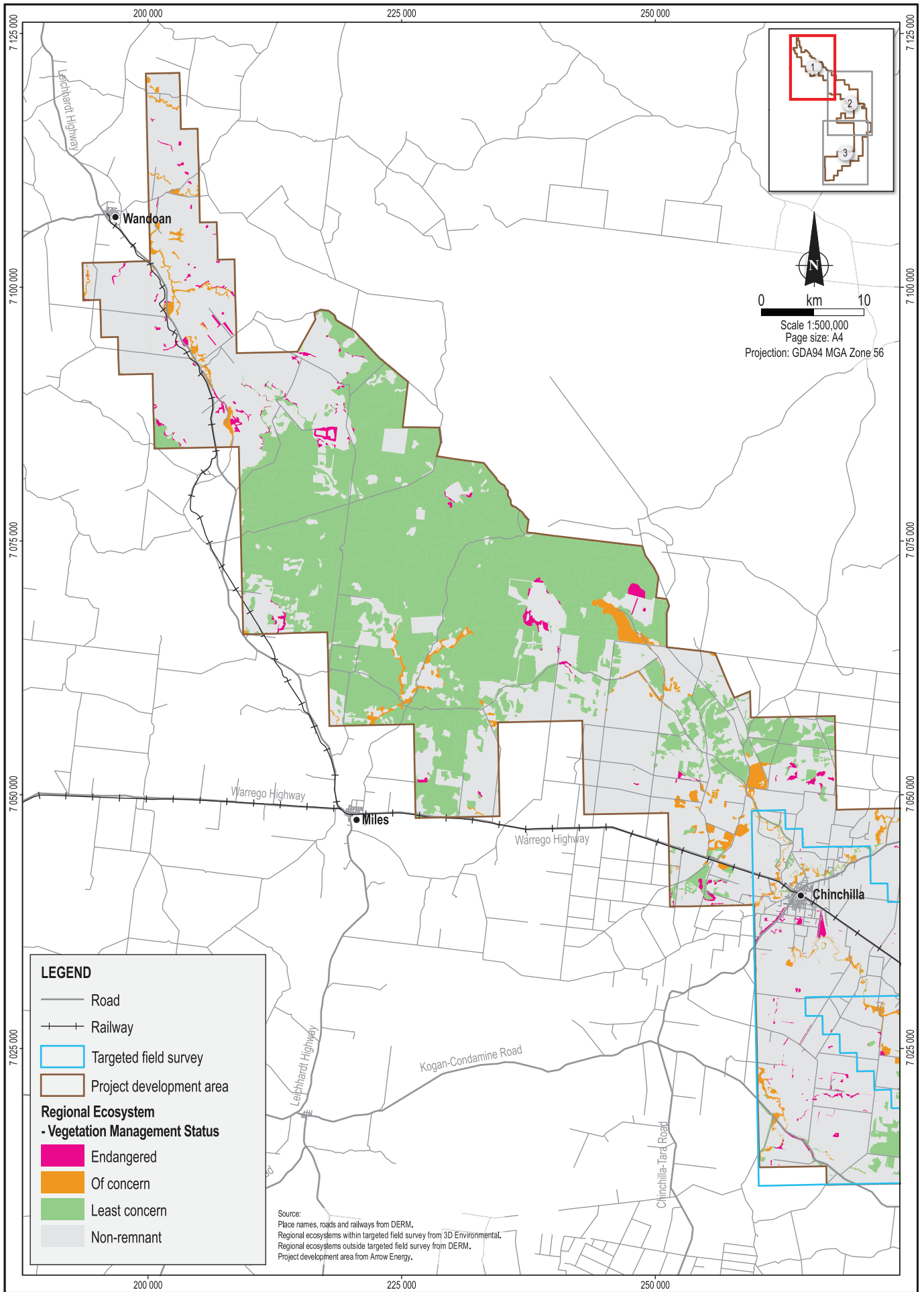
**Plate 17.05**  
Natural grasslands on basalt and  
fine-textured alluvial plains of  
northern New South Wales and  
southern Queensland

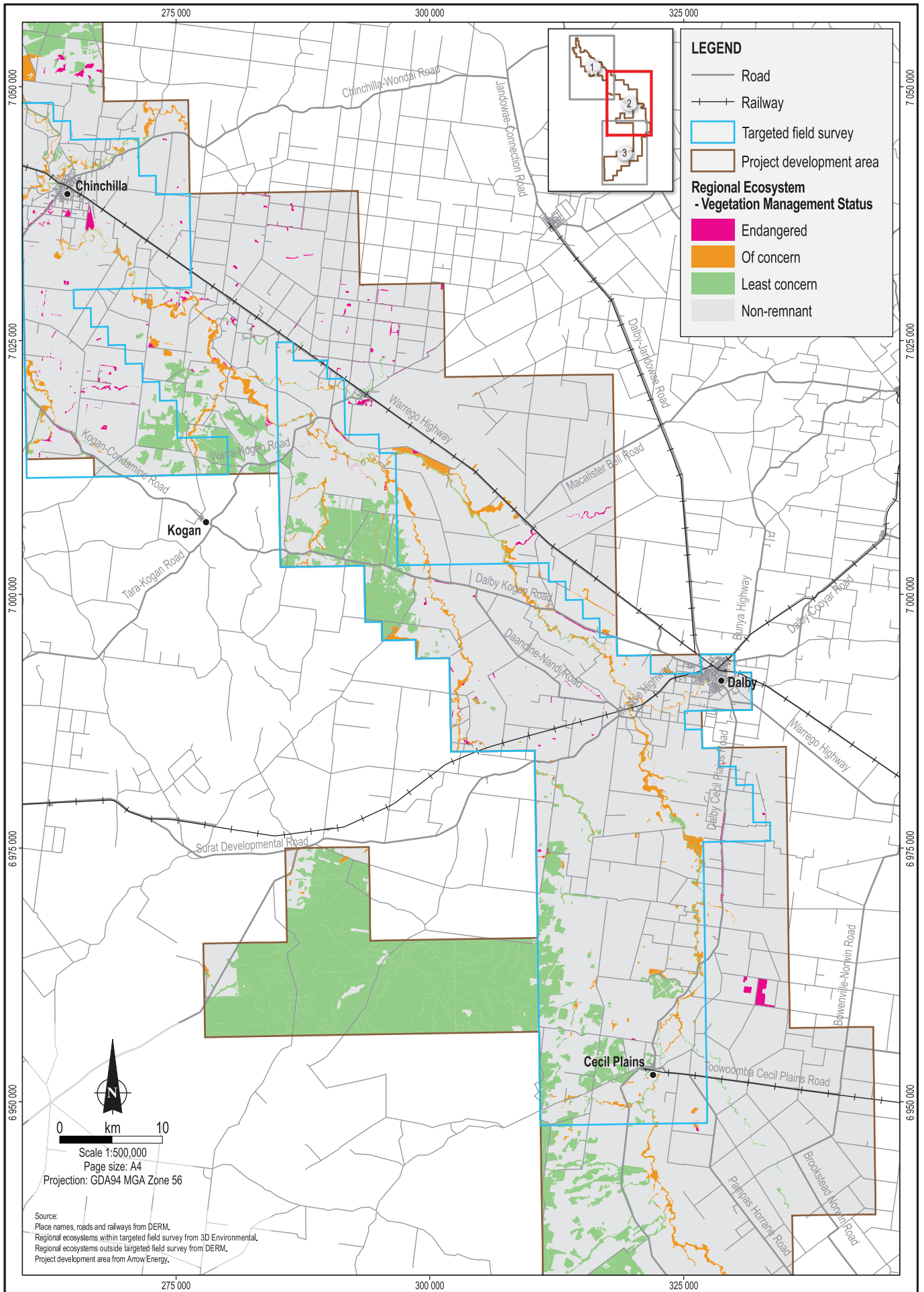
- Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South Bioregions ('endangered'): this community is represented as RE 11.3.3 and is likely to be found in areas north of Chinchilla around the Charleys Creek floodplain and other tributaries of the Condamine River. Although not identified in field surveys, this community is likely to occur as a subdominant community in association with REs 11.3.25 and 11.3.4 in the project development area.

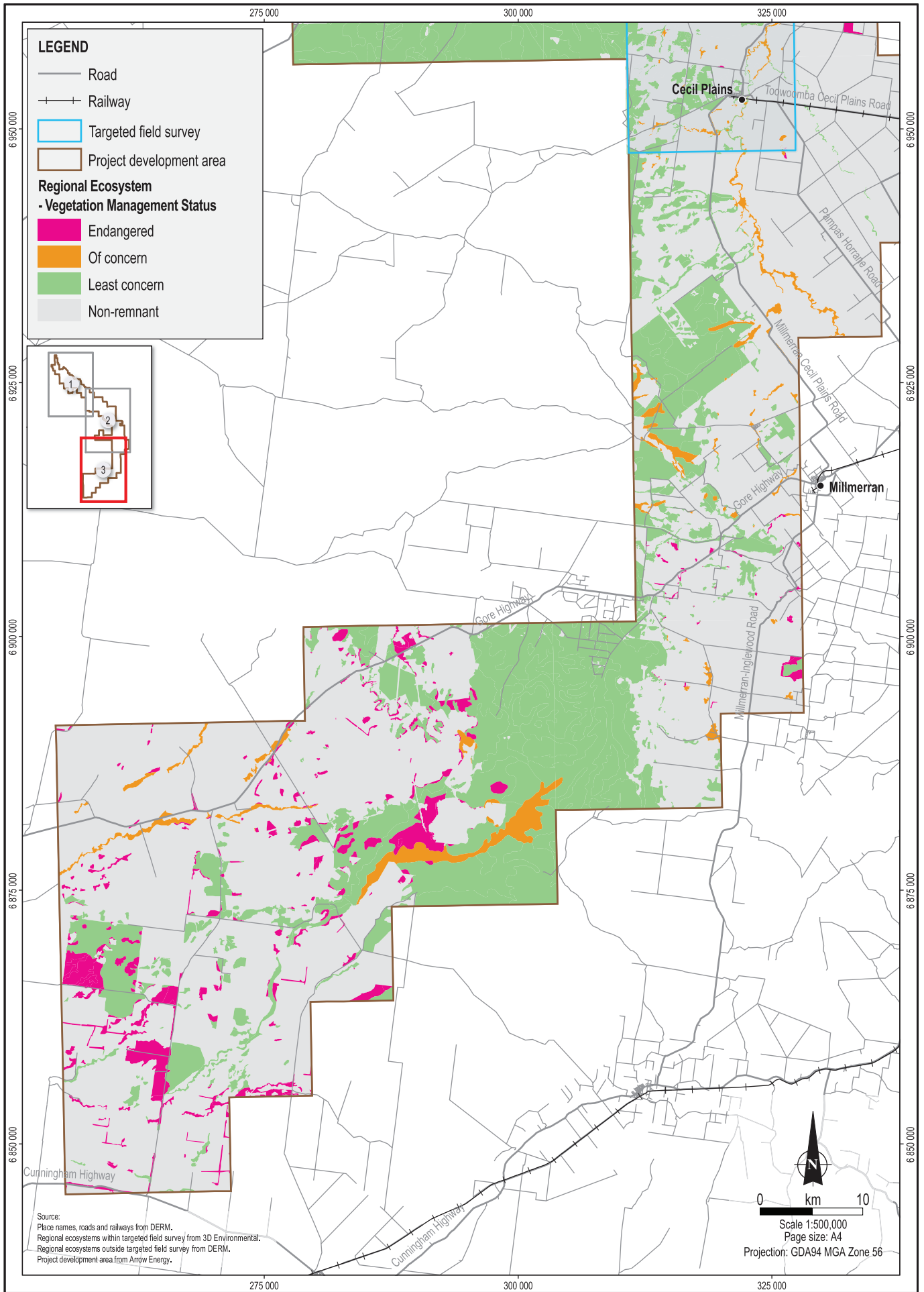
### ***State Classified Vegetation Communities***

Regional ecosystems are classified by their VM class and their biodiversity status. The regional ecosystems also comprise of remnant and high-value regrowth vegetation.

There are 35 regional ecosystems mapped in the project development area. Table 17.4 groups the regional ecosystems by sensitivity and provides details of the VM class and biodiversity status. Using the VM class there are 9 'endangered', 7 'of concern' and 19 'least concern' regional ecosystems. Figures 17.3a, 17.3b and 17.3c show the regional ecosystems mapped by VM class over the project development area. Using the biodiversity status, there are 11 regional ecosystems as 'endangered' and 7 as 'of concern', while 17 identified as being of 'no concern at present'. The endangered regional ecosystems under their biodiversity status are classified as a Category B ESA and 'of concern' as category C. These are shown in figure Figure 17.2.







**Table 17.4 Summary of the sensitivity, status and extent for regional ecosystems within the project development area**

RE Number	Regional Ecosystem Description	VM Class	Biodiversity Status	EPBC Act Status	Extent of the Project Development Area	
					(ha)	(%)
<b>Regional ecosystems of extremely high sensitivity</b>						
11.3.21	<i>Dichanthium sericeum</i> and/or <i>Astrebla</i> spp. grassland on alluvial plains. Cracking clay soils.	'Endangered'	'Endangered'	'Critically endangered'	717	0.08
11.3.24	<i>Themeda avenacea</i> grassland on alluvial plains. Basalt-derived soils.	'Endangered'	'Endangered'	'Critically endangered'	125	0.01
11.8.2a	<i>Eucalyptus tereticornis</i> and <i>E. melliodora</i> occurring on low hills.	'Least concern'	'No concern at present'	'Critically endangered'	1,138	0.13
<b>Regional ecosystems of high sensitivity</b>						
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains.	'Endangered'	'Endangered'	'Endangered'	774	0.09
11.4.3, 11.4.3a	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> shrubby open forest on Cainozoic clay plains.	'Endangered'	'Endangered'	'Endangered'	4,616	0.54
11.4.10	<i>Eucalyptus populnea</i> or <i>E. pilligaensis</i> , <i>Acacia harpophylla</i> , <i>Casuarina cristata</i> open forest to woodland on margins of Cainozoic clay plains.	'Endangered'	'Endangered'	'Endangered'	1,784	0.21
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks.	'Endangered'	'Endangered'	'Endangered'	3,792	0.45
11.9.6	<i>Acacia melvillei</i> ± <i>A. harpophylla</i> open forest on fine-grained sedimentary rocks.	'Endangered'	'Endangered'	'Endangered'	152	0.02
11.9.4a	Semi-evergreen vine thicket or <i>Acacia harpophylla</i> with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks.	Endangered	Endangered	Endangered	12	<0.01
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks.	'Of concern'	'Of concern'	'Endangered'	19	<0.01
11.3.17	<i>Eucalyptus populnea</i> woodland with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> on alluvial plains.	'Of concern'	'Endangered'	Not listed	4,412	0.52

**Table 17.4 Summary of the sensitivity, status and extent for regional ecosystems within the project development area (cont'd)**

RE Number	Regional Ecosystem Description	VM Class	Biodiversity Status	EPBC Act Status	Extent of the Project Development Area	
					(ha)	(%)
<b>Regional ecosystems of high sensitivity (cont'd)</b>						
11.9.10	<i>Acacia harpophylla</i> , <i>Eucalyptus populnea</i> open forest on fine-grained sedimentary rocks.	'Of concern'	'Endangered'	Not listed	175	0.02
11.4.12	<i>Eucalyptus populnea</i> woodland on Cainozoic clay plains.	'Endangered'	'Endangered'	Not listed*	946	0.11
<b>Regional Ecosystems of moderate sensitivity</b>						
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains.	'Of concern'	'Of concern'	Not listed*	5,333	0.63
11.3.4	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains.	'Of concern'	'Of concern'	Not listed	4,945	0.58
11.3.3	<i>Eucalyptus coolabah</i> woodland on alluvial plains.	'Of concern'	'Of concern'	'Endangered'	259	0.03
11.3.25**	<i>Eucalyptus tereticornis</i> or <i>Eucalyptus camaldulensis</i> woodland fringing drainage lines.	'Least concern'	'Of concern'	Not listed**	9,550	1.12
11.3.27a, b, c, d	Freshwater wetlands.	'Least concern'	'Of concern'	Not listed	910	0.11
11.9.7	<i>Eucalyptus populnea</i> , <i>Eremophila mitchellii</i> shrubby woodland on fine-grained sedimentary rocks.	'Of concern'	'Of concern'	Not listed	704	0.08
<b>Regional ecosystems of low sensitivity<sup>†</sup></b>						
11.3.14	<i>Eucalyptus</i> spp., <i>Angophora</i> spp., <i>Callitris</i> spp. woodland on alluvial plains.	'Least concern'	'No concern at present'	Not listed	222,910	26.24
11.3.18	<i>Eucalyptus populnea</i> , <i>Callitris glaucophylla</i> , <i>Allocasuarina luehmannii</i> shrubby woodland on alluvium.	'Least concern'	'No concern at present'	Not listed		
11.3.19	<i>Callitris glaucophylla</i> , <i>Corymbia</i> spp. and/or <i>Eucalyptus melanophloia</i> open forest to woodland on Cainozoic alluvial plains.	'Least concern'	'No concern at present'	Not listed		
11.3.26	<i>Eucalyptus moluccana</i> or <i>E. microcarpa</i> woodland to open forest on margins of alluvial plains.	'Least concern'	'No concern at present'	Not listed		

**Table 17.4 Summary of the sensitivity, status and extent for regional ecosystems within the project development area (cont'd)**

RE Number	Regional Ecosystem Description	VM Class	Biodiversity Status	EPBC Act Status	Extent of the Project Development Area	
					(ha)	(%)
<b>Regional ecosystems of low sensitivity<sup>†</sup> (cont'd)</b>						
11.5.1, 11.5.1a	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>Angophora leiocarpa</i> , <i>Allocasuarina luehmannii</i> woodland on Cainozoic sand plains/remnant surfaces.	'Least concern'	'No concern at present'	Not listed	222,910	26.24
11.5.20	<i>Eucalyptus moluccana</i> and/or <i>E. microcarpa</i> / <i>E. pilligaensis</i> <sup>§</sup> ± <i>E. crebra</i> woodland on Cainozoic sand plains.	'Least concern'	'No concern at present'	Not listed		
11.5.21	<i>Corymbia bloxsomei</i> ± <i>Callitris glaucophylla</i> ± <i>Eucalyptus crebra</i> ± <i>Angophora leiocarpa</i> woodland on Cainozoic sand plains/remnant surfaces.	'Least concern'	'No concern at present'	Not listed		
11.5.4	<i>Eucalyptus crebra</i> , <i>Callitris glaucophylla</i> , <i>C. endlicheri</i> , <i>E. chloroclada</i> , <i>Angophora leiocarpa</i> on Cainozoic sand plains/remnant surfaces. Deep sands.	'Least concern'	'No concern at present'	Not listed		
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone.	'Least concern'	'No concern at present'	Not listed		
11.7.4, 11.7.4c	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> on Cainozoic lateritic duricrust.	'Least concern'	'No concern at present'	Not listed		
11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks.	Least concern	'No concern at present'	Not listed		
11.7.6	<i>Corymbia citriodora</i> or <i>Eucalyptus crebra</i> woodland on Cainozoic lateritic duricrust.	Least concern	'No concern at present'	Not listed		
11.7.7	<i>Eucalyptus fibrosa</i> subsp. <i>nubila</i> ± <i>Corymbia</i> spp. ± <i>Eucalyptus</i> spp. on Cainozoic lateritic duricrust.	'Least concern'	'No concern at present'	Not listed		
11.9.9, 11.9.9a	<i>Eucalyptus crebra</i> woodland on fine-grained sedimentary rocks.	'Least concern'	'No concern at present'	Not listed		



**Table 17.4 Summary of the sensitivity, status and extent for regional ecosystems within the project development area (cont'd)**

RE Number	Regional Ecosystem Description	VM Class	Biodiversity Status	EPBC Act Status	Extent of the Project Development Area	
					(ha)	(%)
<b>Regional ecosystems of low sensitivity<sup>†</sup> (cont'd)</b>						
11.10.1, 11.10.1a, 11.10.1d	<i>Corymbia citriodora</i> open forest on coarse-grained sedimentary rocks.	'Least concern'	'No concern at present'	Not listed		
13.12.5	<i>Eucalyptus youmanii</i> on igneous rocks.	'Least concern'	'No concern at present'	Not listed		

\*Regional ecosystems identified in association with EPBC Act communities, however not awarded EPBC Act status.

†Regional ecosystems that were not captured in detailed field assessments and did not warrant further investigation due to their status of 'least concern' under the Vegetation Management Act. The potential exists for moderately sensitive regional ecosystems to occur within this category; however, further surveys are required to verify.

§*Eucalyptus pilligaensis* has been recently subsumed within the broader reclassification of *Eucalyptus woollsiana*.

\*\*Reassessed as moderate sensitivity after Appendix K, Terrestrial Ecology Impact Assessment, had been submitted.

## Core Habitat

Areas known to be core habitat for national- and state-listed flora and fauna species within the project development area include:

- Lake Broadwater Conservation Park.
- Bendidee National Park.
- Bendidee State Forest.
- Larger remnant vegetation patches, such as Barakula State Forest, Braemar State Forest, Western Creek State Forest and Whetstone State Forest.
- Regional ecosystems of brigalow (dominant and sub dominant) (i.e., REs 11.3.1, 11.4.3, 11.9.4b, 11.9.5, 11.9.6, 11.9.10).
- Native grasslands and grassy woodlands (i.e., REs 11.3.2, 11.3.3, 11.3.21, 11.3.24) and derived native grasslands.

Core habitat within the project development area is identified in Figure 17.4.

## Vegetation Corridors

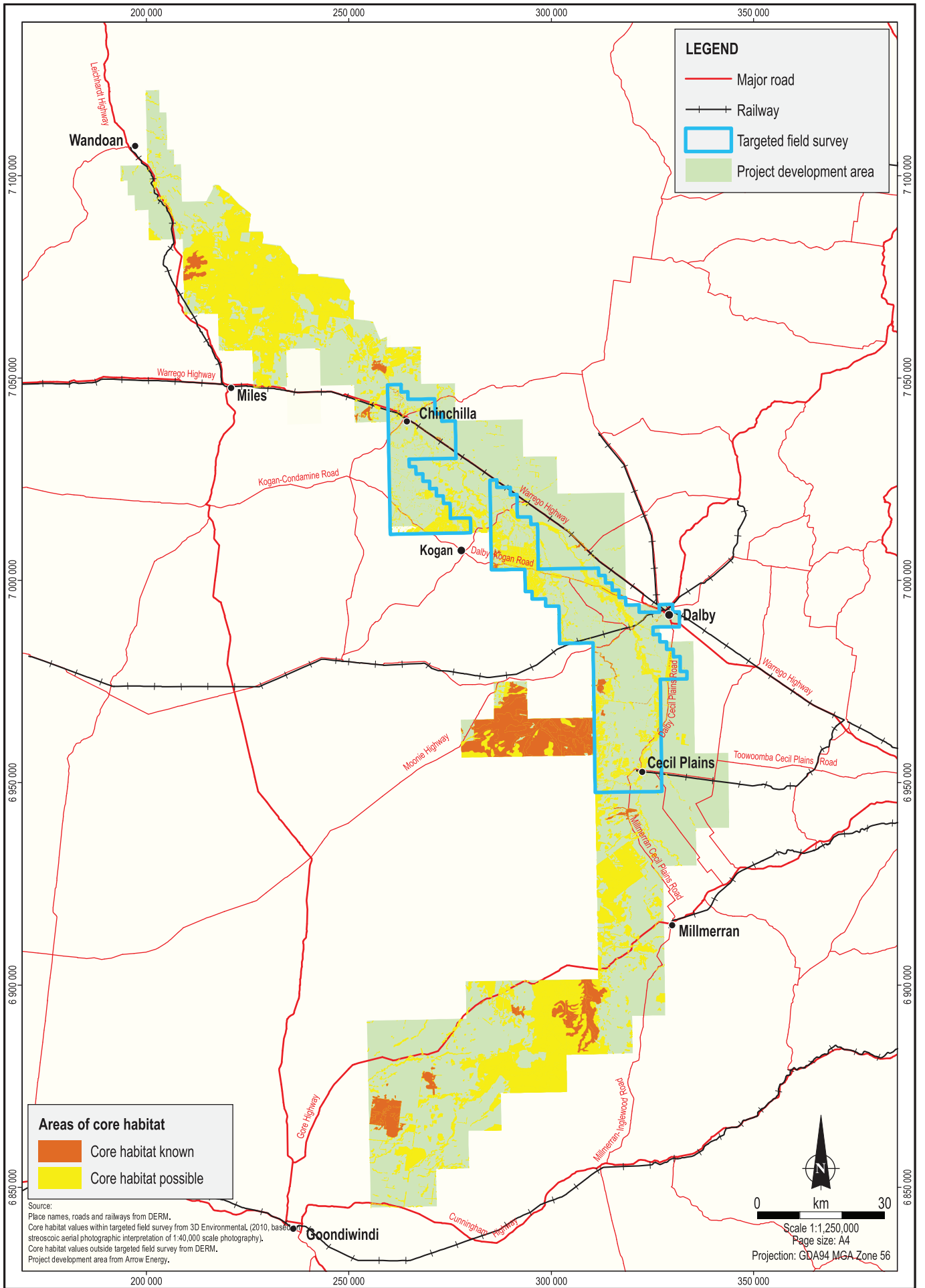
State wildlife corridors are identified under the Vegetation Management Act and are used by fauna to move between existing vegetation stands. These have been identified as large vegetation tracts (under Criterion C, tract size) and vegetation intersecting rivers (under Criterion J, corridors). Prime examples include vegetation along the Condamine River, Charleys Creek and Wilkie Creek.

## Wetlands

Palustrine and lacustrine wetlands have been identified within REs 11.3.27 and 11.4.3a as forming part of the Condamine River floodplain. Two wetland areas (Lake Broadwater and Long Swamp) are identified as forming components of RE 11.3.27. These areas are known to support a high number of listed flora species in addition to migratory species and listed fauna identified under the China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Ramsar listed wetland communities were identified downstream of the Condamine River system, flowing from the project development area. These include:

- **Narran Lakes Nature Reserve.** The site is the terminal wetland of the Narran River which is fed by the Condamine River. The Condamine River drains a substantial part of the project development area. Located in northern New South Wales, approximately 75 km northwest of Walgett and 50 km northeast of Brewarrina, Narran Lake provides habitat for migratory species and is of cultural significance to indigenous people. The wetland is located some 500 km by river from the project development area.
- **Shoalwater and Corio Bays.** The site comprises five major estuarine and marine environments, which represent the largest area in central east Queensland containing representative coastal, subcoastal, aquatic landscapes and ecosystems. The Fitzroy River and its tributary the Dawson River drain the northern part of the project development area which flows into the sea southeast of Rockhampton. Its mouth is 50 km south of the Ramsar wetlands of the Shoalwater and Corio Bays Area and is more than 500 km by river from the project development area.



Due to the expansive distances between the project development area and the Narran Lakes Nature Reserve and the Shoalwater and Corio Bays Area wetlands, it is unlikely project-related activities will impact on these sites. Consequently, the assessment did not include these sites.

### **Additional Areas of Environmental Value**

Four additional areas of environmental value were identified in the project development area, including three road reserve areas, which are invaluable for the preservation of a number of highly significant ecosystems and for facilitating faunal movement between disjunct areas of remnant and regrowth vegetation. These areas are:

- **Chinchilla rifle range** (Plate 17.6). Located within the Chinchilla Sands Local Fossil Fauna Site on freehold land within the northern part of the project development area, the site has been assessed as the best-known preserved tract of remnant brigalow. It is one of the few preserved examples of floodplain vegetation, with an intact riparian fringe on the Condamine River comprising 100 ha of RE 11.4.3 and 50 ha of RE 11.4.12.
- **Dalby Kogan Road reserve**. This reserve is comprised of a 150-m-wide strip of Queensland grassland (RE 11.3.21) and poplar box open woodland (RE 11.3.2) on the south side of the Warrego Highway, extending from 5 km west of Dalby to the Condamine River on the Kogan Road. The reserve is known to support populations of threatened and 'near-threatened' species, including the listed species *Solanum papaverifolium* (which was recorded in recent surveys), and has been regarded as 'best-quality' grassland under the EPBC threshold criteria.
- **Dalby Cecil Plains Road reserve** (Plate 17.7). This reserve possesses similar attributes to the Dalby Kogan Road reserve, although has been assessed as 'good-quality' grasslands under the EPBC threshold criteria due to increased weed invasion. One of the few known populations of grassland earless dragon (*Tympanocryptis cf. tetraporophora*) is known to inhabit this area.
- **Dalby St George Road reserve** (Plate 17.8). This reserve contains a dominant presence of the EPBC Act and Nature Conservation Act listed species Belson's panic grass (*Homopholis belsonii*) within a relatively continuous habitat of RE 11.3.17.



Source: 3D.

**Plate 17.06**  
Chinchilla rifle range



Source: 3D.

**Plate 17.07**  
Dalby Cecil Plains Road reserve



Source: 3D.

**Plate 17.08**  
Dalby St George Road reserve

## Flora Species

The flora of the project development area is highly diverse, with 1,390 flora species recorded through the desktop study and field surveys. The flora identified represents approximately 14% of Queensland's known flora species. Flora species of particular importance for the impact assessment include:

- State and nationally listed species (37 in total) that are either known to occur (6 species verified) or are likely to occur within the project development area (Table 17.5). Species for which spatial records are available are shown in Figure 17.5.
- Regionally significant (non-listed) species (eight in total).
- Pest flora species (218 species, or 16% of total flora identified within the project development area).

**Table 17.5 Listed flora species identified in the project development area**

Status	Known	Likely
<b>EPBC Act (Cwlth)</b>		
'Endangered'	<ul style="list-style-type: none"> <li>• <i>Digitaria porrecta</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Microcarpaea agonis</i>*</li> </ul>
'Vulnerable'	<ul style="list-style-type: none"> <li>• <i>Acacia curranii</i><sup>†</sup></li> <li>• <i>Bothriochloa biloba</i></li> <li>• <i>Macrozamia machinii</i>*</li> <li>• <i>Denhamia parviflora</i><sup>†</sup></li> <li>• <i>Homopholis belsonii</i><sup>†</sup></li> <li>• <i>Philotheca sporadica</i><sup>†</sup></li> <li>• <i>Prostanthera</i> sp. (Dunmore)*</li> <li>• <i>Pterostylis cobarensis</i></li> <li>• <i>Thesium australe</i><sup>†</sup></li> <li>• <i>Xerothamnella herbacea</i>*</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Picris evae</i><sup>†</sup></li> <li>• <i>Acacia handonis</i><sup>†</sup></li> <li>• <i>Acacia wardellii</i><sup>†</sup></li> <li>• <i>Cadellia pentastylis</i><sup>†</sup></li> <li>• <i>Calytrix gurulumundensis</i>*</li> <li>• <i>Rhaponticum australe</i><sup>†</sup></li> </ul>
<b>Nature Conservation Act (QLD)</b>		
'Endangered'	<ul style="list-style-type: none"> <li>• <i>Aristida forsteri</i>*</li> <li>• <i>Homopholis belsonii</i><sup>†</sup></li> <li>• <i>Pomaderris coomingalensis</i><sup>†</sup></li> <li>• <i>Rutidosia lanata</i><sup>†</sup></li> <li>• <i>Solanum papaverifolium</i></li> <li>• <i>Xerothamnella herbacea</i>*</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Ptilotus extenuatus</i><sup>†</sup></li> <li>• <i>Microcarpaea agonis</i>*</li> <li>• <i>Micromyrtus carinata</i><sup>†</sup></li> </ul>
'Vulnerable'	<ul style="list-style-type: none"> <li>• <i>Acacia barakulensis</i><sup>†</sup></li> <li>• <i>Acacia curranii</i><sup>†</sup></li> <li>• <i>Cyperus clarus</i><sup>†</sup></li> <li>• <i>Denhamia parviflora</i><sup>†</sup></li> <li>• <i>Gonocarpus urceolatus</i></li> <li>• <i>Macrozamia machinii</i>*</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Picris evae</i><sup>†</sup></li> <li>• <i>Acacia handonis</i><sup>†</sup></li> <li>• <i>Acacia wardellii</i><sup>†</sup></li> <li>• <i>Apatophyllum teretifolium</i><sup>†</sup></li> <li>• <i>Calytrix gurulumundensis</i>*</li> </ul>

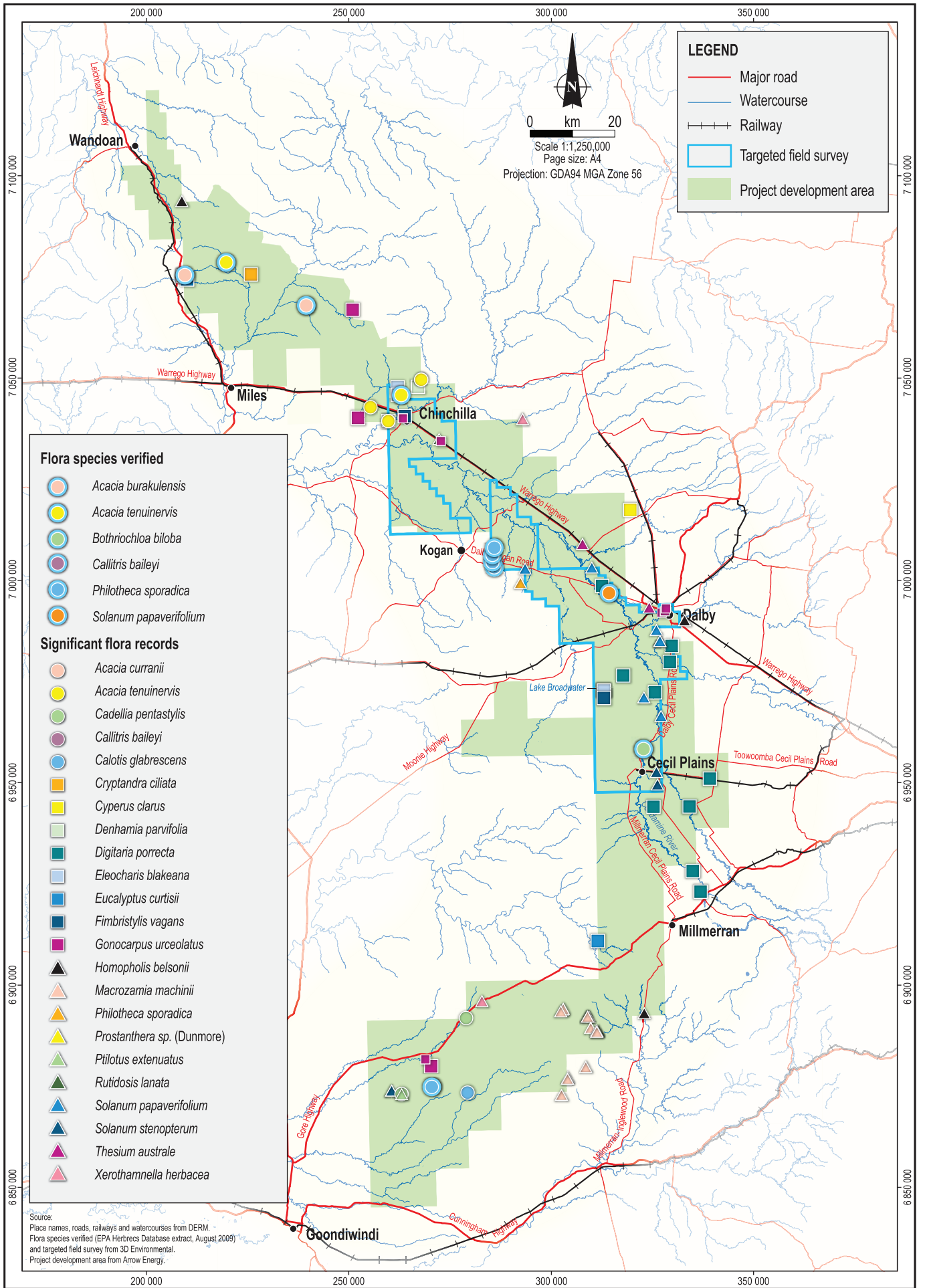
**Table 17.5 Listed flora species identified in the project development area (cont'd)**

Status	Known	Likely
<b>Nature Conservation Act (QLD) (cont'd)</b>		
'Vulnerable' (cont'd)	<ul style="list-style-type: none"> <li>• <i>Philotheca sporadica</i><sup>†</sup></li> <li>• <i>Picris barabrorum</i><sup>†</sup></li> <li>• <i>Prostanthera</i> sp. (Dunmore)*</li> <li>• <i>Solanum stenopterum</i><sup>†</sup></li> <li>• <i>Thesium australe</i><sup>†</sup></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Rhaponticum australe</i><sup>†</sup></li> </ul>
'Near threatened'	<ul style="list-style-type: none"> <li>• <i>Acacia tenuinervis</i></li> <li>• <i>Callitris baileyi</i></li> <li>• <i>Cryptandra ciliata</i></li> <li>• <i>Digitaria porrecta</i></li> <li>• <i>Eleocharis blakeana</i></li> <li>• <i>Eucalyptus curtisii</i></li> <li>• <i>Fimbristylis vagans</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Calotis glabrescens</i></li> </ul>

Source: Individual species assessments can be found in Appendix K, Terrestrial Ecology Impact Assessment.

\*Sensitivity is assessed as 'extremely high'.

<sup>†</sup> Sensitivity is assessed as 'high'.



**LEGEND**

- Major road
- Watercourse
- +—+— Railway
- Targeted field survey
- Project development area

**Flora species verified**

- Acacia burakulensis*
- Acacia tenuinervis*
- Bothriochloa biloba*
- Callitris baileyi*
- Philotheca sporadica*
- Solanum papaverifolium*

**Significant flora records**

- Acacia curranii*
- Acacia tenuinervis*
- Cadellia pentastylis*
- Callitris baileyi*
- Calotis glabrescens*
- Cryptandra ciliata*
- Cyperus clarus*
- Denhamia parvifolia*
- Digitaria porrecta*
- Eleocharis blakeana*
- Eucalyptus curtisii*
- Fimbristylis vagans*
- Gonocarpus urceolatus*
- Homopholis belsonii*
- Macrozamia machinii*
- Philotheca sporadica*
- Prostanthera* sp. (Dunmore)
- Ptilotus extenuatus*
- Rutidosia lanata*
- Solanum papaverifolium*
- Solanum stenopterum*
- Thesium australe*
- Xerothermella herbacea*

Source:  
 Place names, roads, railways and watercourses from DERM.  
 Flora species verified (EPA Heritages Database extract, August 2009)  
 and targeted field survey from 3D Environmental.  
 Project development area from Arrow Energy.



The occurrence and distribution of pest flora species vary throughout the bioregion. Twenty declared species of noxious weeds listed under the Land Protection (Pest and Stock Route Management) Act are known to occur within the project development area. An additional three species not previously recorded were identified as posing a high risk of proliferation. Table 17.6 categorises these species relative to their class listing under the act.

**Table 17.6 Pest flora species**

Listed	Species Name
Class 1	<ul style="list-style-type: none"> <li>• <i>Salix babylonica</i>*</li> </ul>
Class 2	<ul style="list-style-type: none"> <li>• <i>Opuntia tomentosa</i></li> <li>• <i>Opuntia stricta</i></li> <li>• <i>Opuntia aurantiaca</i></li> <li>• <i>Eriocereus martinii</i></li> <li>• <i>Eriocereus tortuosa</i></li> <li>• <i>Bryophyllum delagoensis</i></li> <li>• <i>Bryophyllum x. houghtonii</i></li> <li>• <i>Ambrosia artemisiifolia</i></li> <li>• <i>Baccharis halimifolia</i></li> <li>• <i>Parthenium hysterophorus</i>*</li> <li>• <i>Pistia stratiotes</i></li> <li>• <i>Prosopis glandulosa</i> var. <i>glandulos</i></li> <li>• <i>Prosopis velutina</i></li> <li>• <i>Salvinia molesta</i>*</li> <li>• <i>Senecio madagascariensis</i></li> <li>• <i>Cryptostegia grandiflora</i>*†</li> </ul>
Class 3	<ul style="list-style-type: none"> <li>• <i>Cardiospermum grandiflorum</i></li> <li>• <i>Celtis sinensis</i></li> <li>• <i>Cinnamomum camphora</i></li> <li>• <i>Schinus terebinthifolius</i></li> </ul>
Not declared	<ul style="list-style-type: none"> <li>• <i>Phyla canescens</i>†</li> <li>• <i>Eragrostis curvula</i>†</li> </ul>

\*Species identified as Weeds of National Significance.

†Not previously recorded.

Exotic species identified as being of primary concern within the project development area include:

- Lippia (*Phyla canescens*).
- African lovegrass (*Eragrostis curvula*).
- Parthenium (*Parthenium hysterophorus*).
- Mesquite (*Prosopis glandulosa* var. *glandulos*, *Propospis velutina*).

### 17.3.4 Terrestrial Fauna

Fauna identified during the desktop study comprised 497 terrestrial vertebrate species (29 frogs, 97 reptiles, 308 birds and 63 mammals) and 63 terrestrial invertebrate species (49 butterfly and 14 dragonfly species) within the project development area.

The desktop study identified 27 state and nationally listed fauna species as known or likely to occur within the project development area, comprising 2 butterflies, 1 amphibian, 9 reptiles, 12

birds and 3 mammals (Table 17.7). Species for which spatial records are available are shown in Figure 17.6.

**Table 17.7 Listed fauna species identified in the project development area**

Group	Scientific Name	Common Name	EPBC Act Status*	Nature Conservation Act Status*
Insects	<i>Hypochrysops piceatus</i> **	Bull oak jewel butterfly	-	E
	<i>Jalmenus eubulus</i> <sup>†</sup>	Pale imperial hairstreak	-	V
Amphibians	<i>Cyclorana verrucosa</i>	Rough-collared frog	-	NT
Reptiles	<i>Strophurus taenicauda</i>	Golden-tailed gecko	-	NT
	<i>Delma torquata</i> **	Collared delma	V	V
	<i>Paradelma orientalis</i>	Brigalow scaly-foot	V	V
	<i>Anomalopus mackayi</i> **	Five-clawed worm-skink	V	E
	<i>Egernia rugosa</i>	Yakka skink	V	V
	<i>Tympanocryptis</i> cf. <i>tetraporophora</i> <sup>†, ††</sup>	Grassland earless dragon	E	E
	<i>Acanthophis antarcticus</i>	Common death adder	-	NT
	<i>Furina dunmali</i>	Dunmall's snake	V	V
	<i>Hemiaspis damelii</i>	Grey snake	-	E
Birds	<i>Accipiter novaehollandiae</i>	Grey goshawk	-	NT
	<i>Lophoictinia isura</i>	Square-tailed kite	-	NT
	<i>Nettapus coromandelianus</i>	Cotton pygmy-goose	-	NT
	<i>Stictonetta naevosa</i>	Freckled duck	-	NT
	<i>Calyptorhynchus lathami</i>	Glossy black-cockatoo	-	V
	<i>Ephippiorhynchus asiaticus</i>	Black-necked stork	-	NT
	<i>Geophaps scripta scripta</i>	Squatter pigeon (southern)	V	V
	<i>Anthochaera phrygia</i> <sup>§§</sup>	Regent honeyeater	E	E
	<i>Grantiella picta</i>	Painted honeyeater	-	NT
	<i>Melithreptus gularis</i>	Black-chinned honeyeater	-	NT

**Table 17.7 Listed fauna species identified in the project development area (cont'd)**

Group	Scientific Name	Common Name	EPBC Act Status*	Nature Conservation Act Status*
Birds (cont'd)	<i>Neophema pulchella</i>	Turquoise parrot	-	NT
	<i>Rostratula australis</i> <sup>§§</sup>	Australian painted snipe	V	V
Mammals	<i>Dasyurus maculatus maculatus</i>	Spotted-tailed quoll	E	V
	<i>Chalinolobus picatus</i>	Little pied bat	-	NT
	<i>Nyctophilus corbeni</i> <sup>§</sup>	South-eastern long-eared bat	V	V

Source: Individual species assessments can be found in Appendix K, Terrestrial Ecology Impact Assessment.

\*E = 'Endangered', V = 'Vulnerable', NT = 'Near threatened', - none.

§ Other names = *Nyctophilus timoriensis*

\*\*Extremely sensitive.

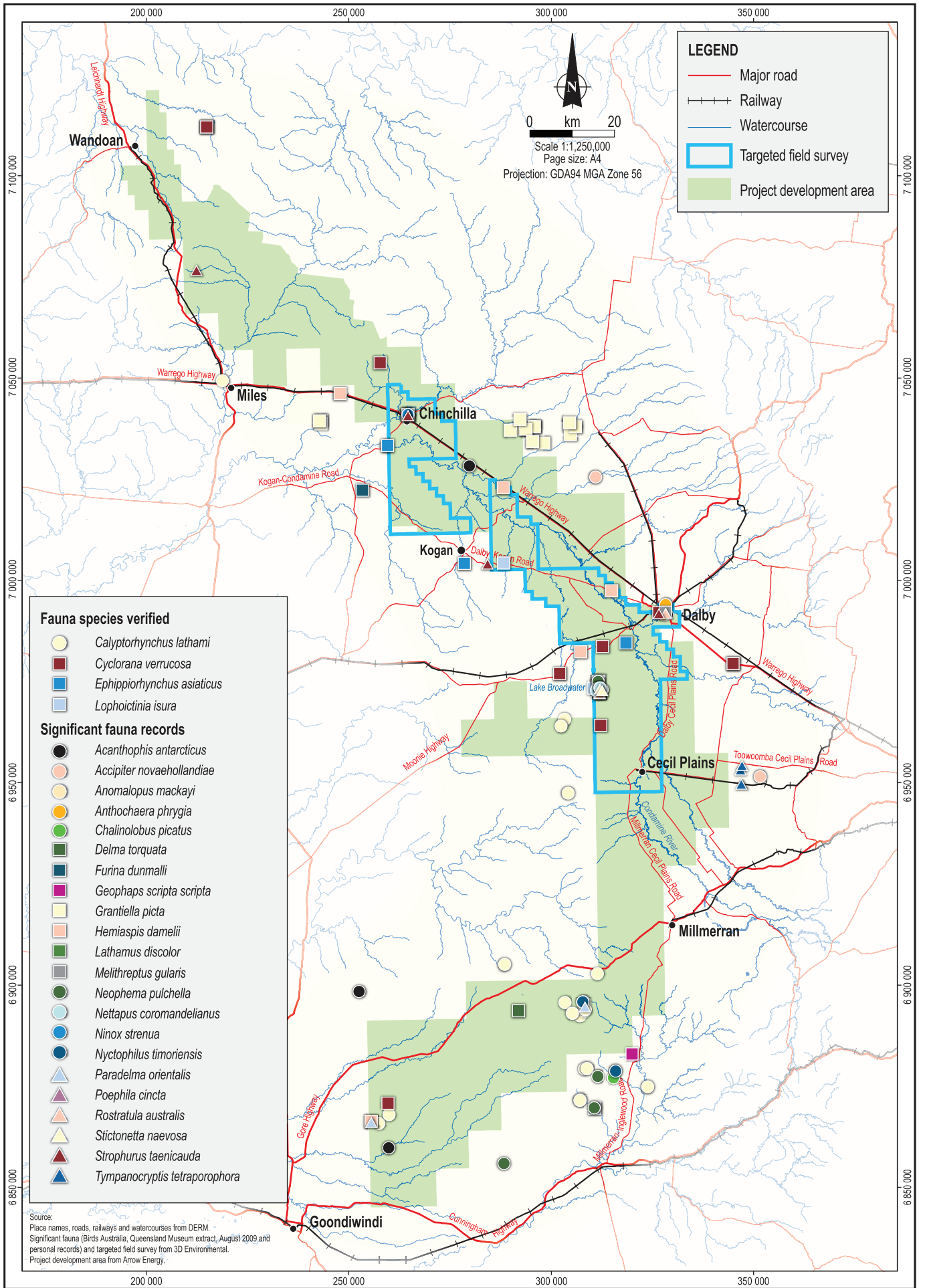
†Highly sensitive.

†† Two species of earless dragon have been identified through the impact assessment: EPBC Act- listed grassland earless dragon (*Tympanocryptis pinguicolla*), and the newly state listed Darling Downs earless dragon (*Tympanocryptis cf. tetraporophora*). Genetic studies suggest that the grassland earless dragon (*Tympanocryptis pinguicolla*) does not occur in the project development area and the earless dragon present is more likely to be the Darling Downs earless dragon (*Tympanocryptis cf. tetraporophora*). For assessment purposes, both species (and their associated national- and state listings) have been referred to as the grassland earless dragon, *Tympanocryptis cf. tetraporophora*.

A total of 29 EPBC Act-listed migratory fauna species were identified as potentially occurring in the project development area and six of these were verified during field surveys. Of the species verified, one migratory marine, one migratory wetland and four migratory terrestrial species were recorded. Nearly half of the migratory species with potential to occur within the project development area are wader species, typical of estuarine habitats. These species may occur at Lake Broadwater and other permanent and semi-permanent watercourses, which are likely to provide suitable habitat for threatened migratory species.

In addition to species listed under state and national legislations, 47 non-listed species of bioregional significance (e.g., scientific value or of cultural significance) were identified (e.g., koala).

Pest fauna species are listed in the Land Protection (Pest and Stock Route Management) Act. Class 2 species are species which have or may have a substantial negative economic, environmental or social impact. Seven Class 2 declared pest species were identified within the project development area, namely wild dog (*Canis familiaris*), European red fox (*Vulpes vulpes*), feral cat (*Felis catus*), feral deer (*Cervus spp.*), feral goat (*Capra hircus*), European rabbit (*Oryctolagus cuniculus*) and feral pig (*Sus scrofa*). The European rabbit does not pose a threat within the area due to unfavourable ecological conditions.



**LEGEND**

- Major road
- + -+ -+ -+ Railway
- Watercourse
- Targeted field survey
- Project development area

**Fauna species verified**

- Calyptorhynchus lathami*
- Cyclorana verrucosa*
- Ephippiorhynchus asiaticus*
- Lophoictinia isura*

**Significant fauna records**

- Acanthopis antarcticus*
- Accipiter novaehollandiae*
- Anomalopus mackayi*
- Anthochaera phrygia*
- Chalinolobus picatus*
- Delma torquata*
- Furina dunmali*
- Geophaps scripta scripta*
- Grantiella picta*
- Hemiaspis damelii*
- Lathamus discolor*
- Melithreptus gularis*
- Neophema pulchella*
- Nettapus coromandelianus*
- Ninox strenua*
- Nyctophilus timoriensis*
- Paradelma orientalis*
- Poephila cincta*
- Rostratula australis*
- Stictonetta naevosa*
- Strophurus taenicauda*
- Tympanocryptis tetraporophora*

Source:  
 Place names, roads, railways and watercourses from DERM.  
 Significant fauna (Birds Australia, Queensland Museum extract, August 2009 and personal records) and targeted field survey from 3D Environmental.  
 Project development area from Arrow Energy.

These other six species have increased potential to proliferate and affect native fauna values within the project development area. The cane toad (*Rhinella marina*- no classification given) is also considered to have a substantial risk of proliferation and impact.

A complete species list of flora, fauna and pest species identified in the desktop study and field surveys is provided in Appendix K, Terrestrial Ecology Impact Assessment.

### 17.3.5 Summary of Terrestrial Ecology Values

Each terrestrial ecology environment identified within the project development area contains unique attributes. These attributes dictate the overarching value of each terrestrial ecology environment and formed the basis of the assessment from which the sensitivity of the value was determined. A summary of the overarching environmental values is presented in Table 17.8.

The terrestrial ecology present within the project development area has been categorised into 16 existing environments as a means of summarising the array of environmental values in a summary for the purposes of the EIS main report. The summary of values acknowledges that the existing environments listed in Table 17.8 have inherently identified impacts on flora and fauna within the project development area through the assessment of core habitat and habitat known to contain species of environmental concern. Where particular regional ecosystems share a similar listing in state or national acts and the same sensitivity rating, they have been grouped together. The existing environment categories also take advantage of the fact that listed ecological communities are very similar in most respects to the Queensland-based regional ecosystems, and they have therefore been correlated as such. For the detailed breakdown of terrestrial ecology environmental values and the associated sensitivity for each, see the Terrestrial Ecology Impact Assessment Report (Appendix K).

**Table 17.8 Attributes and sensitivities allocated to values of each existing environment**

Existing Environment	Attributes	Sensitivity of the Value
EPBC Act Community: Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (REs 11.3.21, 11.3.24).	<ul style="list-style-type: none"> <li>Nationally and state listed ('critically endangered').</li> <li>Confined almost entirely to designated stock routes.</li> <li>Exhibit high integrity.</li> <li>Assessed as 'good-quality' grasslands under the EPBC threshold criteria.</li> </ul>	Extremely High
EPBC Act Community: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (RE 11.8.2a).	<ul style="list-style-type: none"> <li>Nationally and state listed ('critically endangered').</li> <li>Intact habitat with minimal fragmentation.</li> <li>Largely confined to inaccessible terrain.</li> </ul>	Extremely High
Category A ESAs: <ul style="list-style-type: none"> <li>Wondul Range National Park.</li> <li>Bendidee National Park.</li> <li>Lake Broadwater Conservation Park.</li> </ul>	<ul style="list-style-type: none"> <li>Nationally and state listed ('endangered').</li> <li>Exhibit high integrity.</li> <li>Special biodiversity values.</li> <li>Core habitats for many listed species.</li> <li>Migratory bird habitat.</li> </ul>	Extremely High

**Table 17.8 Attributes and sensitivities allocated to values of each existing environment (cont'd)**

Existing Environment	Attributes	Sensitivity of the Value
Chinchilla rifle range and natural grassland road reserves (Dalby Kogan, Dalby Cecil Plains, and Dalby St George).	<ul style="list-style-type: none"> <li>• Best preserved tracts of vegetation type.</li> <li>• Special biodiversity values.</li> <li>• Core habitats for select listed species.</li> </ul>	Extremely High
EPBC Act Community: Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant) (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6).	<ul style="list-style-type: none"> <li>• Nationally and state listed ('endangered').</li> <li>• <i>Acacia harpophylla</i> communities.</li> <li>• Core habitats for select listed species.</li> </ul>	High
EPBC Act Community: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions (REs 11.9.4a, 11.8.3).	<ul style="list-style-type: none"> <li>• Nationally and state listed ('endangered').</li> <li>• Special biodiversity values (wildlife refugia).</li> <li>• Special biodiversity values (specific species composition).</li> <li>• Limited extent.</li> </ul>	High
EPBC Act Community: Weeping Myall Woodlands.	<ul style="list-style-type: none"> <li>• Nationally listed ('endangered').</li> <li>• Best preserved in road reserves and stock routes.</li> <li>• Limited extent.</li> </ul>	High
Category B ESAs: REs with an 'endangered' biodiversity status, not EPBC Act -listed: 11.3.17, 11.4.12 and 11.9.10.	<ul style="list-style-type: none"> <li>• State significance.</li> <li>• Vegetation complexity.</li> <li>• Minor historical impacts.</li> <li>• Larger structurally complex patches.</li> <li>• High species diversity and abundance.</li> <li>• Core habitats for many listed species.</li> </ul>	High
Category C ESAs by tenure: <ul style="list-style-type: none"> <li>• Gurulmundi State Forest.</li> <li>• Bendidee State Forest.</li> <li>• Binkey State Forest.</li> <li>• Barakula State Forest.</li> </ul>	<ul style="list-style-type: none"> <li>• State significance.</li> <li>• Vegetation complexity.</li> <li>• Minor historical impacts.</li> <li>• Larger structurally complex patches.</li> <li>• High species diversity and abundance.</li> <li>• Core habitat for many listed species.</li> </ul>	High
Wyaga-Kindon Ooline populations.	<ul style="list-style-type: none"> <li>• State significance.</li> <li>• Isolated population of the ooline tree (<i>Cadellia pentastylis</i>).</li> </ul>	High
Stock routes* and state or bioregional wildlife corridors.	<ul style="list-style-type: none"> <li>• Encompass the 10 largest vegetation tracts identified within the Brigalow Belt South bioregion.</li> <li>• Stock routes may provide valuable corridors for faunal movement, as well as habitat preservation and linkage.</li> <li>• Well-preserved riparian vegetation, with mature canopy trees and established groundcover.</li> </ul>	High

**Table 17.8 Attributes and sensitivities allocated to values of each existing environment (cont'd)**

Existing Environment	Attributes	Sensitivity of the Value
Essential habitat (supporting listed wildlife species).	<ul style="list-style-type: none"> <li>Comprises habitat capable of supporting one or more breeding pairs and important resources (such as nest sites, roostcaves, major food sources) for species of regional significance (both threatened and non-threatened).</li> <li>Also identified within Category C ESAs, e.g., the bull oak jewel butterfly (<i>Hypochrysops piceatus</i>) within Bendidee State Forest adjoining Bendidee National Park.</li> </ul>	High
EPBC Act Community: Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South bioregions (RE 11.3.3).	<ul style="list-style-type: none"> <li>Nationally listed ('endangered').</li> <li>Small pockets of the ecological community.</li> <li>Found in association with koala food trees (<i>Eucalyptus tereticornis</i>).</li> </ul>	Moderate
REs 11.3.2, 11.3.25, 11.3.4, 11.3.27 and 11.9.7.	<ul style="list-style-type: none"> <li>State listed ('least concern').</li> </ul>	Moderate
Other state forests and timber reserves.	<ul style="list-style-type: none"> <li>Possible core habitat for listed species.</li> </ul>	Moderate
All regional ecosystems identified within the project development area that are not listed above (see Table 17.4).	<ul style="list-style-type: none"> <li>State listed ('least concern').</li> </ul>	Low

\*Regional ecosystems along stock routes that were identified through field surveys are of extremely high or high sensitivity and are provided in this table as listed regional ecosystems (including those identified along the extremely high sensitivity road reserves). The category designated by the asterisk captures any stock routes outside the area surveyed that may support additional, highly sensitive regional ecosystems.

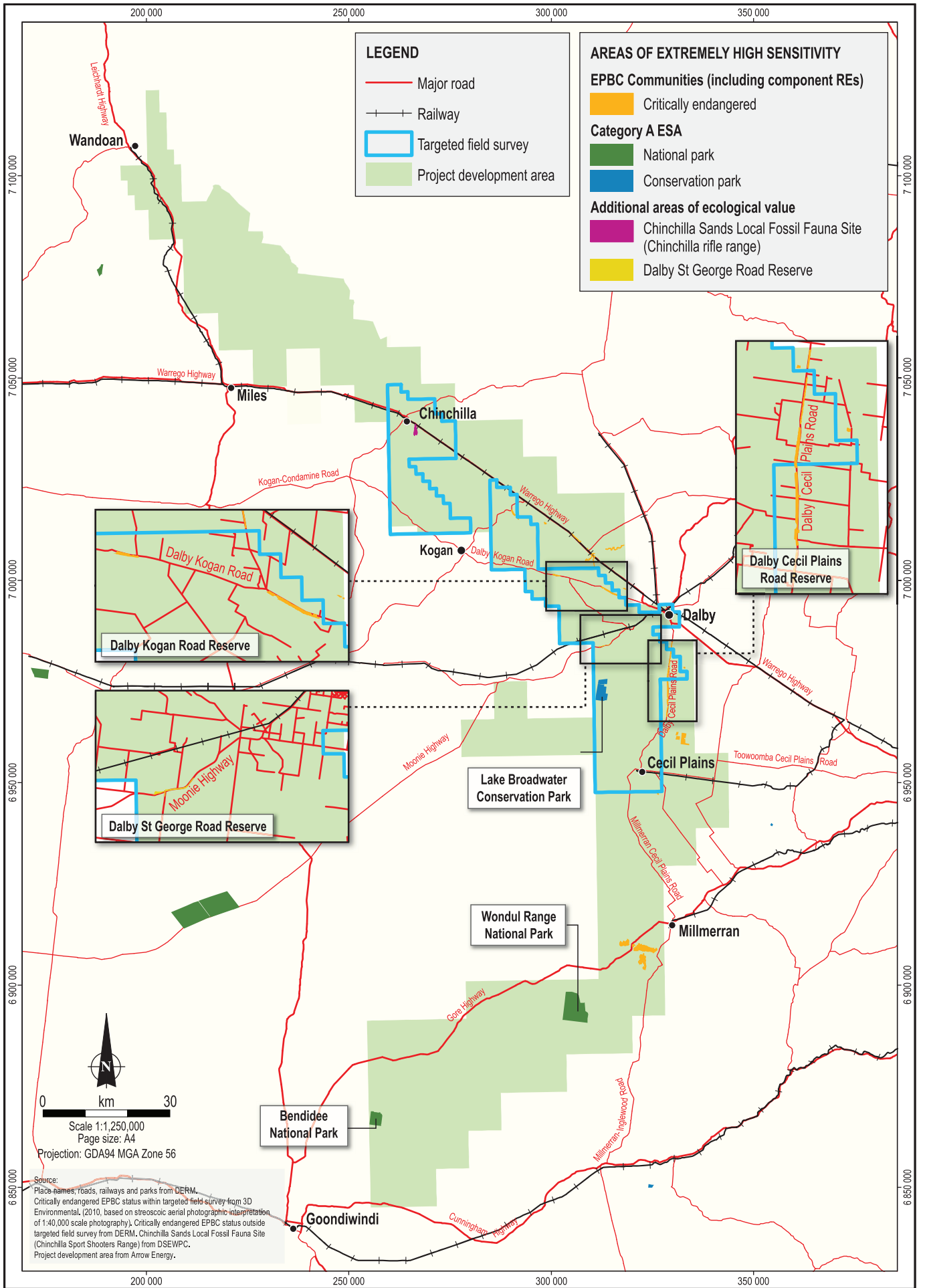
Existing environments identified as being of extremely high and high sensitivity are shown in Figures 17.7 and 17.8 respectively.

Sensitive regional ecosystems within the project development area are summarised in Table 17.9 below.

**Table 17.9 Portion of project development area comprising sensitive habitat**

Sensitive Habitat	Extent of the Project Development Area*	
	(ha)	(%)
Extremely sensitive areas	1,980	0.23
Highly sensitive areas	16,682	1.96
Moderately sensitive areas	21,701	2.55
Low sensitivity areas	222,910	26.24
Not sensitive areas	586,107	69.00

\*Values do not add to 100% due to rounding.



**LEGEND**

- Major road
- +— Railway
- Targeted field survey
- Project development area

**AREAS OF EXTREMELY HIGH SENSITIVITY**

**EPBC Communities (including component REs)**

- Critically endangered

**Category A ESA**

- National park
- Conservation park

**Additional areas of ecological value**

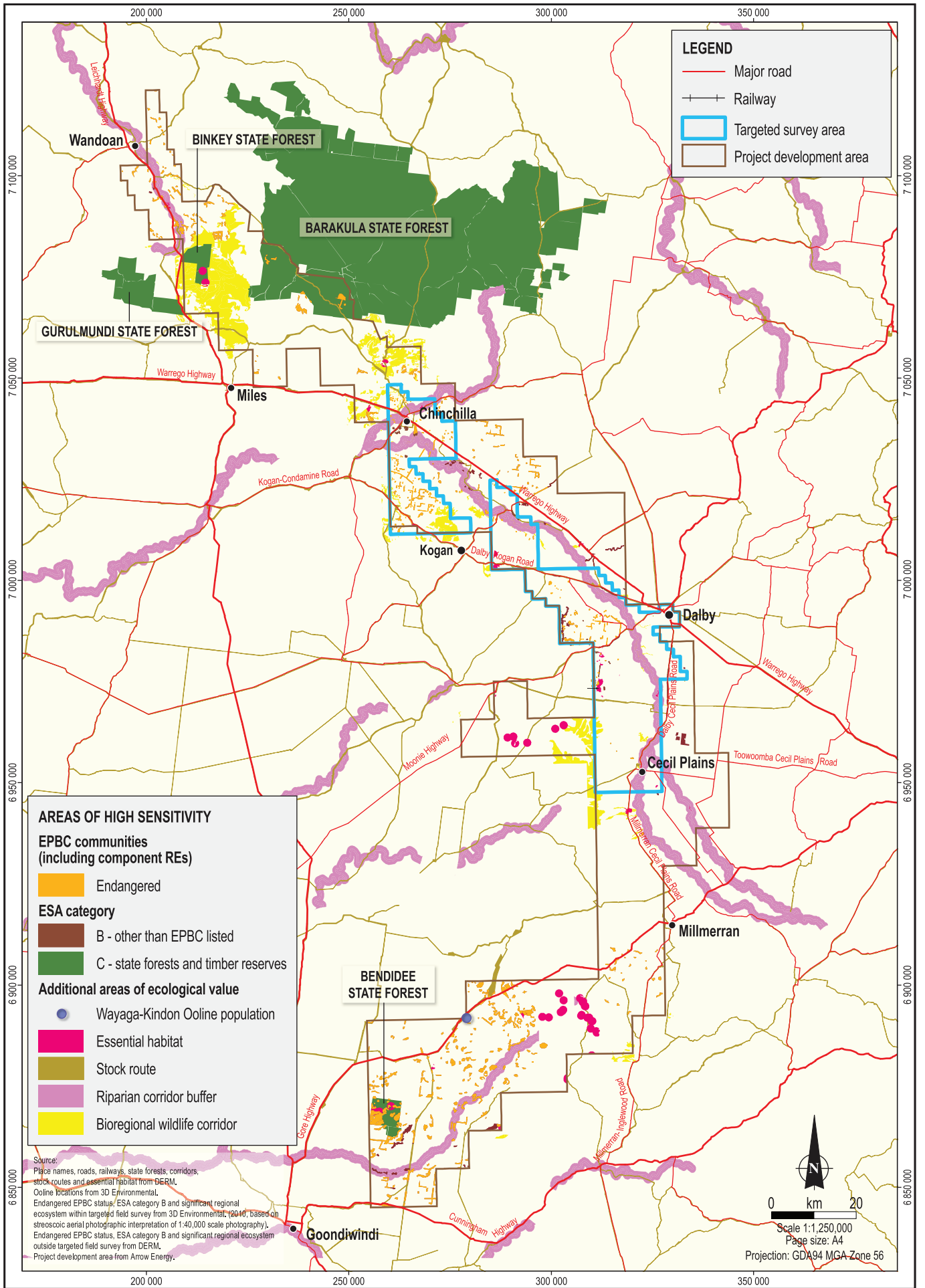
- Chinchilla Sands Local Fossil Fauna Site (Chinchilla rifle range)
- Dalby St George Road Reserve

0 km 30

Scale 1:1,250,000  
Page size: A4  
Projection: GDA94 MGA Zone 56

Source:  
Place names, roads, railways and parks from DERM.  
Critically endangered EPBC status within targeted field survey from 3D Environmental, (2010, based on stereoscopic aerial photographic interpretation of 1:40,000 scale photography). Critically endangered EPBC status outside targeted field survey from DERM. Chinchilla Sands Local Fossil Fauna Site (Chinchilla Sport Shooters Range) from DSEWPC.  
Project development area from Arrow Energy.





**LEGEND**

- Major road
- +— Railway
- Targeted survey area
- Project development area

**AREAS OF HIGH SENSITIVITY**

**EPBC communities (including component REs)**

- Endangered

**ESA category**

- B - other than EPBC listed
- C - state forests and timber reserves

**Additional areas of ecological value**

- Wayaga-Kindon Ooline population
- Essential habitat
- Stock route
- Riparian corridor buffer
- Bioregional wildlife corridor

Source:  
 Place names, roads, railways, state forests, corridors, stock routes and essential habitat from DERM.  
 Ooline locations from 3D Environmental.  
 Endangered EPBC status/ ESA category B and significant regional ecosystem within targeted field survey from 3D Environmental (2014, based on stereoscopic aerial photographic interpretation of 1:40,000 scale photography).  
 Endangered EPBC status, ESA category B and significant regional ecosystem outside targeted field survey from DERM.  
 Project development area from Arrow Energy.



Scale 1:1,250,000  
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 Projection: GDA94 MGA Zone 56

## 17.4 Issues and Potential Impacts

The significance of potential impacts on the identified terrestrial ecology environmental values has been assessed by considering the sensitivity of the value and the magnitude of the potential impact as described in Chapter 7, Impact Assessment Method. Potential direct and indirect impacts on the environmental values from associated project activities are outlined below.

### 17.4.1 Habitat Fragmentation and Isolation of Populations

Vegetation clearance has the potential to impact upon intact corridors that connect the landscape and help facilitate movement of terrestrial fauna species.

Discounting habitat degradation and loss of individuals of flora and fauna that occur due to edge effects, which are raised in Sections 17.4.2 and 17.4.3, fragmentation resulting from project activities may lead to:

- An altered landscape (and hence habitat) mosaic.
- Modification of large core unmodified habitats that may be structurally varied, contain source populations and have high habitat heterogeneity.
- Increased barriers to movement, isolating populations or reducing movement rates.
- Impacts on significant wildlife corridors, including riparian areas along Wilkie Creek, Charleys Creek and the Condamine River.

Clearing within corridors may isolate populations or reduce movement thereby creating subpopulations within a larger population. The severity of modifying vegetation within corridors will have varied effects on movement rates, with the magnitude of impact being directly related to the final location of infrastructure and the extent to which sensitive values can be avoided. In the event that avoidance is not practicable, production facilities are likely to have a less significant impact than wells, gathering lines and access tracks because production facilities are relatively non-linear in extent and will most likely affect the movement of smaller ground-dwelling species (some small lizards) and arboreal mammals only.

### 17.4.2 Habitat Loss or Degradation and Fauna Mortality

Impacts resulting in habitat loss or degradation and fauna mortality could result from project activities.

#### Habitat Loss and Degradation

Habitat will be lost through clearing of vegetation for the coal seam gas and water gathering systems, access roads, temporary camps, production wells, production facilities and borrow pits.

Habitat degradation could result from dust generated by vehicle movement, noise, light spill or the spread and invasion of pest flora and fauna species and exposure to contaminants.

**Pest Flora.** Four exotic flora species, all of which are classified as weeds, are considered to have a high potential for impact within the project development area due to the favourable climatic conditions and habitats available:

- African lovegrass (*Eragrostis curvula*) is an aggressive and difficult-to-control, grassy weed that is widely established on road verges. The species has the long-term potential to displace native pasture grasses and decrease grazing productivity. African lovegrass provides a potential threat to the integrity of native grassland and associated listed species.

- Parthenium (*Parthenium hysterophorus*) colonises weak pastures with disturbed ground cover. A few widely scattered occurrences have been recorded on roadsides within and in the vicinity of the project development area; however, no major infestations are known.
- Mesquite (*Prosopis glandulosa* var. *glandulos*, *Prosopis velutina*), which forms dense impenetrable thickets in riparian areas that can outcompete native vegetation, is known from a few scattered records around Brookstead and Millmerran on heavy soils.
- Lippia (*Phyla canescens*) is widespread on the floodplains in the project development area and is a prominent weed on the floodplain of the Condamine River, displacing native ground covers. The species spreads both vegetatively and by seed and severely threatens grazing productivity. Its deep-rooting nature may be associated with streambank erosion and is considered a major threat to floodplains and native pasture grasses.

If exotic plants are not managed, the project has the potential to increase their abundance and facilitate dispersal which may have negative economic and social effects as well as negative impacts on native vegetation and biodiversity. Mechanisms of weed dispersal from project activities are generally associated with:

- Movement of equipment and machinery, particularly machinery sourced from adjacent regions.
- Ground disturbance, such as grading, removal and relocation of topsoil.

**Pest Fauna.** Project-related activities have the potential to increase pest fauna abundance, which could lead to increased competition with and predation of native fauna and habitat degradation (e.g., through wallowing and foraging by feral pigs). In particular, pest fauna abundance and distribution may increase due to:

- The construction of linear infrastructure, which may create pathways and increase dispersal capability.
- The construction of dams, which can provide a permanent water source for feral animals, thereby increasing their abundance and distribution. In addition, dams may attract cane toads, increasing the risk of toxic ingestion in predatory species, such as grey snake, common death adder and black-necked stork.
- Putrescible waste dumps, which can become a food resource for a variety of pest fauna species, leading to an increase in their abundance.

Fauna species considered to have a moderate potential for increased distribution as a result of project activities include:

- Cane toad (*Rhinella marina*).
- European red fox (*Vulpes vulpes*).
- Feral cat (*Felis catus*).
- Wild dog (*Canis familiaris*).
- Feral pig (*Sus scrofa*).

### **Fauna Mortality**

Fauna mortality can potentially result from entrapment in the pipe trench and dams, vehicle strikes or displacement and starvation as a result of vegetation clearance. Mortality of small mammals and reptiles residing within piled logs and debris may occur during movement of these materials during rehabilitation works.

### **17.4.3 Edge Effects**

Edge effects occur where project activities encroach on the perimeter of a vegetation community. The structural type of the community and the extent and type of disturbance at the perimeter of the community determines the degree to which ecosystem function is affected, particularly the extent to which the community can continue to provide viable habitat. Changes resulting from edge effects include modified composition and structure of the community (as perimeter plants are exposed to different light conditions and the drying affects of wind) and refuge loss as fauna species withdraw deeper into the community.

### **17.4.4 Alteration of Ecological Processes**

There is the potential for the alteration of ecological processes, including fire frequency, fire extent and surface water flow conditions, to occur as a result of project activities.

Specifically, the project will be conducting construction activities (i.e., welding) and operations activities (i.e., flaring) that have the potential to increase the risk of ignition and fire if not conducted in accordance with applicable procedures. Furthermore, the clearing of forests will alter the natural burning patterns through artificially created fire breaks along access roads and pipeline rights of way (ROWs).

Increased erosion and surface water flow disturbance may result from ground clearance, physical obstructions and increased runoff due to ground compaction. This flow disturbance could impact on vegetation communities and fauna, particularly migratory species around natural wetlands.

### **17.4.5 Project Activities with Potential to Impact Terrestrial Ecology Environmental Values**

Project activities that may cause potential adverse impacts on terrestrial ecology environmental values during the construction, operations and decommissioning phases of the project are described below.

#### **Construction**

The project activities most likely to adversely impact on terrestrial ecology environmental values are the construction of production wells and associated low- and medium-pressure gas and water gathering pipelines and the construction of high-pressure gas pipelines, through:

- Site clearance.
- Ground disturbance and soil movements.
- Potential spills of hazardous materials.
- Vehicle movement (which potentially leads to fauna strikes and the spread of weeds and pathogens).
- Construction activities that create barriers to fauna movement or pathways for pest species.
- Trenching (which, when left open, may entrap animals and interfere with fauna movement pathways).
- Light and noise emissions.
- Storage of putrescible waste.

Construction of the production facilities will also involve these activities; however, they will be localised to the site, which will be selected to reduce impacts on terrestrial flora and fauna.

### **Operations**

During operations, the following project activities could impact upon environmental values:

- Release or spill of waste water or hazardous materials.
- Vehicle movements.
- Light and noise emissions.
- Storage of putrescible waste.

### **Decommissioning**

During the decommissioning phase, impacts on terrestrial ecology environmental values will be similar to the construction and operations activities. These will occur in addition to the removal of infrastructure (e.g., pipelines and foundations), which will involve ground disturbance. These activities will predominately occur in previously disturbed areas.

## **17.5 Environmental Protection Objectives**

The environmental protection objectives for terrestrial ecology are:

- To minimise habitat loss and fauna mortality.
- To avoid or minimise adverse effects on and to protect terrestrial ecosystems and associated biodiversity and habitat of state and national conservation significance.
- To avoid or minimise adverse impacts on and to protect ESAs.
- To prevent project activities from introducing or spreading new or existing exotic terrestrial flora or fauna.

## **17.6 Avoidance, Mitigation and Management Measures**

Avoidance, mitigation and management measures have been proposed to achieve the identified environmental protection objectives.

### **17.6.1 General Measures**

The primary means by which environmental protection for terrestrial ecology will be achieved is through design and site selection that results in avoidance of high-value sites. Arrow's environmental framework focuses on early identification of sensitive locations that should be avoided by project activities, as described in Chapter 8, Environmental Framework. Arrow will conduct the below measures that mitigate impacts on terrestrial ecology.

#### **Planning and Design**

Through the planning and design phase, areas of extremely high sensitivity will be avoided.

- Avoid the following areas:
  - Wondul Range National Park, Bendidee National Park and Lake Broadwater Conservation Park (Category A ESAs).
  - Chinchilla Sands Local Fossil Fauna Site.

- ‘Critically endangered’ EPBC Act communities within the project development area (REs 11.3.21, 11.3.24, 11.8.2a), including three natural grassland road reserves (Dalby Kogan, Dalby Cecil Plains and Dalby St George Road). [C217]
- Aim to avoid:
  - Additional national- and state-listed communities: Brigalow (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6), Semi-evergreen vine thickets (REs 11.9.4a, 11.8.3), Weeping Myall Woodlands, and Coolibah Blackbox Woodlands (RE 11.3.3).
  - Category B ESAs.
  - Category C ESAs, including Gurulmundi State Forest, Bendidee State Forest, Binkey State Forest and Barakula State Forest.
  - Wyaga-Kindon Ooline populations.
  - Stock routes and state or bioregional wildlife corridors.
  - Essential and core habitat (supporting listed wildlife species).
  - State forests and resources reserves.
  - State-listed ‘of concern’ regional ecosystems. [C218]

Where not possible to avoid Bendidee State Forest (which provides habitat for the ‘endangered’ bull oak jewel butterfly), conduct activities in predisturbed areas following the development and implementation of a bull oak jewel butterfly management plan with regard to the existing recovery plan (Lundie-Jenkins & Payne, 2000). [C249]

Should Arrow seek to work within disturbed areas within the Bendidee State Forest, a preconstruction clearance survey of the forest will also be conducted with input from a butterfly specialist to inform the critical habitat and food resource of the bull oak jewel butterfly (*Hypochrysops piceata*). [C523]

Conduct preconstruction clearance surveys to identify any additional areas that may need to be avoided. [C220]

## **Construction and Operations**

During construction and operations, a number of buffers will need to be enforced. The success of managing these buffers will be improved through clear direction and awareness for workers (including contracting personnel). Establishment and management of buffers will be as follows:

- Manage potential impacts to Category A, B and C ESAs through implementation of the buffers proposed in Table 17.10. [C227]
- Implement a 100-m buffer zone from the high bank of all watercourses to ensure that no development or clearance occurs within these buffers (other than construction of watercourse crossings for roads, pipelines and discharge infrastructure and associated stream monitoring equipment). [C157]
- Ensure boundaries are clearly marked for site-specific sensitive areas that require avoidance. [C228]

- Ensure relevant workers, including contract plant and machinery operators, are made aware of the location of significant remnant vegetation and buffers and are guided by qualified personnel when clearing is undertaken. [C229]
- Demarcate buffers and inform workers and machinery operators of buffer locations when working within the vicinity of national- and state-listed communities and areas identified for potential avoidance. [C230]

The following definitions relating to project activities apply:

- **Low-Impact Activities.** These activities include the limited prescribed activities that do not result in the clearing of native vegetation, cause disruption to soil profiles through earthworks or excavation, or result in significant disturbance to land. Examples of such activities include but are not limited to soil surveys; topographic, cadastral and ecological surveys; and traversing land by car or foot via existing access tracks or routes.
- **Limited Petroleum Activities.** Such activities include single well sites not exceeding 1 ha of disturbance and multi-well sites not exceeding 1.5 ha of disturbance, geophysical surveys, ecological and geological surveys, gathering pipelines from a wellhead to the initial production facility, supporting access tracks, and roads and communication and powerlines necessary for the undertaking of petroleum activities. The definition excludes construction of dams, borrow pits, production facilities and construction camps.

**Table 17.10 Proposed buffer distances from the ESA boundary**

ESA Category	Proposed Activities within the ESA	Proposed Activities within 200 m of the ESA Boundary	Proposed Activities within a Secondary Protection Zone*
Category A	None	Low-impact activities	Limited petroleum activities within 800 m of the primary protection zone. <sup>†</sup>
Category B: excluding regional ecosystems with 'endangered' status	Low-impact activities	Low-impact activities	Limited petroleum activities within 300 m of the primary protection zone. <sup>†</sup>
Category B: regional ecosystems with an 'endangered' status	Limited petroleum activities	Limited petroleum activities	Only limited petroleum activities within 300 m of the primary protection zone. <sup>†</sup>
Category C: excluding regional ecosystems with an 'of concern' status, state forests and timber reserves	Low-impact activities	Low-impact activities	Limited petroleum activities within 300 m of the primary protection zone. <sup>†</sup>
Category C: regional ecosystems with an 'of concern' status, state forests and timber reserves	Limited petroleum activities	Limited petroleum activities	Limited petroleum activities within 300 m of the primary protection zone. <sup>†</sup>

\* ESA buffers (derived from the guidelines under the EP Act 1994; Model Conditions for level 1 Environmental Authorities for Coal Seam Gas Activities) will be applied unless the activity occurs in pre-existing cleared areas or significantly disturbed land within the buffer and no reasonable or practicable alternatives exist.

† The primary protection zone is considered to be within 200 m of the ESA boundary.

## Decommissioning

Prior to commencing ground disturbance activities, Arrow will develop a project rehabilitation plan or implement a procedure that will:

- Implement site planning, preparation and management requirements in accordance with a developed and approved decommissioning and rehabilitation plan. [C245]
- Decommission the pipeline corridors in a manner that minimises potential impacts on the environment. [C246]
- Identify areas for rehabilitation. [C247]
- Prioritise areas for rehabilitation based on the preconstruction clearance survey baseline characteristics. [C248]
- Advise, through procedures and plans, on requirements for rehabilitation in identified areas that are no longer in use. [C250]
- Clear areas progressively and implement rehabilitation as soon as practicable following construction activities. [C015]
- Reinstate self-supporting drainage lines. [C251]
- Inspect rehabilitation areas after decommissioning for regrowth similar to the surrounding environment. [C252]

### 17.6.2 Habitat Fragmentation and Isolation of Populations

Project activities with the potential to cause habitat fragmentation and isolation of populations largely relate directly to site-clearing activities and, in particular, the construction of access roads and gas and water gathering systems. Mitigation and management measures that will address the potential for this adverse impact will require Arrow to:

- Minimise the disturbance footprint and vegetation clearing. [C020]
- Minimise the width of construction ROWs within areas of sensitivity to the greatest extent practicable without compromising the safety of workers. [C231]
- Clear areas progressively and implement rehabilitation as soon as practicable following construction and decommissioning activities. [C015]

### 17.6.3 Habitat Loss or Degradation and Fauna Mortality

Potential impacts resulting in habitat loss or degradation and fauna mortality would result primarily from such activities as trenching, site clearing and watercourse crossings.

Mitigation and management measures identified in Section 17.6.2, Habitat Fragmentation and Isolation of Populations, also address these potential impacts. Additional measures identified to minimise potential habitat loss or degradation, as well as fauna mortality, are as follows:

#### Habitat Loss

Mitigation and management measures to minimise the potential for habitat loss are to:

- Conduct preconstruction clearance surveys and include as a minimum:
  - Vegetation mapping at a scale suitable for site-specific planning.



- Identification of core habitats and listed species.
- Identification of site-specific sensitive areas that require avoidance or buffer areas. [C232]
- Retain habitat trees, where practicable. [C234]
- Translocate or propagate significant species where it is deemed necessary for use during rehabilitation or in offsets in accordance with relevant legislation. [C239]
- Consider the preconstruction clearance survey baseline characterisation when rehabilitating project sites. [C244]
- Develop threatened species management procedures as and when project activities are identified as likely to impact upon individuals. [C224]
- Avoid construction activities in waterbodies frequented by migratory species. [C225]
- Design gathering lines and tracks to avoid watercourses, drainage lines and riparian area (particularly permanent watercourses or perennial aquatic habitat), where practicable. [C191]

### **Habitat Degradation**

The major potential impacts result from improved access to the project area through the introduction of exotic weeds and fauna and pathogens, collection of flora and forest products, and exposure to contaminants, thereby increasing the potential for habitat degradation.

- Construct production wells, gathering lines and access tracks within cleared areas, where possible, with the aim of avoiding remnant vegetation and high-value regrowth. [C240]
- Implement noise control techniques in accordance with the noise and vibration commitments and standard industry noise suppression techniques. [C254]
- Minimise light spill from project activities to reduce disturbance to nocturnal fauna. [C255]
- Prohibit disturbance or harassment of wildlife and the unauthorised collection of flora and forest products. [C256]
- Confine project traffic to designated roads and access tracks, where practicable. [C033]
- Fell trees away from existing stands where practicable. Where trees unavoidably fall into a stand, leave trees in situ to emulate natural tree fall and provide habitat for ground-dwelling species where practicable. [C241]
- Avoid damaging standing trees not identified for removal. Limit the scraping of standing tree trunks and breaking of limbs by equipment as far as practicable. [C242]
- Install and maintain sediment and erosion control structures at work sites. [C261]
- Use coal seam gas water for dust suppression on roads or for construction and operations activities authorised in the environmental authority, in accordance with the water quality parameters described in the environmental authority. [C176]

Specific measures will be implemented to avoid habitat degradation by contamination and by pest plants and animals.

### ***Habitat Degradation (Contamination)***

- Apply appropriate international, Australian and industry standards and codes of practice for the handling of hazardous materials (such as chemicals, fuels and lubricants). [C035]
- Apply appropriate international, Australian and industry standards and codes of practice for the design and installation of infrastructure associated with the storage of hazardous materials (such as chemicals, fuels and lubricants). [C048]
- Carry out corrective immediately upon the identification of any contamination of soil or groundwater that has occurred as a result of project activities. [C038]

### ***Habitat Degradation (Pest Flora and Fauna)***

Mitigation and management measures to minimise the potential spread of weeds and pathogens are to:

- Identify declared weeds during the preconstruction field survey. [C193]
- Clear areas progressively and implement rehabilitation as soon as practicable following construction and decommissioning activities. [C015]
- Develop a declared weed and pest management plan in accordance with the Petroleum Industry - Pest Spread Minimisation Advisory Guide (Biosecurity Queensland, 2008). Undertake species-specific management for identified key weed species at risk of spread through project activities (mesquite, parthenium, African lovegrass and lippia). Increase weed control efforts in areas particularly sensitive to invasion. The pest management plan should include, as a minimum, training, management of pest spread, management of pest infestations, and monitoring effectiveness of control measures. [C188]
- Ensure all relevant personnel are made aware of the location and extent of weed infestations in the vicinity of the work area and the risks involved in moving from one site or property to another. [C179]
- When sourcing maintenance materials, ensure that such materials as bedding sand, topsoil, straw bales and sand bags are only brought to site after it is ascertained that the materials are not contaminated with weeds and plant or animal pathogens. A Weed Hygiene Declaration form must be requested from the supplier where there is possible risk of contamination in products. [C190]
- Design washdown facilities to ensure that runoff is contained on site and does not transfer weed seeds, spores or infected soils to adjacent areas. Treat or dispose of washdown solids in a registered landfill. [C187]
- Do not wash down vehicles in watercourses. [C180]
- Wash down vehicles and equipment that have potentially been in contact with weeds before entering new work sites. [C099]

Mitigation and management measures to minimise the potential for pest fauna population increase and expansion are to:

- Dispose of food scraps in large skips or bins that prevent animal access. Empty these storage devices regularly in a manner that does not involve disposal to onsite trenches or waste dumps. [C258]

- Train field personnel to identify key pest species and to maintain constant vigilance of weeds and pest fauna species throughout the project life to ensure early detection and intervention. [C259]

### **Fauna Mortality**

Mitigation and management measures to be conducted to minimise the potential for fauna mortality to result from project activities are to:

- Design dams to have an egress (escape point) for wildlife. [C214]
- Minimise the time a trench is left open. Construct exit points when construction is within 1 km of native vegetation, using appropriate material. Provide fauna refuges, such as sawdust-filled bags, regularly through areas of high fauna activity. [C233]
- Implement speed limits on project-controlled roads to reduce the potential for vehicle collisions with wildlife. [C260]
- Assess trees prior to felling for potential nesting hollows. If identified, fell trees in the presence of a qualified fauna spotter and roll them so that the hollows are facing upwards allowing fauna to escape. [C235]
- Identify key koalas trees (*Eucalyptus tereticornis* and *Eucalyptus populnea*), and visually inspect prior to clearing to ensure that they are free of koalas. If koalas are located, the tree should be retained until the animals have moved on, typically overnight. [C236]
- Use appropriately trained personnel or a wildlife handler to capture injured wildlife, where possible. If further action is required, consult with a qualified vet to determine appropriate action. [C237]
- Erect fauna-exclusion fences around project dams. [C243]
- During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality. [C473]

### **17.6.4 Edge Effects**

Most of the mitigations for habitat loss can reduce edge effects because they focus on reducing damage to the standing vegetation adjacent to areas of clearance. However, the most effective mitigations are those that allow the ROW to regenerate except for a narrow area over the pipeline. Rehabilitation should occur as soon as possible following disturbance.

Other mitigation measures include:

- Retain woody debris, logs and rocks for use in rehabilitation. These should be spread over part or all of the corridor or, as a minimum, piled along the edge of the cleared corridor to provide refuge for crossing fauna. [C238]
- Select plant species for the purposes of rehabilitation that are specific to the original ecosystem and local provenance, wherever practicable. [C253]

### **17.6.5 Altered Ecological Processes**

Project-related activities have the potential to alter surface water flow and fire regimes (fire extent and frequency) throughout the life of the project. Mitigation and management measures to minimise change to these processes include:

- Install and maintain appropriate sediment and erosion control structures at work sites. [C261]
- Design facilities to ensure natural surface water flows are not impounded, e.g., by installing culverts on roads and stormwater diversion ditches around production facilities. [C221]
- Develop fire plans for production facilities. [C223]

### 17.6.6 Habitat Offsets

Habitat offsets include measurable conservation outcomes resulting from actions designed to compensate for residual impacts from project activities after appropriate avoidance and mitigation measures have been taken.

Where avoidance is not possible, implement an offset strategy approved by a relevant government agency and comply with reporting conditions of an offset plan. [C219]

## 17.7 Residual Impacts

The avoidance, mitigation and management measures outlined above will avoid or reduce the severity of potential adverse impacts on terrestrial ecology environmental values. Areas of extremely high sensitivity will be avoided, thereby eliminating potential impacts in these areas and will therefore not be discussed below. The significance of any residual impacts in the less sensitive environments associated with project activities are described below.

### 17.7.1 Habitat Fragmentation and Isolation of Populations

Habitat fragmentation and isolation of populations largely relates to site-clearing activities. Following the implementation of mitigation measures in highly sensitive areas, the magnitude and significance of the residual impacts are expected to generally be **low** to **moderate**. The magnitude and significance of the residual impacts in moderate and low sensitive areas are predicted to be **insignificant** to **low**.

### 17.7.2 Habitat Loss or Degradation and Fauna Mortality

Project activities contributing to habitat loss or degradation and fauna mortality include site clearing, pipeline trenching and vehicle movements. Implementation of mitigation measures is expected to reduce residual impacts to **moderate** for highly sensitive areas and to **low** to **moderate** for moderate and low sensitive areas.

### 17.7.3 Edge Effects

Forest clearing for project infrastructure will contribute to edge effect impacts; however, with the implementation of mitigation measures, residual impacts are likely to range from **moderate** in highly sensitive areas to **low** or **moderate** in moderate and low sensitive areas.

### 17.7.4 Altered Ecological Processes

Project-related activities through site clearance and physical obstruction are likely to alter existing fire regimes and surface water flow. Residual impacts from the effective mitigation measures are expected to range from **low** to **moderate** in highly sensitive areas and **insignificant** or **low** in moderate and low sensitive areas.

### 17.7.5 Summary of Residual Impacts

Table 17.11 summarises the potential impacts prior to mitigation, along with proposed mitigation and management measures and the subsequent residual impacts assuming implementation of

proposed mitigation and management measures. For the detailed assessment, see Appendix K, Terrestrial Ecology Impact Assessment.

**Table 17.11 Summary of terrestrial ecology impact assessment**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b><i>Habitat fragmentation and isolation of populations</i></b>							
<b>Construction:</b> <ul style="list-style-type: none"> <li>• Site clearance.</li> <li>• Ground disturbance and soil movements.</li> <li>• Potential spills of hazardous materials.</li> <li>• Vehicle movement (which potentially leads to fauna strikes and the spread of weeds and pathogens).</li> <li>• Construction activities that create barriers to fauna movement or pathways for pest species.</li> <li>• Trenching (which, when left open, may entrap animals and interfere with fauna movement pathways).</li> <li>• Light and noise emissions.</li> <li>• Storage of putrescible waste.</li> <li>• Construction of production facilities will also involve these activities; however, they will be localised to the site which will be selected to reduce impacts on terrestrial flora and fauna.</li> </ul>	EPBC Act Community: Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (REs 11.3.21, 11.3.24).	Extremely High	Major	Major	Avoid	NA	NA
	EPBC Act Community: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (RE 11.8.2a).	Extremely High	High	Major	Avoid	NA	NA
	Category A ESAs: <ul style="list-style-type: none"> <li>• Wondul Range National Park.</li> <li>• Bendidee National Park.</li> <li>• Lake Broadwater Conservation Park.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA
	Chinchilla rifle range.	Extremely High	Major	Major	Avoid	NA	NA
	Road reserves: <ul style="list-style-type: none"> <li>• Dalby Kogan.</li> <li>• Dalby Cecil Plains.</li> <li>• Dalby St George.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Habitat fragmentation and isolation of populations (cont'd)</b>							
<p><b>Operations:</b></p> <ul style="list-style-type: none"> <li>Release or spill of waste water or hazardous materials.</li> <li>Vehicle movements.</li> <li>Light and noise emissions.</li> <li>Storage of putrescible waste.</li> </ul> <p><b>Decommissioning:</b></p> <ul style="list-style-type: none"> <li>During the decommissioning phase, impacts on terrestrial ecology environmental values are similar to the construction and operations activities. These will occur in addition to the removal of infrastructure (e.g., pipes and foundations), which will involve ground disturbance. These activities will predominately occur in previously disturbed areas.</li> </ul>	EPBC Act Community: Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant) (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6).	High	Moderate	Moderate	<ul style="list-style-type: none"> <li>Apply the specific planning and design, construction, operation and decommissioning mitigation measures.</li> <li>Minimise the disturbance footprint and vegetation clearing.</li> <li>Minimise the width of construction ROWs within areas of sensitivity to the greatest extent practicable without compromising the safety of workers.</li> <li>Clear areas progressively and implement rehabilitation as soon as possible following construction activities.</li> </ul>	Low	Moderate
	EPBC Act Community: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions (REs 11.9.4a, 11.8.3).	High	Moderate	Moderate		Low	Moderate
	EPBC Act Community: Weeping Myall Woodlands.	High	Low	Moderate		Low	Moderate
	Category B ESAs: REs with an 'endangered' biodiversity status, not EPBC-listed: 11.3.17 and 11.9.10.	High	Low	Moderate		Low	Moderate
	Category B ESA: RE with an 'endangered' biodiversity status, not EPBC-listed: 11.4.12.	High	High	High		Low	Moderate
	Category C ESA by tenure: Bendidee State Forest.	High	High	High		High	High
	Category C ESAs by tenure: <ul style="list-style-type: none"> <li>Gurulmundi State Forest.</li> <li>Binkey State Forest.</li> <li>Barakula State Forest.</li> </ul>	High	Moderate	Moderate		Moderate	Moderate

Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Habitat fragmentation and isolation of populations (cont'd)</b>							
	Wyaga-Kindon Ooline populations.	High	Major	Major		Moderate	Moderate
	Stock routes <sup>†</sup> and state or bioregional wildlife corridors.	High	High	High		Moderate	Moderate
	Essential habitat (supporting listed wildlife species).	High	High	High		Low	Moderate
	EPBC Act Community: Coolibah –Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South bioregions (RE 11.3.3).	Moderate	Low	Low		Negligible	Low
	REs 11.3.2, 11.3.25, 11.3.4, 11.3.27 and 11.9.7.	Moderate	Low to High	Low to Moderate		Low	Low
	Other state forests and timber reserves.	Low to Moderate	Moderate	Low to Moderate		Negligible	Insignificant to Low
	All regional ecosystems identified within the project development area that are not listed above (see Table T287).	Low	Low	Low		Negligible	Insignificant
<b>Habitat Loss or Degradation and Fauna Mortality</b>							
<b>Construction:</b> • Site clearance. • Ground disturbance and soil movements. • Potential spills of hazardous materials.	EPBC Act Community: Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (REs 11.3.21, 11.3.24).	Extremely High	Major	Major	Avoid	NA	NA



**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Habitat Loss or Degradation and Fauna Mortality (cont'd)</b>							
<ul style="list-style-type: none"> <li>• Vehicle movement (which potentially leads to fauna strikes and the spread of weeds and pathogens).</li> <li>• Construction activities that create barriers to fauna movement or pathways for pest species.</li> <li>• Trenching (which, when left open, may entrap animals and interfere with fauna movement pathways).</li> <li>• Light and noise emissions.</li> <li>• Storage of putrescible waste.</li> <li>• Construction of production facilities will also involve these activities, however, they will be localised to the site, which will be selected to reduce impacts on terrestrial flora and fauna.</li> </ul> <p><b>Operations:</b></p> <ul style="list-style-type: none"> <li>• Release or spill of waste water or hazardous materials.</li> <li>• Vehicle movements.</li> <li>• Light and noise emissions.</li> </ul>	EPBC Act Community: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (RE 11.8.2a).	Extremely High	High	Major	Avoid	NA	NA
	Category A ESAs: <ul style="list-style-type: none"> <li>• Wondul Range National Park.</li> <li>• Bendidee National Park.</li> <li>• Lake Broadwater Conservation Park.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA
	Chinchilla rifle range. and road reserves: <ul style="list-style-type: none"> <li>• Dalby Kogan.</li> <li>• Dalby Cecil Plains.</li> <li>• Dalby St George.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA
	EPBC Act Community: Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant) (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6).	High	Moderate	Moderate	<ul style="list-style-type: none"> <li>• Apply the specific planning and design, construction, operation and decommissioning mitigation measures.</li> </ul>	Low	Moderate

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Habitat Loss or Degradation and Fauna Mortality (cont'd)</b>							
<ul style="list-style-type: none"> <li>Storage of putrescible waste.</li> </ul> <p><b>Decommissioning:</b></p> <ul style="list-style-type: none"> <li>During the decommissioning phase, impacts on terrestrial ecology environmental values are similar to the construction and operations activities. These will occur in addition to the removal of infrastructure (e.g., pipes and foundations), which will involve ground disturbance. These activities will predominately occur in previously disturbed areas.</li> </ul>	EPBC Act Community: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions (REs 11.9.4a, 11.8.3).	High	Moderate	Moderate	<ul style="list-style-type: none"> <li>Conduct preconstruction clearance surveys.</li> <li>Retain habitat trees, where practicable.</li> <li>Translocate or propagate significant species where necessary.</li> <li>Consider site baseline characteristics when rehabilitating.</li> <li>Develop threatened species management procedures as and when project activities are identified as likely to impact upon individuals.</li> <li>Avoid construction activities in waterbodies frequented by birds and migratory species.</li> <li>Design gathering lines and tracks to avoid watercourses, drainage lines and riparian area (particularly permanent watercourses or perennial aquatic habitat), where practicable.</li> </ul>	Low	Moderate
	EPBC Act Community: Weeping Myall Woodlands.	High	Moderate	Moderate		Low	Moderate
	Category B ESAs: REs with an 'endangered' biodiversity status, not EPBC-listed: 11.3.17 and 11.9.10.	High	Low	Moderate		Low	Moderate
	Category B ESA: RE with an 'endangered' biodiversity status, not EPBC-listed: 11.4.12.	High	High	High		Low	Moderate

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**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<i>Habitat Loss or Degradation and Fauna Mortality (cont'd)</i>							
	Category C ESA by tenure: Bendidee State Forest.	High	High	High	<ul style="list-style-type: none"> <li>• Construct production wells, gathering lines and access tracks within cleared areas, where practicable, with the aim of avoiding remnant vegetation.</li> <li>• Design dams to have an egress (escape point) for wildlife.</li> <li>• Implement noise control techniques.</li> <li>• Minimise light spill from project activities.</li> <li>• Prohibit disturbance or harassment of wildlife and the unauthorised collection of flora and forest products.</li> </ul>	High	High
	Category C ESAs by tenure: <ul style="list-style-type: none"> <li>• Gurulmundi State Forest.</li> <li>• Binkey State Forest.</li> <li>• Barakula State Forest.</li> </ul>	High	Moderate	Moderate	<ul style="list-style-type: none"> <li>• Confine project traffic to roads and access tracks where practicable.</li> <li>• Fell trees to minimise disturbance.</li> <li>• Avoid damaging standing trees not intended for removal.</li> <li>• Install and maintain sediment and erosion control structures.</li> </ul>	Low	Moderate

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<i>Habitat Loss or Degradation and Fauna Mortality (cont'd)</i>							
	Wyaga-Kindon Ooline populations.	High	Major	Major	<ul style="list-style-type: none"> <li>• Use coal seam gas water for dust suppression on roads or for construction and operations activities authorised in the environmental authority.</li> <li>• Design and install storage areas and handle hazardous materials in accordance with Australian and industry standards.</li> <li>• Carry out actions immediately upon the identification of any project-related contamination of soil or groundwater.</li> </ul>	Moderate	Moderate
	Stock routes <sup>†</sup> and state or bioregional wildlife corridors.	High	High	High	<ul style="list-style-type: none"> <li>• Clear areas progressively and implement rehabilitation as soon as practicable.</li> <li>• During rehabilitation works, care will be taken when moving stockpiled logs and vegetation to avoid fauna mortality</li> <li>• Identify weed species, and develop a pest management plan in accordance with industry standards.</li> </ul>	Moderate	Moderate

Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<i>Habitat Loss or Degradation and Fauna Mortality (cont'd)</i>							
	Essential habitat (supporting listed wildlife species).	High	High	High	<ul style="list-style-type: none"> <li>• Train and induct all relevant personnel in the requirements of weed management.</li> <li>• Ensure maintenance materials are not contaminated with weeds and plant or animal pathogens and obtain a Weed Hygiene Declaration form if necessary.</li> <li>• Design washdown facilities to ensure containment or correct disposal of washdown material.</li> </ul>	Low	Moderate
	EPBC Act Community: Coolibah –Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South bioregions (RE 11.3.3).	Moderate	Low	Low	<ul style="list-style-type: none"> <li>• Wash down vehicles and equipment that have potentially been in contact with weeds before entering new work sites.</li> <li>• Do not wash down vehicles in watercourses.</li> <li>• Dispose of food scraps in large skips or bins that prevent animal access.</li> </ul>	Negligible	Low

Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<i>Habitat Loss or Degradation and Fauna Mortality (cont'd)</i>							
	REs 11.3.2, 11.3.25, 11.3.4, 11.3.27 and 11.9.7.	Moderate	Low to High	Low to Moderate	<ul style="list-style-type: none"> <li>• Train field personnel to identify key pest species and to maintain vigilance for pest flora and fauna species.</li> <li>• Inspect, manage and minimise the time that trenches are open to reduce impact on local fauna species.</li> <li>• Implement speed limits on project-controlled roads.</li> <li>• Assess trees for potential nesting hollows and manage accordingly.</li> </ul>	Low	Low
	Other state forests and timber reserves	Low to Moderate	Moderate	Low to Moderate	<ul style="list-style-type: none"> <li>• Identify key koala trees and, if a koala is located, retain until the animal has moved on.</li> <li>• Where possible, capture injured wildlife using appropriately trained personnel or a wildlife handler. If further action is required, consult with a qualified vet to determine appropriate action.</li> </ul>	Negligible	Insignificant to Low

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Habitat Loss or Degradation and Fauna Mortality (cont'd)</b>							
	All regional ecosystems identified within the project development area that are not listed above (see Table T287)	Low	Low	Low		Negligible	Insignificant
<b>Edge Effects</b>							
<b>Construction:</b> <ul style="list-style-type: none"> <li>• Site clearance.</li> <li>• Ground disturbance and soil movements.</li> <li>• Potential spills of hazardous materials.</li> <li>• Vehicle movement (which potentially leads to fauna strikes and the spread of weeds and pathogens).</li> <li>• Construction activities that create barriers to fauna movement or pathways for pest species.</li> <li>• Trenching (which, when left open, may entrap animals and interfere with fauna movement pathways).</li> <li>• Light and noise emissions.</li> <li>• Storage of putrescible waste.</li> </ul>	EPBC Act Community: Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (REs 11.3.21, 11.3.24).	Extremely High	Major	Major	Avoid	NA	NA
	EPBC Act Community: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (RE 11.8.2a).	Extremely High	Moderate	High	Avoid	NA	NA
	Category A ESAs: <ul style="list-style-type: none"> <li>• Wondul Range National Park.</li> <li>• Bendidee National Park.</li> <li>• Lake Broadwater Conservation Park.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA
	Chinchilla rifle range.	Extremely High	Major	Major	Avoid	NA	NA

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Edge Effects (cont'd)</b>							
<ul style="list-style-type: none"> <li>Construction of production facilities will also involve these activities, however, they will be localised to the site, which will be selected to reduce impacts on terrestrial flora and fauna.</li> </ul> <p><b>Operations:</b></p> <ul style="list-style-type: none"> <li>Release or spill of waste water or hazardous materials.</li> <li>Vehicle movements.</li> <li>Light and noise emissions.</li> <li>Storage of putrescible waste.</li> </ul> <p><b>Decommissioning:</b></p> <ul style="list-style-type: none"> <li>During the decommissioning phase, impacts on terrestrial ecology environmental values are similar to the construction and operations activities. These will occur in addition to the removal of infrastructure (e.g., pipes and foundations), which will involve ground disturbance. These activities will predominately occur in previously disturbed areas.</li> </ul>	Road reserves: <ul style="list-style-type: none"> <li>Dalby Kogan.</li> <li>Dalby Cecil Plains.</li> <li>Dalby St George.</li> </ul>	Extremely High	Major	Major	Avoid	NA	NA
	EPBC Act Community: Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant) (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6).	High	Moderate	Moderate	<ul style="list-style-type: none"> <li>Apply the specific planning and design, construction, operation and decommissioning mitigation measures.</li> <li>Implement appropriate mitigations used to address habitat loss.</li> <li>Retain woody debris, logs and rocks for use in rehabilitation. These should be spread over part or all of the corridor or, as a minimum, piled along the edge of the cleared corridor to provide refuge for crossing fauna.</li> <li>Select plant species for the purposes of rehabilitation that are specific to the original ecosystem and local provenance, wherever practicable.</li> </ul>	Low	Moderate
	EPBC Act Community: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions (REs 11.9.4a, 11.8.3).	High	Moderate	Moderate		Low	Moderate
	EPBC Act Community: Weeping Myall Woodlands.	High	High	High		Low	Moderate
	Category B ESAs: REs with an 'endangered' biodiversity status, not EPBC-listed: 11.3.17 and 11.9.10.	High	Low	Moderate		Low	Moderate
	Category B ESA: RE with an 'endangered' biodiversity status, not EPBC-listed: 11.4.12.	High	High	High		Low	Moderate



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**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Edge Effects (cont'd)</b>							
	Category C ESA by tenure: Bendidee State Forest.	High	High	High		High	High
	Category C ESAs by tenure: <ul style="list-style-type: none"> <li>• Gurulmundi State Forest.</li> <li>• Binkey State Forest.</li> <li>• Barakula State Forest.</li> </ul>	High	Moderate	Moderate		Moderate	Moderate
	Wyaga-Kindon Ooline populations.	High	Major	Major		Low	Moderate
	Stock routes <sup>†</sup> and state or bioregional wildlife corridors.	High	High	High		Moderate	Moderate
	Essential habitat (supporting listed wildlife species).	High	High	High		Low	Moderate
	EPBC Act Community: Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South bioregions (RE 11.3.3).	Moderate	Low	Low		Negligible	Low
	REs 11.3.2, 11.3.25, 11.3.4, 11.3.27 and 11.9.7.	Moderate	Low to High	Low to Moderate		Low	Low
	Other state forests and timber reserves.	Low to Moderate	Moderate	Low to Moderate		Negligible	Insignificant to Low
	All regional ecosystems identified within the project development area that are not listed above (see Table T287).	Low	Low	Low		Negligible	Insignificant

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Edge Effects (cont'd)</b>							
	EPBC Act Community: Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland (REs 11.3.21, 11.3.24).	Extremely High	Moderate to High	High to Major		NA	NA
<b>Altered Ecological Processes</b>							
<b>Construction:</b> <ul style="list-style-type: none"> <li>• Site clearance.</li> <li>• Ground disturbance and soil movements.</li> <li>• Potential spills of hazardous materials.</li> <li>• Vehicle movement (which potentially leads to fauna strikes and the spread of weeds and pathogens).</li> <li>• Construction activities that create barriers to fauna movement or pathways for pest species.</li> <li>• Trenching (which, when left open, may entrap animals and interfere with fauna movement pathways).</li> <li>• Light and noise emissions.</li> <li>• Storage of putrescible waste.</li> </ul>	EPBC Act Community: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (RE 11.8.2a).	Extremely High	Low to Moderate	Moderate to High	Avoid	NA	NA
	Category A ESAs: <ul style="list-style-type: none"> <li>• Wondul Range National Park.</li> <li>• Bendidee National Park.</li> <li>• Lake Broadwater Conservation Park.</li> </ul>	Extremely High	Low to Major	Moderate to Major	Avoid	NA	NA
	Chinchilla rifle range.	Extremely High	Major	Major	Avoid	NA	NA
	Road reserves: <ul style="list-style-type: none"> <li>• Dalby Kogan.</li> <li>• Dalby Cecil Plains.</li> <li>• Dalby St George.</li> </ul>	Extremely High	High to Major	Major	Avoid	NA	NA

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>s</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Altered Ecological Processes (cont'd)</b>							
<ul style="list-style-type: none"> <li>Construction of production facilities will also involve these activities, however, they will be localised to the site, which will be selected to reduce impacts on terrestrial flora and fauna.</li> </ul> <p><b>Operations:</b></p> <ul style="list-style-type: none"> <li>Release or spill of waste water or hazardous materials.</li> <li>Vehicle movements.</li> <li>Light and noise emissions.</li> <li>Storage of putrescible waste.</li> </ul> <p><b>Decommissioning:</b></p> <ul style="list-style-type: none"> <li>During the decommissioning phase, impacts on terrestrial ecology environmental values are similar to the construction and operations activities. These will occur in addition to the removal of infrastructure (e.g., pipes and foundations), which will involve ground disturbance. These activities will predominately occur in previously disturbed areas.</li> </ul>	EPBC Act Community: Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant) (REs 11.3.1, 11.4.3, 11.4.10, 11.9.5, 11.9.6).	High	Low to Moderate	Moderate	<ul style="list-style-type: none"> <li>Apply the specific planning and design, construction, operation and decommissioning mitigation measures.</li> <li>Install and maintain sediment and erosion control structures at work sites.</li> <li>Design facilities to ensure natural surface water flows are not impounded, e.g., by installing culverts on roads and stormwater diversion ditches around production facilities.</li> <li>Develop fire plans for production facilities.</li> </ul>	Insignificant to Low	Low to Moderate
	EPBC Act Community: Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions (REs 11.9.4a, 11.8.3).	High	Low to High	Moderate to High		Insignificant to Low	Low to Moderate
	EPBC Act Community: Weeping Myall Woodlands.	High	Moderate	Moderate		Insignificant	Low
	Category B ESAs: REs with an 'endangered' biodiversity status, not EPBC-listed: 11.3.17 and 11.9.10.	High	Low	Moderate		Insignificant to Low	Low to Moderate
	Category B ESA: RE with an 'endangered' biodiversity status, not EPBC-listed: 11.4.12.	High	Low to High	Moderate to High		Insignificant to Low	Low to Moderate
	Category C ESA by tenure: Bendidee State Forest.	High	High	High		Insignificant to Low	Low to Moderate
	Category C ESAs by tenure: <ul style="list-style-type: none"> <li>Gurulmundi State Forest.</li> <li>Binkey State Forest.</li> <li>Barakula State Forest.</li> </ul>	High	Moderate	Moderate		Insignificant to Low	Low to Moderate

**Table 17.11 Summary of terrestrial ecology impact assessment (cont'd)**

Cause of Potential Impacts	Existing Environment	Values Sensitivity	Premitigated Impact		Summary of Mitigation Measures	Residual Impact <sup>§</sup>	
			Magnitude	Significance		Magnitude	Significance
<b>Altered Ecological Processes (cont'd)</b>							
	Wyaga-Kindon Ooline populations.	High	Major	Major		Insignificant to Low	Low to Moderate
	Stock routes <sup>†</sup> and state or bioregional wildlife corridors.	High	High	High		Low	Moderate
	Essential habitat (supporting listed wildlife species)	High	High	High		Low	Moderate
	REs 11.3.2, 11.3.4, 11.3.27 and 11.9.7.	Low to Moderate	Low to High	Low to Moderate		Negligible to Low	Insignificant to Low
	EPBC Act Community: Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South bioregions (RE 11.3.3).	Moderate	Low	Low		Negligible	Low
	REs 11.3.2, 3.3.25, 11.3.4, 11.3.27 and 11.9.7.	Moderate	Low to High	Low to Moderate		Low	Low
	Other state forests and timber reserves.	Moderate	Moderate	Moderate		Low	Insignificant to Low
	All regional ecosystems identified within the project development area that are not listed above (see Table T287).	Low	Low	Low		Negligible	Insignificant

<sup>§</sup>Not applicable.

<sup>†</sup>Regional ecosystems identified through field surveys along stock routes are of extremely high or high sensitivity and are captured as listed regional ecosystems in this table (including those identified along the extremely high sensitivity road reserves). The category designated by the dagger captures any stock routes outside the area surveyed that may support additional, highly sensitive regional ecosystems.

## 17.8 Inspection and Monitoring

The inspection and monitoring of terrestrial ecology will observe and report on the performance of the proposed mitigation and management measures, with a focus on facilitating early intervention and remediation of identified non-conformances or the implementation of adaptive management if required.

A set of inspection and monitoring measures have been designed to extend throughout the project and beyond the decommissioning phase. The process of landscape recovery may be ongoing well beyond the life of the project; and the risk of impact from disease, exotic species or changes to the population dynamics of threatened species will continue until the process of landscape stabilisation is complete.

Inspection and monitoring measures include:

- Inspect areas of avoidance to ensure that boundaries are clearly marked prior to clearing activities. [C533]
- Monitor clearing activities to ensure marked boundaries are adhered to. [C534]
- Inspect marked areas after clearing activities to ensure areas of avoidance remain and that no unauthorised encroachment has occurred. [C535]
- Supervise construction activities in sensitive areas to ensure appropriate methods (e.g., narrowing of ROW) are being implemented, where required. [C536]
- Inspect and manage open trenches in accordance with the following:
  - Inspect trenches for the presence of fauna daily (preferably in the morning), as well as immediately prior to closing a trench.
  - Have appropriately trained personnel remove any fauna from a trench to minimise stress to the animal and to avoid personal injury.
  - Record details of trapped fauna for inclusion in the DERM Wildnet database. [C500]
- Carry out routine monitoring of rehabilitation success. [C478]
- Inspect and monitor the success of newly propagated or translocated listed species, in accordance with the approved translocation or management plan. [C482]
- Inspect erosion and sediment control measures following significant rainfall events to ensure effectiveness of measures are maintained. [C505]
- Routinely inspect for pest flora and evidence of pest fauna species within project disturbed areas. [C508]
- Inspect food scrap bins and exclusion fences to ensure they are properly operated and maintained. [C212]
- Develop monitoring programs that are site-specific and based on the identified risk to the conservation or maintenance of a viable population. [C303]

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